CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

OUR SHARED WATER FUTURE

CAPE TOWN'S WATER STRATEGY

Making progress possible. Together.

A NEW RELATIONSHIP WITH WATER

It's time for a new way of thinking about water. It's time to start seeing water as one finite resource. There is no "wastewater", only wasted water. We are all custodians of water and the City is the driver of change. Our goal is to make Cape Town a world-class city for our citizens. Water is the key to growth. We must secure our water future to get us there.

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.

Together we can reduce wastage and lessen the burden on this natural resource. Together we can treat water as one resource, with many sources that need to be secure at all stages. Together we can give water a second life and share the prosperity. Together we can make Cape Town a world-class city that leads the way in its approach to water technology and the prosperity of its citizens and the planet.

MAYOR'S FOREWORD

Cape Town became known around the world as a city that nearly ran out of water. In March 2018, at the height of a three-year drought (the worst on record), the dams supplying the city dropped to one fifth full. A massive combined effort by residents and the City helped us avoid a potential catastrophe by reducing water use. Cape Town won an award from the International Water Association as the first city to reduce water demand by half in just three years and is now becoming known as the 'number one water-saving city in the world'.

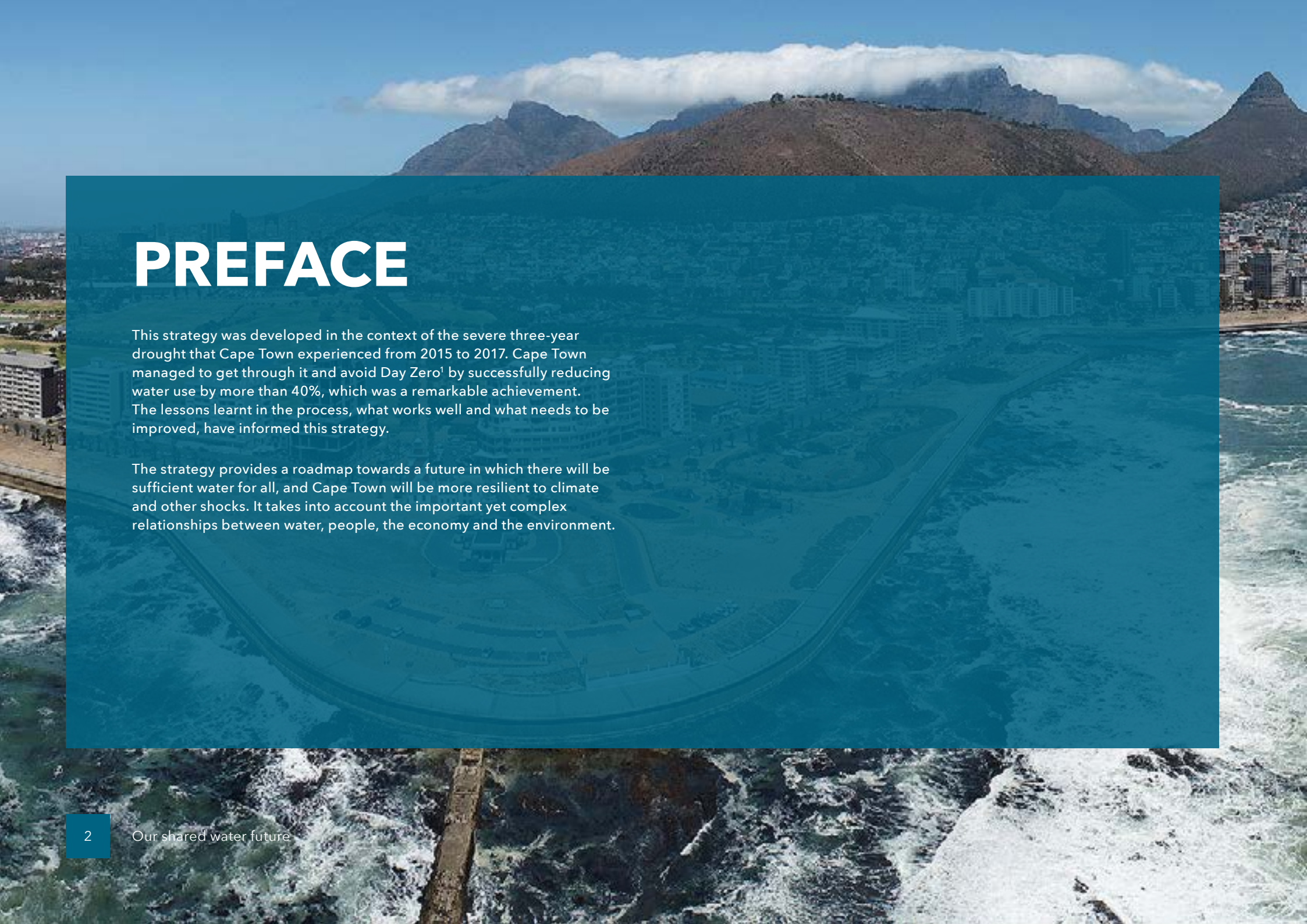
While the City recognises that our collective achievement was significant, we want to ensure that we do not have to implement such extreme measures in future. There is a growing consensus that Cape Town is vulnerable to climate change, and that this is likely to result in lower and less reliable rainfall.

We also recognize the struggles faced by many of our residents who have been economically and socially marginalised. While these challenges are difficult to solve, we are committed to improving the daily lived experience of all our people.

We have developed this strategy to guide us in how we respond to these twin challenges – improving our water resilience and improving the quality of life of all of our citizens. It sets out five clear and practical commitments that together will help ensure that our citizens' access to sufficient and reliable water, and safe sanitation, is not compromised. I want to emphasise, however, that these commitments are not just for the City to follow. Residents also have a crucial role to play. To emphasise this point we have titled this document *"Our Shared Water Future"*.

We are aware that we are not the only city facing these challenges. We hope that the lessons we have learned, and will continue to learn as we implement this strategy, can benefit others. Our goal is to lead the way to becoming a water resilient, inclusive and caring city.

Alderman Dan Plato
Executive Mayor
City of Cape Town



PREFACE

This strategy was developed in the context of the severe three-year drought that Cape Town experienced from 2015 to 2017. Cape Town managed to get through it and avoid Day Zero[1] by successfully reducing water use by more than 40%, which was a remarkable achievement. The lessons learnt in the process, what works well and what needs to be improved, have informed this strategy.

The strategy provides a roadmap towards a future in which there will be sufficient water for all, and Cape Town will be more resilient to climate and other shocks. It takes into account the important yet complex relationships between water, people, the economy and the environment.

SUPPORTING THE LIFE OF THE CITY

Cape Town residents were reminded during the recent drought that water is life and having enough of it makes the city's life possible. Without it, everyone's quality of life is at risk. The City understands that it has a central role to play in ensuring that this fundamental need is met. This strategy puts quality of life for everyone in the city as the first priority. Poverty and poor living conditions are a daily reality for many households in Cape Town. So this strategy also supports poverty reduction and improved living conditions by outlining practical steps to improve the quantity and quality of water and sanitation services provided to all people, particularly those living in informal settlements. Better management of stormwater, rivers and waterways in the city will reduce flood risk. Cost-effective, secure water provision provides an essential foundation for economic growth and job creation.

The effective implementation of the water strategy is necessary to achieve Cape Town's other development goals – undoing the spatial legacy of apartheid, eradicating crime and violence, improving living conditions, and enabling work opportunities.

This strategy can therefore be regarded as both a foundational and enabling strategy for Cape Town and its people.

CLIMATE UNCERTAINTY

Cape Town and surrounds have always experienced a high degree of climate variability and uncertainty. Rainfall patterns are highly variable from one year and one place to the next, and droughts and localised floods are common. Changes in temperature and wind also affect water availability. The development and management of surface water schemes in South Africa take these uncertainties into account. Planning was based on the probability of low rainfall years. Dams and the related systems supplying water to urban areas in South Africa are generally designed to achieve a 98% level of supply assurance. This means that, for any given year, there is a 98% probability that there will be sufficient water to meet demand. This does not mean that water restrictions will be imposed only once in every 50 years, though. The normal operating rules developed for drought conditions are based on the principle that light restrictions should be applied more frequently, and more severe restrictions less frequently. Applying increasingly more severe restrictions enables maximum sustainable abstraction from the system while ensuring that the dams never run empty.

The three-year drought in Cape Town was a 1-in-590-year event based on historical rainfall records. The additional uncertainties associated with climate change now need to be included in future planning, including changes in rainfall, temperature and wind, and a likely increase in the intensity and frequency of extreme weather events. Nobody is able to accurately predict the future climate and water availability, so Cape Town needs to make plans that are robust in the context of this uncertainty.

VISION, PRINCIPLES, COMMITMENTS AND ACTION

This strategy, which is informed by a long-term vision and set of principles, is centred on five core commitments made by the City to the citizens of Cape Town. The fulfilment of these five commitments will result in citizens' needs being met, support being given for improved living conditions and protection of the environment, and will ultimately enable and support a growing economy. The steps necessary to translate the strategy into action are set out in the last section of this document and include the strengthening of institutions, financial resourcing and building trust.

A STRATEGY, NOT A DETAILED PLAN

Many of the comments received on the draft strategy, which was published for public comment in March 2019, requested more details on the City's plans. The City makes use of a number of detailed planning instruments, including its Integrated Development Plan and Water Services Development Plan. Many of these plans are required by law and include the appropriate level of detail on planned investments in terms of the City's budget cycle. This document is not a plan. Instead, it is a high-level strategy document that sets out the City's approach to water, identifies key priorities and articulates a set of core commitments.

THE CITY'S FIVE COMMITMENTS

Commitment: *A willingness to devote our time and energy to something we believe in; a promise, a firm decision to do something.*

THE CITY'S COMMITMENTS IN THE CONTEXT OF A WHOLE-OF-SOCIETY APPROACH

This strategy sets out the City's commitments in relation to its constitutional responsibilities to provide water services and manage the urban water environment. However, achieving the strategic vision of a water-sensitive Cape Town through wise water use will depend on the actions of all the city's people and institutions. Therefore, the City will follow a collaborative approach in implementing this strategy. Collaborative relationships are based on trust, and trust is built where there is transparency and mutual accountability, and where all partners' stated intentions are consistently translated into action.

1

SAFE ACCESS TO WATER AND SANITATION

The City of Cape Town metropolitan municipality[2] will work hard to provide and facilitate safe access to water and sanitation for all of its residents in terms of well-defined minimum standards. In particular, the City will work with communities in informal settlements and with other stakeholders to improve the daily experience of access to water and sanitation, with an emphasis on building trust and increasing safety within these communities through this process.

2

WISE USE

The City will promote the wise use of water by all water users. This will include promoting water conservation behaviour through (a) pricing water with reference to the cost of providing additional supply, while retaining the commitment to provide a basic amount of water for free for those not able to afford this; (b) revising by-laws and planning requirements, and using other incentives to support water efficiency and the treatment and reuse of water; (c) supporting active citizenship by substantially improving customer management and engagement; and (d) managing the water network effectively to reduce losses and non-revenue water.

3

SUFFICIENT, RELIABLE WATER FROM DIVERSE SOURCES

The City will develop new, diverse supplies of water including groundwater, water reuse and desalinated water, cost effectively and timeously to increase resilience[3] and substantially reduce the likelihood of severe water restrictions in future. The City is committed to increasing supply by building affordable new capacity of approximately 300 million litres per day over the next ten years, and in suitable increments thereafter, in a way that is adaptable and robust to changes in circumstances.

4

SHARED BENEFITS FROM REGIONAL WATER RESOURCES

The City will work with key stakeholders and partners, including other urban and agriculture water users and other spheres of government, to make the most of the opportunities to optimise the economic, social and ecological benefits of regional[4] water resources, and to reduce the risks. The City will do this through collaborative processes.

5

A WATER-SENSITIVE CITY[5]

The City will actively facilitate the transition of Cape Town over time into a water-sensitive city with diverse water resources, diversified infrastructure and one that makes optimal use of stormwater and urban waterways for the purposes of flood control, aquifer recharge, water reuse and recreation, and is based on sound ecological principles. This will be done through new incentives and regulatory mechanisms as well as through the way the City invests in new infrastructure.

THE FUTURE OF CAPE TOWN'S WATER SUPPLY

As a consumer, resident, employee, business owner, investor or political representative, here are eight things you need to know about the reliability of Cape Town's water supply:

1. Our collective relationship with water will and must change. We cannot ignore the reality of being in a water-scarce region, so this means that we all need to continue to use water wisely. The City will continue to ensure an adequate supply of water, at the right quality, to meet all users' needs, and the water tariff structure will help ensure that water is affordably available, but will also discourage waste (the more you use the more you pay).

2. Cape Town will continue to rely on rain-fed dams for most of its water. About 95% of Cape Town's water comes from a regional, integrated surface water system managed by the National Department of Water and Sanitation, called the Western Cape water supply system. It is much more affordable for the City to continue to rely on rain-fed dams for most of its water, than from alternative sources. Therefore, even though the City will invest in alternative water sources, rain-fed dams will still supply more than three quarters of Cape Town's water in ten years time.

3. The City commits to increasing available supply over the next ten years. Based on a scenario analysis, the City will commit to increasing available supply by more than 300 million litres per day over the next ten years, at a cost of approximately R5,4 billion (in 2018 terms). This programme is adaptable and robust when tested against the different scenarios (including a significant reduction in rainfall in the short term). Both the timing and composition of the committed programme are subject to review as new information and circumstances come to light. Further investments will be necessary thereafter as water demand increases due to population and economic growth.

4. The build programme will reduce the likelihood of severe water restrictions in future. The build programme is based on a higher reliability standard (99,5%) than that used in the past (98%). This will substantially reduce the likelihood of severe water restrictions in future, unless there is a step change in rainfall due to climate change. If this turns out to be the case, the programme will be both accelerated and expanded.

5. The cost of more reliable water is affordable. Though the investment in new and diverse water sources, including groundwater, wastewater reuse and desalination, will increase the cost of water, the cost works out to about R2,50 per month per person living in Cape Town, which is much less than the cost of a single bottle of water or cooldrink.[6]

6. Even though the new infrastructure might not be used all the time, the investment would not have been wasted. All water schemes provide insurance against periods of low rainfall, which may become more frequent and more severe as a result of climate change. But it is also possible, and even likely, that the additional, more expensive water supplies (such as reuse and desalination) will not be used all the time. Nevertheless, this will not have been wasteful expenditure. The future is uncertain, and the cost of very severe restrictions is much higher than the cost of insuring against this likelihood.

7. Desalination, reuse and groundwater will become important components of Cape Town's water future. As we already know, new surface water resources (ie: dams, rivers, reservoirs) are limited. So in future, a greater proportion of Cape Town's water supplies will be met from alternative sources. In the medium and longer term, desalination is very likely to become an increasingly significant share of the mix because it is scalable and not dependent on rainfall. The City will aim to prepare desalination sites, allowing for rapid deployment if needed.

8. Securing the City's water supply will be a team effort. Cape Town will proactively address regional water risks in partnership with other users and key stakeholders through a collaborative approach.

(See commitment 4, page 43)

CONTENTS

VISION AND PRINCIPLES

Our vision: By 2040, Cape Town will be a water-sensitive city that optimises and integrates the management of water resources to improve resilience, competitiveness[7] and liveability for the prosperity of its people.

TEN PRINCIPLES INFORMING THE STRATEGY

1. Water is life. Our water resources are precious and scarce. Water is the basis of all life. It is not only essential for basic human needs, vital for productive and resilient natural ecosystems, and central to food, energy and economic security, it is also an important part of the spiritual, cultural and recreational life of communities. The strategy recognises that different people hold multiple and diverse views of water, and value it in different ways.[8]

2. Grow inclusivity and trust. Water will be managed equitably, inclusively and transparently. Trade-offs are inevitable, especially because water is scarce. However, inaction is likely to increase costs and result in even more difficult trade-offs. This strategy will therefore seek to share benefits and costs in a fair way, keeping in mind that changes will only enjoy support if they are seen to be necessary, effective and equitable. As such, the strategy will promote measures that are both proactive and adaptive in the face of change.[9]

3. Build capability. The strategy will support the development of the necessary capabilities to manage Cape Town's complex water supply system. Effective management requires skilled practitioners with adaptive abilities and a willingness to learn, and who can work collaboratively within and across institutions and among multiple stakeholders.

4. Work together and across boundaries. Water catchment boundaries do not coincide with political and administrative boundaries, and water is also transferred between catchments. A collaborative and partnering approach across neighbourhood, catchment, physical, economic and political boundaries is necessary to build a more resilient future and address the challenges at the appropriate scale – whether local, regional or national.

5. Be fluid like water. While change is certain, we cannot predict with any confidence the pace or sometimes even the direction of change. Changes in population size and composition, climate, the economy and technology will influence both water use and availability. For this reason, the strategy will support an adaptive approach to the management of water, increasing resilience.

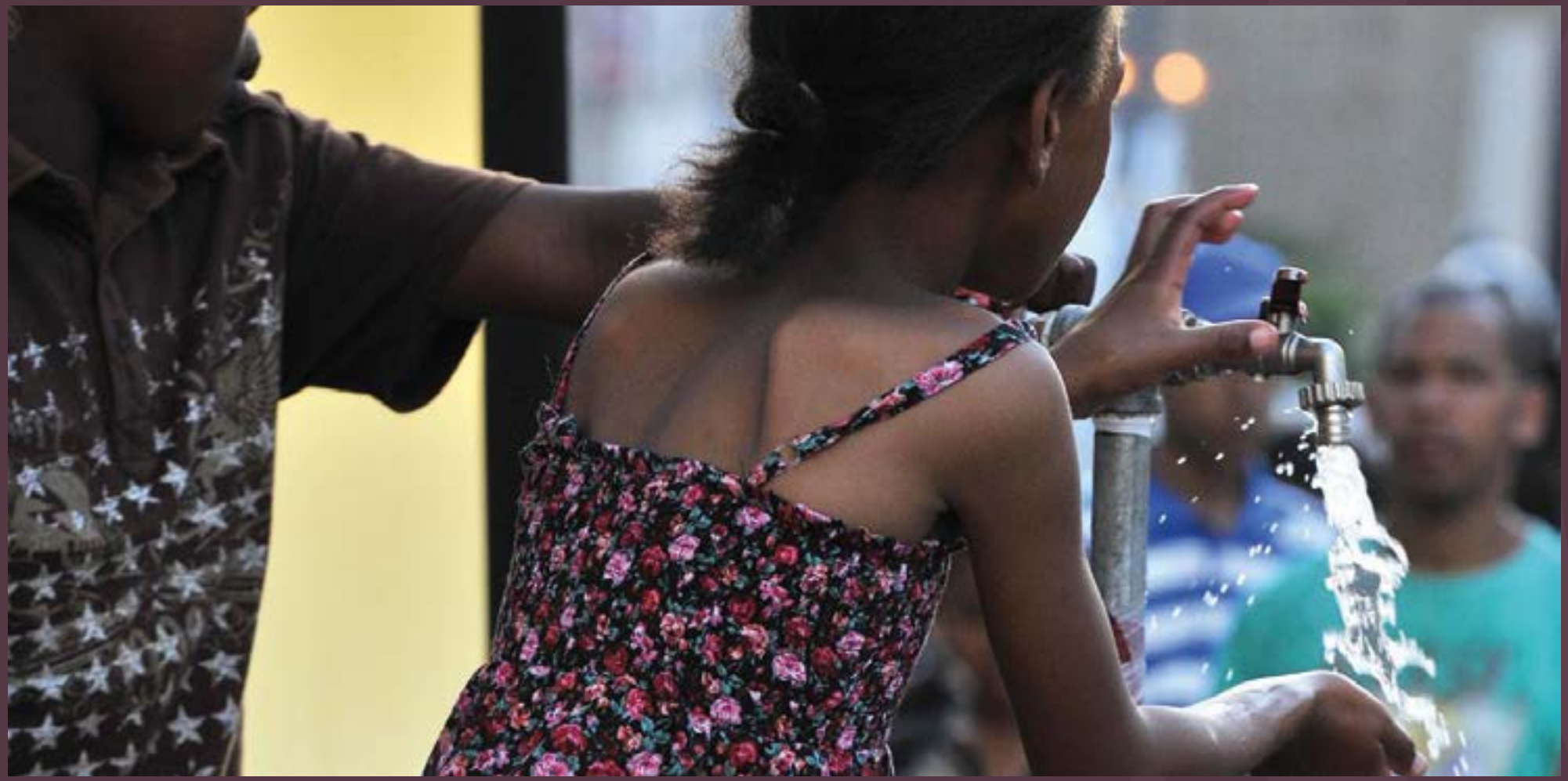
6. Water is all around us. Water flows through the urban environment, but it is often channelled, hidden and polluted. The strategy will support the rehabilitation of urban waterways and increase their value and use for recreation, flood management and water supply.

7. Work with nature. The natural environment[10] within and beyond the urban area filters, stores and transports water. The strategy will support the protection of these natural environments, as well as their integration with the built environment to enhance the function, beauty and resilience of the region's water infrastructure and landscape.

8. When it rains, slow, store and repurpose. Fast-moving stormwater is hard to manage. The strategy will support approaches to increase the permeability of surfaces, reduce pollution and increase local storage. The management of stormwater will be integrated with the management of waterways and groundwater, and the repurposing of rainwater for appropriate uses will be encouraged.

9. The future could shock us. Water-related shocks, including droughts and floods, are likely to become more frequent and intense. The strategy will develop greater urban resilience by improving the City's preparedness and response to these shock events.

10. Watering the green economy. New economic opportunities can emerge where the value of water as a scarce resource is appreciated. The decisions we take to secure our water future can enable local design of water-related products and services, and stimulate increased demand for these products across our economy. This, in turn, could support the creation of enterprises and jobs.



COMMITMENT 1:

SAFE ACCESS TO WATER AND SANITATION

The City of Cape Town will work hard to provide and facilitate safe[11] access to water and sanitation for all of its residents in terms of well-defined minimum standards. In particular, the City will work with communities in informal settlements and with other stakeholders to improve the daily experience of access to water and sanitation, with an emphasis on building trust and increasing safety within these communities through this process.

THE CHALLENGES

The core business of Cape Town Water[12] is to facilitate access to safe water and sanitation services. The City has a responsibility to provide reliable, convenient and safe[13] water and sanitation services, and the processes used to do this need to be transparent, financially sustainable, and responsive to citizens. Water quality needs to be assured, and wastewater and faecal sludge need to be collected, treated and discharged appropriately and in line with the relevant standards.

Within a developing-city context, the City performs relatively well on most of these measures, and for a large majority of its residents. The City will continue to provide these services, aiming for steady and incremental improvements in all performance domains. However, there is one area of service provision that is much more challenging than the rest. This is the provision of sanitation services in informal settlements. Although households living in informal settlements express the need for safety and jobs as their top priorities,[14] improvement in water and sanitation provision is also very important. The City affirms the fundamental human right to water and a safe environment, including access to basic sanitation, and the obligation to progressively realise this right together with other spheres of government, as set out in South Africa's Constitution.

The drought did not have a significant direct impact, in terms of water supply, for the approximately half a million people living in informal settlements (about one in every eight persons living in Cape Town). Water is supplied for free through public taps at a ratio of approximately 25 households or fewer per tap, and water use averages about 50 litres per person per day. Water use in informal settlements therefore accounts for only 5% of total use in the entire city. As noted above, safety is a significant concern for people living in informal settlements. Since the large majority of households share sanitation facilities with others, this means sanitation services are connected with residents' safety concerns, especially when shared facilities are used at night. Maintaining clean shared facilities is another significant challenge. Improving sanitation, therefore, is a much higher priority than water supply and other services in informal settlements.

While the City is committed to becoming a safe and caring city,[15] human dignity and respect are compromised when communities in informal settlements experience water and sanitation services as insufficient. At the same time, as the number of people living in informal settlements increases, so does the size of the challenge.

QUALITY OF SERVICE

Access to water and sanitation has to be underpinned by quality of service, which must encompass the following: accessibility, reliability and water quality. National regulations define minimum service standards, though Cape Town aims to exceed these standards. These standards are set out in the City's by-laws and in the Customer Services Charter and are operationalised through the Water Services Development Plan and standard operating procedures. Further details are provided in annexure A. The quality of water in the environment is addressed under commitments 3 and 5.

ACHIEVING BETTER OUTCOMES THROUGH BUILDING TRUST

The City makes a significant effort to improve living conditions for people living in informal settlements. Yet the impediments to improved services are numerous and multifaceted. Unplanned high densities make it impossible to construct and operate permanent infrastructure without relocating households. Many settlements are located on land that is unsuitable for residential development or is privately owned, constraining the City's ability to provide permanent infrastructure. Alternative sanitation solutions are continually assessed and tested, and mechanisms to improve drainage around communal taps and mitigate floods are explored. Every settlement is unique, and successful interventions can only be determined with intensive, time-consuming and complex citizen engagement. There are no easy answers to these difficult challenges. The fundamental challenge is not a technical one, but social, financial and political. Nevertheless, the City commits itself to finding better ways to provide safe water and sanitation services through processes that build dignity, trust and social cohesion. This will require multidisciplinary approaches that extend beyond the scope and mandate of Cape Town Water on its own. Practical steps to achieve this are set out in the section "Translating the strategy into action".

COMMITMENT 2:

WISE USE

The City will promote wise water use by all consumers.[16] This will include promoting water conservation by (a) pricing water with reference to the cost of providing additional supply, while retaining the commitment to provide a basic amount of water for free to those who cannot afford to pay; (b) revising by-laws and planning requirements as well as using other incentives to support water efficiency and water treatment and reuse; (c) supporting active citizenship by substantially improving customer management and engagement; and (d) managing the water network effectively to reduce losses and non-revenue water.

CAPE TOWN HAS BECOME A WATER-WISE CITY, BUT NEEDS TO SUSTAIN THIS

Through repeated drought responses Cape Town has become a progressively more water-wise city. Overall water use (including all[17] uses and water losses) had reduced from 330 litres per person per day in 1998 to 220 litres per person per day in 2014. In 2018, water use was restricted to below 135 litres per person per day, which was a reduction of nearly 60% compared to 1998 (figure 1). During the most recent drought, water usage was far below the average use per person in the other South African metros, which has caused an unsustainable level of personal and economic hardship. And although usage will increase when restrictions are lifted, many of the changes in water use are likely to be permanent. During the drought, households, businesses and institutions invested in alternative sources of supply (such as groundwater, rainwater tanks and reuse).[11] They replaced lawns and plants requiring a lot of water with alternatives requiring less water, and they invested in water-saving devices such as low-flow taps, water-saving shower heads, smaller toilet cisterns, etc. Other behaviour, such as taking shorter showers and using shower water to flush toilets, is likely to change over time, but not to pre-drought norms. The drought has changed Cape Town's relationship with water. Cape Town's challenge now is to reach a sustainable level of wise water use.

FIGURE 1: TOTAL WATER USE[18] IN CAPE TOWN SINCE 1970

Water use as measured by the treated water supplied (includes losses), average for each year in million litres per day (MLD)

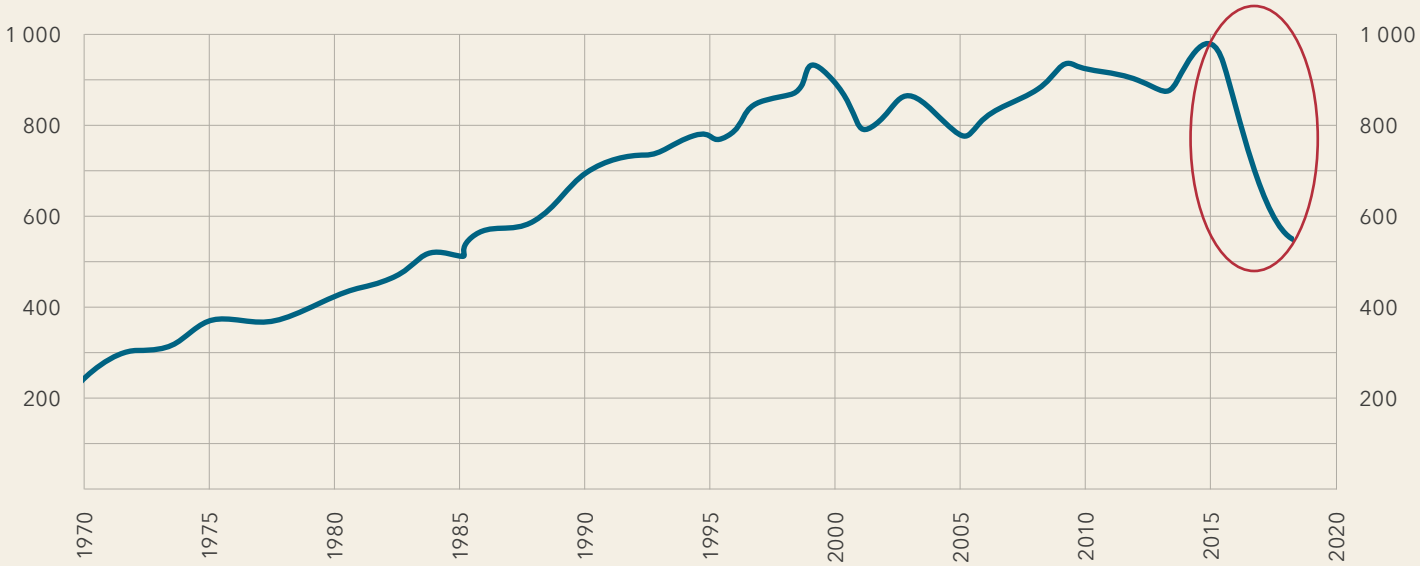
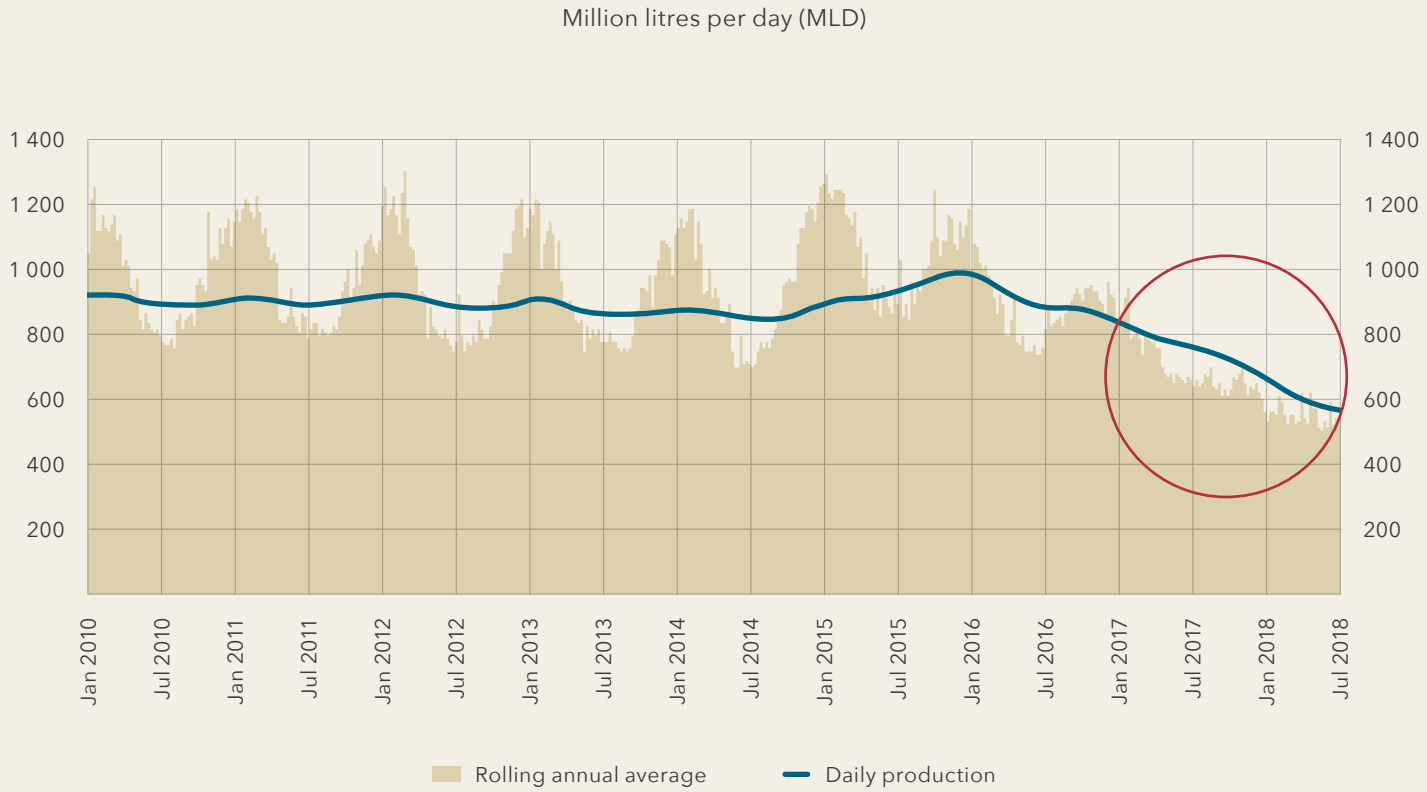


FIGURE 2: SEASON WATER DEMAND IN CAPE TOWN SINCE JANUARY 2010



HOW MUCH WATER DO WE NEED AND USE?

According to the World Health Organisation, we need at least 50 litres of water per person each day to satisfy our basic needs – drinking, cooking, washing (ourselves and our clothes), flushing the toilet and other basic uses.[19] A typical household bucket contains about seven litres of water, so each person needs seven buckets of water a day.

Cape Town currently supplies free water to approximately half a million people living in informal settlements. On average, actual water use by these households is less than the basic-need amount: water is heavy to carry, and a household of four would need to carry 28 buckets of water every day to use 50 litres per person. Total usage in informal settlements, including all types of use and losses, is about 50 litres per person per day (seven buckets), constituting only 5% of total usage in Cape Town.

Cape Town also supplies, on average, about 87 litres (12 buckets) of free water per person per day to approximately one million people in formal households living in properties with a municipal valuation of R400 000 or less[20] (about one in every four persons in the city). In practice, many households on these properties use more water than this, so the average use for this category is higher. The additional use is billed.

The rest of Cape Town's residents (just over two and a half million people) previously used much more water – about 220 litres per person per day (30 buckets) on average. During the drought, this use was reduced to some 120 litres per person per day (15 buckets), which represents a reduction of nearly 50%.

PRICING

The City will use pricing to promote wise water use. As such, water will be priced with reference to the cost of providing additional supply.

Having access to a basic amount of water every day is a human right, and so the City provides this basic water allocation for free to those who cannot afford to pay for it (approximately 1,5 million people, making up more than a third of the total population in the city). If these households use more than the basic amount, then they are required to pay for the excess. All other households and businesses must pay for all the water they use.

When water is priced correctly, taking into account the full costs of adding new supplies, households and other users can decide for themselves how much water they want to use. This, together with the enforcement of relevant environmental laws, will result in the efficient allocation of resources at the same time as ensuring that the environment is protected.

Beyond the social policy of ensuring that a basic amount of water is affordable for everyone, the price of water will promote wise and responsible use. The correct price to ensure this is called the "long-run marginal cost", also known as the "average incremental cost".[21] The City will set the price of water at the average incremental cost, and at the same time ensure that basic needs are met. (See "Translating the strategy into action".)

OTHER INCENTIVES TO PROMOTE WISE WATER USE

In addition to using price to promote efficient water use, **the City will also continue to review and improve its by-laws, regulatory mechanisms and other incentives to promote water efficiency and the treatment and reuse of groundwater, stormwater and wastewater.** This will be in support of the City's Municipal Spatial Development Framework, which seeks to improve the efficiency of the urban form through densification. Regulations and other incentives will be subject to a cost-benefit analysis to ensure that the benefits exceed the costs. Key areas include low-flush toilets, low-flow taps and showers, management and use of greywater, and night-flow monitoring for large users. Decentralised treatment[22] and debt write-off linked to leak repairs and responsible payment[23] will be approved where this is justified (see also commitment 5, "A water-sensitive city").

When reviewing and implementing regulations and incentives, the City will draw on international best practice and aim for stability and predictability. (See annexure E, "Water conservation and demand management".)

ALTERNATIVE WATER FOR NON-DRINKING PURPOSES

The City will continue to promote the responsible use of rainwater, greywater and groundwater from private borehole and well points for non-drinking purposes. The City will work with relevant authorities and partners to provide guidelines and supportive regulations for this purpose.[24]

SUPPORTING ACTIVE CITIZENSHIP THROUGH CUSTOMER ENGAGEMENT

The City will support active citizenship by substantially improving customer management and engagement.

During the drought, many households were inconvenienced by low pressures and various matters associated with meter reading and water management devices. To assist with water management, and to avoid unaffordable water bills, about 220 000 water management devices have been installed by the City. These devices automatically cut off the water after the daily allocation has been reached. The installation of these devices was accelerated during the drought to households who contravened the water use limits for households – initially 20 kℓ/month and later 10,5 kℓ/month. This, together with a lack of understanding of how the devices worked, and high bills (due to the implementation of drought tariffs), contributed to a high number of complaints to the City. Aggressive pressure management also contributed to no water being available in a few areas, sometimes for several hours, increasing the number of complaints. Response times were therefore slow due to the increased number of complaints.

The City will continue to improve the services it provides and will significantly enhance the customer management function within Cape Town Water, including call response times and the time to resolve complaints and will adhere to a core set of service levels and response times. Changes will be made in the way services are provided and paid for to increase the level of responsibility taken by citizens and to increase citizen engagement. (See "Translating the strategy into action".)

The City will engage with citizens to promote water conservation awareness and develop water-use norms appropriate for a water scarce region. Education programmes at schools are important to ensure that the high level of conservation awareness gained during the drought is maintained and passed on to younger citizens.

Prior to the drought, much drinking water was used inefficiently for swimming pools and watering gardens. The City will work with researchers and specialists to explore new water-efficient technologies and establish guidelines for water-wise irrigation and swimming pools.

EFFECTIVE WATER NETWORK MANAGEMENT

The City will continue to manage and reduce water demand through improved network management, including the establishment of pressure management zones, night-flow monitoring, water leak detection and reducing non-revenue water.

The administration complies with the norms and standards published in terms of sections 9 and 10 of the Water Services Act of 1997, which state that pressure may not exceed 9 bars and that the flow rate must be at least 10 litres per second. The minimum pressure for firefighting must be implemented as prescribed in the National Building Regulations of 1977, or as amended. The onus is on the user to adjust accordingly for higher pressures, as required based on their needs.

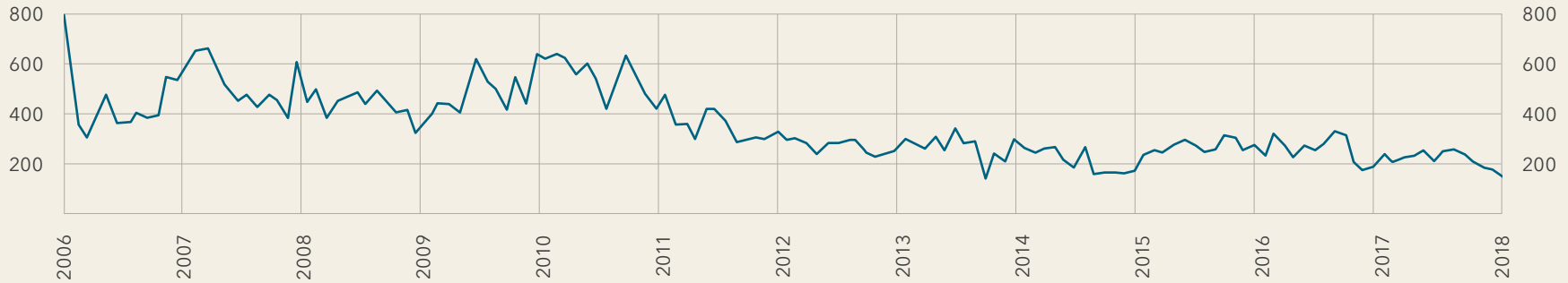
Cape Town has a well-managed water network. Before the drought, water losses (a component of non-revenue water[25]) were just 15%, which was much lower than in other South African cities.[26] This was

achieved through a water demand management programme initiated during the drought in 2000 and has been in place ever since. Activities included proactive leak detection as well as pipe and meter replacement informed by a sophisticated asset management strategy, resulting in a reduced number of pipe bursts (figure 3). The time from leak alert to repair completion was also substantially improved through a first responder system.

During the most recent drought, the City made significant investments to increase its ability to manage water pressure on a zone-by-zone basis using smart pressure controllers. At the time of developing this strategy, 102 zones had been isolated and optimised using pressure management, resulting in a saving of over 50 Mℓ per day. Pressure management, together with a large increase in the price of water, significantly contributed to the reduction in demand achieved in February 2018, from 600 Mℓ per day down to 550 Mℓ per day. Other reduction activities were also intensified, including leak detection and repairs and the retrofitting of Council buildings with water-efficient fittings.

The City will continue to invest in further improvements to the management of the network, including the optimisation of network pressure and taking long-term effects into account, while also meeting minimum standards.

FIGURE 3: WATER PIPE BURSTS PER MONTH



COMMITMENT 3:

SUFFICIENT, RELIABLE WATER

The City will develop new, diverse supplies of water including groundwater, water reuse and desalinated water cost-effectively and timeously to increase resilience[27] and substantially reduce the likelihood of severe water restrictions in future. The City is committed to increasing supply by building affordable new capacity of approximately 300 million litres per day over the next ten years, and in suitable increments thereafter, in a way that is adaptable and robust to changes in circumstances.

EXCLUSIVE RELIANCE ON RAINWATER IS NO LONGER WISE

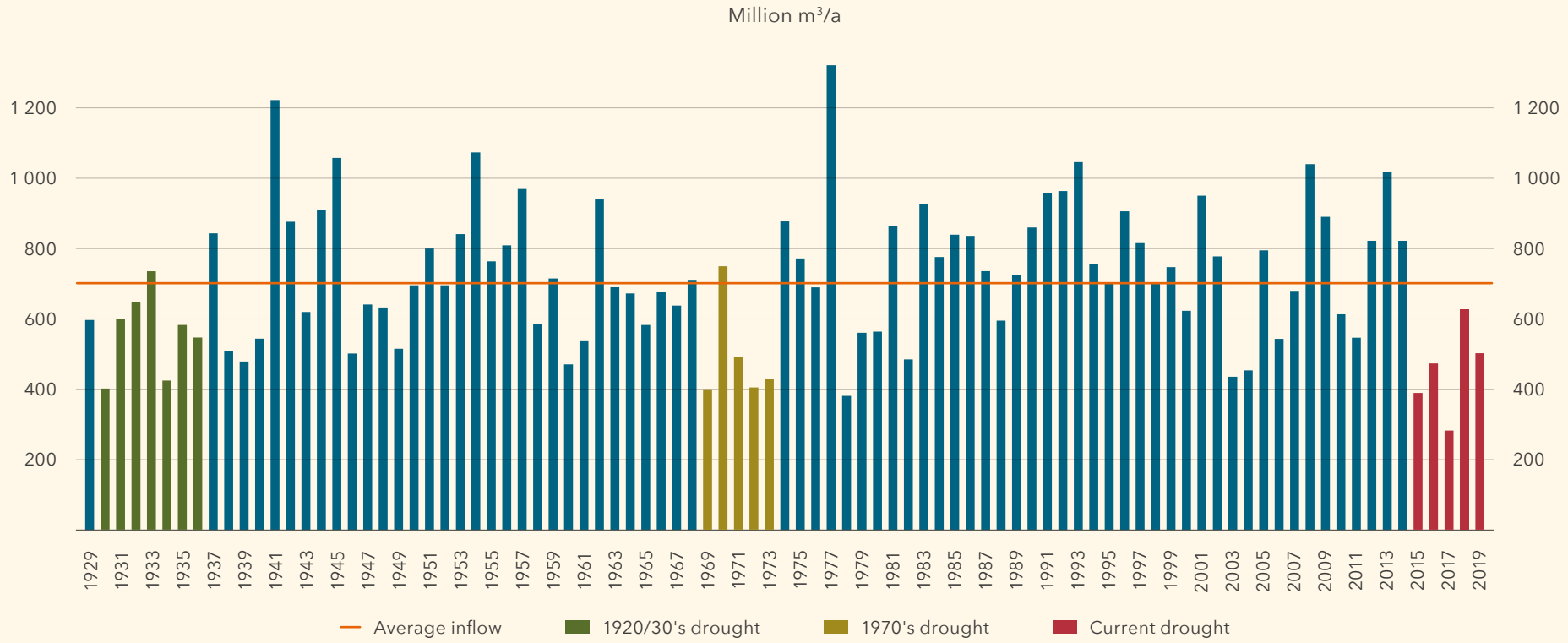
The primary cause of the Cape Town water crisis was low rainfall. The combined inflow for the years 2015, 2016 and 2017 was lower than any other consecutive three-year period in the 90-year record, so the crisis has been defined as a 1-in-590-year event (figure 4).[28]

Most global climate models predict lower rainfall for the Cape Town region, with more frequent low rainfall years. Apart from rainfall, water availability is affected by temperature and wind.[29] Therefore, it is possible that Cape Town could experience (or may already have experienced) a step change in water availability due to climate change (annexure B).

DOING NOTHING IS NOT AN OPTION

If the City does nothing, Cape Town will continue to be fully exposed to the risks that resulted in the water crisis. These risks, including climate change and growth in invasive alien vegetation, are likely to increase. And as the city's population and economy grow, so too will the demand for water. This means that the risk of another severe water crisis will be much higher than in the past. Ongoing water insecurity will affect investor confidence and slow down economic growth. In addition, the people of Cape Town are very unlikely to want to experience severe restrictions again. The time to act is now, apathy and complacency are not options.

FIGURE 4: ANNUAL INFLOW INTO CAPE TOWN'S DAMS OVER THE 90 YEARS FROM 1929 TO 2019



Inflow data is for the hydrological year ending 30 September.

APPROACH

Planning in the context of uncertainty. In the context of high levels of uncertainty, the City will adopt a scenario-planning approach to ensure sufficient and reliable water availability.

New build programme. The City will undertake a responsible new build programme, comprised of a diverse range of water sources, to increase water security and increase resilience. This will build on Cape Town's past experience of investing in water supplies as well as new learnings to ensure that the most cost-effective approach is followed.

New and diverse water sources linked to an integrated surface system. A key shift is that the City will be developing diverse water sources at scale, including groundwater, water reuse and desalination. These schemes will be developed alongside, and integrated with, the existing surface water system that provides water to different users – both urban and agricultural.

Water reuse is a major feature of the strategy. The City is committed to maximising the reuse of wastewater in line with the second edition of the National Water Resource Strategy (2013) to meet current and future water demand. At present, some 8% of treated wastewater is used for industrial, commercial and landscaping purposes. A very small volume is also used in combination with stormwater to recharge the Atlantis aquifer and maintain the seawater intrusion barriers associated with the groundwater scheme. The 10-year committed programme includes future plans for the use of treated wastewater to recharge the Cape Flats aquifer, and also as a direct source of drinking water that will be blended with water supplied from the Faure water treatment plant, which serves a large part of the municipal area. This is in keeping with the City's objective of creating a water-sensitive city that seeks to maximise integration of the urban water cycle that both builds resilience and protects Cape Town's sensitive natural ecosystems. It also draws on international best practice.

Insurance against low rainfall and climate change. The build programme is necessary to provide insurance against low rainfall or lower water availability. Periods of low rainfall may become more frequent and more severe as a result of climate change. It is possible, and even likely, that the additional, more expensive water supplies (such as reuse and desalination) will not be used all the time. Still, this will not have been wasteful expenditure. The future is uncertain, and the cost of very severe restrictions or running out of water is much higher than the cost of insuring against this likelihood by providing additional water supply capacity.

Complementary programmes. The build programme complements the City's activities to promote wise water use while actively managing demand, increasing opportunities from the integrated surface water supply system, and transforming Cape Town into a water-sensitive City. All are necessary.

PLANNING IN THE CONTEXT OF UNCERTAINTY

The two key planning variables for investing in new water supply are future water demand and future water availability. Unfortunately, both are subject to a high degree of uncertainty:

- **Future water demand** is uncertain because of the disruptive effect of the recent drought. It is not known with any certainty how future demand will be affected by the drought in the short and longer term. This is due to significant changes in behaviour, the price of water, and water users' own investments (in the past or the future) in water efficiency or alternative water sources.
- **Future water availability** from rainfall is uncertain because of climate change, the effect of which cannot be accurately forecast.

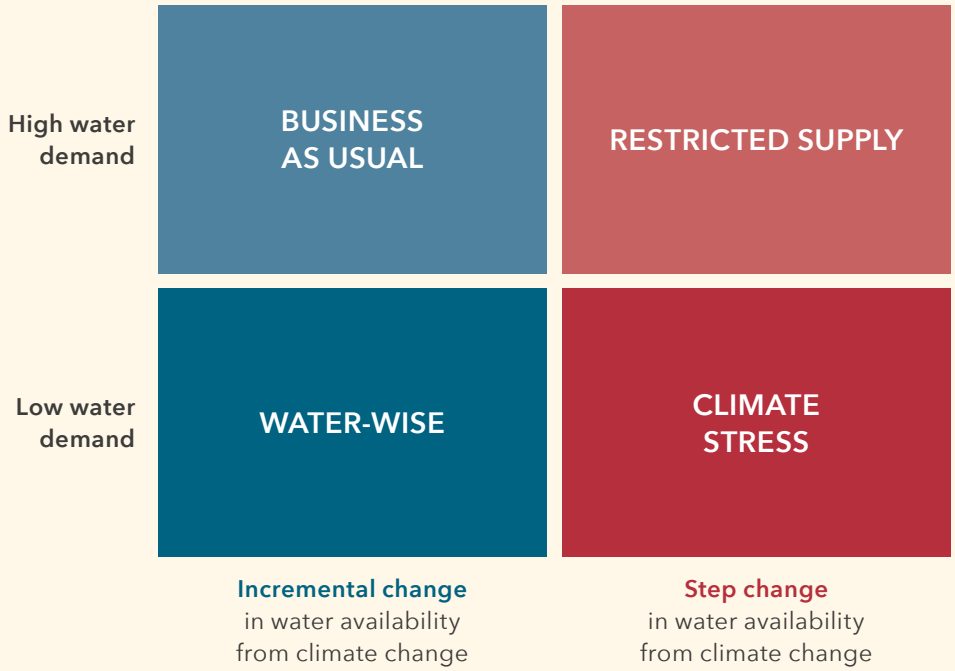
The high degree of uncertainty associated with these two variables far exceeds the effect of any other variables on future demand and supply. For further details, see annexure B.

SCENARIOS

In light of the significant uncertainties, it is prudent to plan based on scenarios. The key variables beyond the City's control are future water demand (without restrictions) and future changes to water availability (climate change affecting rainfall, temperature and wind). While the City can influence demand by imposing restrictions, the aim is to supply sufficient water to meet unrestricted water-wise demand. (See commitment 2, page 17.)

The four scenarios against which a plan needs to be tested are shown in figure 5 alongside.

FIGURE 5: SCENARIOS AGAINST WHICH PLANS MUST BE TESTED



WHERE DOES CAPE TOWN GET ITS WATER FROM, AND HOW WILL THIS CHANGE?

Cape Town gets almost all of its water from the Western Cape Water Supply System (WCWSS). This is an integrated system providing water for both urban and agricultural use. In a "normal" year, Cape Town uses about 60% of the available water, and agriculture uses about 30%.

Supply to Cape Town is dominated by surface water sources. The bulk of the water supplied in the supply area is from surface water sources, which rely on winter rains. Rainfall varies significantly across the area and between years.

The surface water system comprises six large dams and a number of smaller ones. The City owns three of the six large dams. The other dams are owned by National Government. Total storage of the six large dams is approximately 900 million kilolitres.

The WCWSS is managed by the national Department of Water and Sanitation (DWS) in partnership with the City. DWS is responsible for water resources regulation (making allocations and monitoring abstraction) as well as for water resources planning. DWS and the City jointly manage the operation of the complex, interconnected system of dams, pipelines, tunnels and related infrastructure.

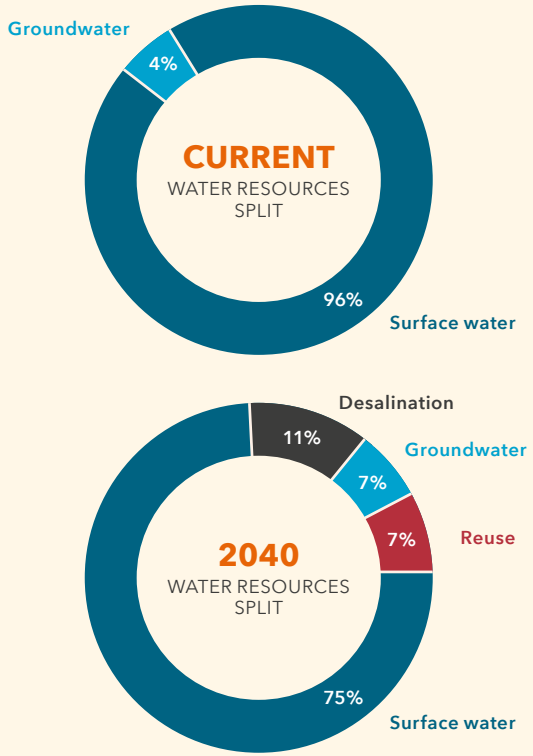
A WCWSS water resource reconciliation study was completed in 2007. The study explored future water demand and supply, and proposed interventions to ensure that supply exceeds demand. DWS produces regular status updates, of which the most recent was in 2016. (The 2018 update is in progress.)

An annual operating analysis informs operating rules and restrictions. The hydrological year ends on 30 October, when DWS, in consultation with water users, makes a decision on operating rules for the system for the hydrological year ahead.

The WCWSS steering committee makes recommendations. The committee, which comprises water users, meets annually to review the status (and other) reports submitted and make recommendations on interventions, including new supply schemes.

Additional supply was planned for 2022. At the time of drafting this strategy, the next water augmentation scheme was the Lower Berg River augmentation scheme. The scheme would add 23 million cubic metres per year into the WCWSS and was due for completion in 2022 (Status Report May 2016).

FIGURE 6: HOW CAPE TOWN'S WATER SUPPLY SYSTEM WILL CHANGE



AN INCREASE IN THE SECURITY OF SUPPLY

Cape Town gets most of its water from rain-fed dams. The security of this supply relies on the probability of water use restrictions when rainfall is low. Up until now, Cape Town's water supply systems had a 98% level of assurance (based on historical rainfall records).

This approach needs to change, for two reasons:

1. In the context of climate change, assurance of supply set at this level and by looking backward (at past rainfall patterns to estimate future water availability) is unlikely to be adequate to reliably meet Cape Town's water needs going forward.
2. If Cape Town continues on a water-wise path, the City's ability to restrict supply without substantial economic harm will be significantly compromised. Maintaining the current level of assurance of supply would be sensible only in a case where climate change is not a significant factor, and demand returns to pre-drought levels (figure 7).

Therefore, the City will aim to increase the level of assurance to 99,5% (based on historical rainfall records). This means that, for any given year, there would be a probability of only 1 in 200 of there being insufficient water to meet planned demand. This is a prudent approach in the present circumstances.

FIGURE 7: SCENARIOS AND THE APPROPRIATE CHOICE OF ASSURANCE OF SUPPLY

	No climate change. Future rainfall is the same as in the past.	**Climate change.** Lower rainfall and more frequent droughts (but quantum of changes unknown).
High water demand. Water demand returns to pre-drought levels.	**Current level of assurance can be maintained.**	**Not applicable.** (High water demand cannot be met affordably in this scenario.)
Low water demand. Water-wise with efficient water use.	**An increase in assurance of supply is prudent,** because it becomes more difficult to restrict demand without economic cost.	**An increase in assurance of supply is prudent,** because probabilities based on the past are not predictive of the future.

The implication of this will be a potential reduction in the severity of water restrictions imposed on Cape Town's residents and businesses during periods of drought.

Building for this higher reliability of supply (99,5%) means that the City will implement water augmentation infrastructure sooner than would have been the case using a lower reliability standard (98%). The cost of doing this is approximately R2,7 billion (in 2018 terms) over ten years, a cost premium of approximately 20% of the committed build programme.[30]

PLANNING FOR THE FUTURE – THE NEW WATER PROGRAMME

The plan to ensure sufficient water is based on a set of assumptions that are considered to be most likely to occur. This is called the "base case plan". This plan was then tested against the three scenarios described in annexure C. These scenarios consider the possible alternative futures for key variables beyond the City's control, namely future climate (and related water availability in the dams) and future water demand. The augmentation plan developed for this base case is shown to be robust and adaptable, should the future differ from the base case assumptions.

The base case plan was developed using the following four assumptions (also see annexure B):

1. **Climate change.** A gradual change in climate, resulting in reduced water availability from rain-fed dams over time.[31]
2. **Assurance of supply.** An increase in assurance of supply from 49 in 50 years (98%) to 199 in 200 years (99,5%), resulting in a reduction in assured water availability from the WCWSS.
3. **Management of the WCWSS.** Decrease in runoff due to invasive alien vegetation, changes in water allocations, and inefficiencies in the management of the existing integrated system. Steps to address the management of the integrated system have been incorporated into the plan and are discussed further under commitment 4.
4. **Water use.** A moderate rebound in water use once the drought restrictions are lifted.

The programme to ensure sufficient water availability was designed based on the base case planning assumptions and tested for robustness and adaptability against the other scenarios (annexure C).

In selecting projects for the new water programme, the City took the following into account:

- **Cost.** Low-cost interventions have been prioritised, including water demand management, the control and eradication of invasive alien vegetation, and improvements to the management and effectiveness of the integrated surface water system.
- **Existing funding commitments.** Schemes where funding has already been committed will be completed, unless compelling reasons emerge not to do so.
- **Timing.** Schemes that can provide water sooner will be prioritised until the desired reliability standard has been reached.
- **Diversification and early learning.** Diverse water sources, with relatively uncorrelated risks, will be developed to learn about how previously undeveloped resources perform. This will help achieve increased resilience. Where new water sources are likely to become an important part of the future water supply mix (for example, desalination), the City will bring forward projects and implement these at a more modest scale to ensure earlier learning. This will enable future larger-scale projects to be implemented more quickly and cost-effectively, which is an important benefit.
- **Adaptability and scalability.** Water sources that can be scaled and have adaptable implementation timing (allowing for acceleration, if necessary) will be prioritised in light of the significant uncertainties relating to both future rainfall and water demand.
- **Earlier than needed.** To account for uncertainty, the City will implement future supply schemes five years ahead of when they are required.

Specific uncertainties accounted for are: current uncertainty regarding allocations and assurance of supply within the WCWSS, inherent uncertainty regarding the impact of climate change on system yield, uncertainty regarding the effectiveness of the water conservation and water demand management programme,[32] challenges in maintaining invasive alien plant clearance programmes beyond the City's control, and project implementation risks.

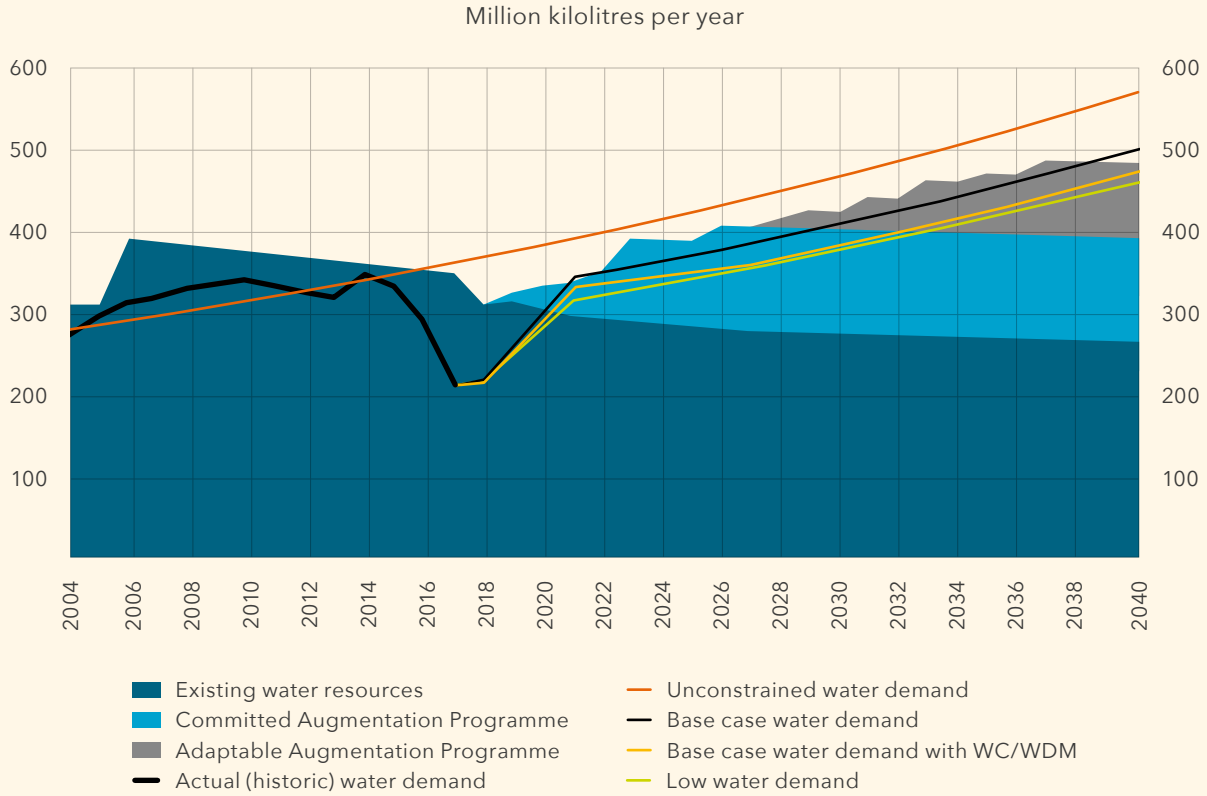
- **Phasing.** The programme is structured in two phases, namely committed projects and an adaptable programme, which can be brought forward and/or scaled as necessary and as new circumstances emerge.

The overall timing and scale of the interventions in the new water programme are shown in figure 8.

The reasons for the decrease in yield from the WCWSS from 2006 to 2018 are discussed in annexure B.

The committed programme will deliver more than 300 million litres of additional supply per day over ten years, and a saving of approximately 70 million litres per day from demand management. The adaptable programme will deliver another approximately 250 million litres of new capacity per day up to 2040.

FIGURE 8: THE SCALE AND TIMING OF THE NEW WATER PROGRAMME



HOW DOES THE CITY DECIDE HOW MUCH NEW CAPACITY TO BUILD?

There is a trade-off between the reliability of water supply, and how much it costs. Rainfall is not reliable. In some years, it rains a lot; in other years, it only rains a little. When rainfall is low, water flow into the dams is not enough to meet Cape Town's needs. It is possible to increase the reliability of water from these dams by building more dam storage capacity and developing other water sources. Both options cost more money.

Rainfall is likely to become less reliable in future. There is now substantial evidence at the global level that climate change is resulting in increased temperatures and changes to weather patterns. Cape Town's rain-fed water supply is vulnerable to climate change. The City will make plans based on the assumption that rainfall will become less reliable in future.

Doing nothing is not an option. If the City does nothing, Cape Town will continue to be fully exposed to the risks of insufficient water. These risks are likely to increase as a result of climate change. And as the city's population and economy grow, so too will the demand for water. This means it is likely that the City will experience water stress with severe water restrictions in future years, unless active steps are taken to reduce these risks.

New and diverse supplies will increase reliability. Investment in new and diverse water supplies – surface water, groundwater, reuse and desalination – will reduce the risk of severe water restrictions in future.

The City will plan for a higher level of reliability. In the past, water planning for Cape Town was based on a reliability standard of 98%, meaning that, for any one year, there was a 98% probability (98 out of 100 years) that the City would be able to supply a certain volume of water from the sources serving it, based on historical records of water flows into the dams.

Because of the risk of climate change, and consumers' reduced ability to further lower demand going forward (as they have become increasingly water-wise), this reliability standard is no longer adequate. Therefore, the City will plan for its water supply based on a reliability standard of 99,5%. The intention with this new reliability standard is to increase the volume of assured supply and, as a result, substantially reduce the likelihood and severity of water restrictions during periods of drought.

The City will adopt scenario planning with annual reviews. In the context of high levels of uncertainty, the City will adopt a scenario planning approach, with annual reviews, to ensure sufficient and reliable water availability.

The committed programme balances risk and cost. The committed programme is designed to balance risk and cost. If less capacity is built, the risk of severe water restrictions will increase. If more capacity is built, the risk is further reduced, but the cost increases. The proposed programme reduces risk at an affordable price.

Committed programme

The purpose of the committed programme is to build now to achieve the desired reliability of supply as soon as possible, subject to the conditions set out on page 33. The committed interventions that form part of the new water programme over the next ten years are shown in table 1. They comprise management interventions, surface water supply, as well as groundwater abstraction, reuse and desalination.

The risk associated with committing to certain schemes is that they may not all be needed – for instance if demand rebound is lower and slower. However, the cost is capped by the requirement that the committed programme includes schemes that are highly likely to be needed in the next 15 years, regardless. Therefore, while costs may be incurred early, they will not be incurred unnecessarily. On the other hand, this approach offers the benefit of securing a timeous commitment to be able to achieve reliability of supply as rapidly as possible. Put differently, the risk of severe restrictions in future would be higher than the target if this commitment is not made now. If demand is lower than predicted in the base scenario, implementation of some of the schemes could also be delayed.

Furthermore, the committed programme will help the City gain experience of costs, procurement and operation of all the technologies it will need in the future.

Desalination – which is both scalable and independent of rainfall – is an important option to develop. While social, environmental and financial implications need to be considered, desalination can ensure a reliable supply when other options are less available.

In view of the significant risk of another drought, the City will investigate the implementation of one or more "desalination parks" that are permitted and "ready to go" should the need arise to implement permanent desalination capacity more quickly. See the climate stress scenario and the section "Increasing robustness and adaptability".

TABLE 1: COMMITTED NEW WATER PROGRAMME OVER TEN YEARS – PROVISIONAL YIELDS AND COSTS

Intervention*	First water	Effective yield		Total capex	Unit capex**	Operation cost***
		Mℓ/day	Million kℓ pa	R million	Rm/Mkℓ	R/kℓ
Demand management	2019	70	26	410	6	3
Alien vegetation clearing	2019	55	20			~1-2
Management of WCWSS	n/a	27	10			~0,2-0,5
Cape Flats aquifer ph 1	2020	20	7,3	610	31	5
Table Mountain Group ph 1	2020	15	5,5	375	25	5
Cape Flats aquifer ph 2	2021	25	9,1	450	18	5
Atlantis aquifer	2021	10	4	290	29	8
Table Mountain Group ph 2	2022	15	5,5	335	23	5
Table Mountain Group ph 3	2022	20	7,3	326	16	2
Berg River augmentation	2023	40	15			~3-5
Water reuse ph 1	2024	70	26	1 360	20	5
Desalination ph 1	2026	50	18	1 650	33-40	9
Total, including WDM		417	154	5 806		
Total new supply		347	128	5 396		

* Timing and the capital and operating costs are best available engineering estimates. All schemes are subject to the outcomes of ongoing investigations (to determine optimal yield, siting and timing) and relevant approvals. ** Rounded to nearest million rand. *** Rounded to nearest rand.

Proactive Protection – Management interventions

Invasive alien vegetation clearance (catchment management).

The City is committed to help clear invasive alien plants in the catchments of the major dams supplying Cape Town. This source control measure offers multiple social, economic and environmental benefits. It is the least costly means of increasing system yield. Should the spread of invasive alien plants continue without priority intervention, it is likely that the 1:50-year yield of the WCWSS will continue to decrease. The City will work with external stakeholders to prioritise catchments to be cleared, as well as determine the best mechanisms to fund clearing efforts.

Water conservation and water demand management.

This is another priority intervention – see commitment 2, page 17. The City is busy implementing its revised Water Conservation and Water Demand Management Strategy. The strategy includes pressure reduction, leak detection and repairs, meter management, meter replacement, consumer awareness and education campaigns, and the recycling of treated effluent for industry. Refer to annexure E for more detail.

Management of the WCWSS.

The City has recognised the need for improved monitoring and management of water resources. The development of a decision support system is critical to ensure that the City can operationally integrate new water sources with the management of the WCWSS. This will minimise spillage during the wetter years, thereby maximising the stored water available for essential use during droughts. See commitment 4, page 43.

New horizons – New water supplies

Berg River augmentation scheme.

This scheme is a DWS responsibility. See commitment 4, page 43.

Cape Flats aquifer (phases 1 and 2).

The Cape Flats aquifer is a sandy, shallow, unconfined aquifer with boreholes approximately 40 m deep. The aquifer will be incrementally developed in two phases in the clusters of Strandfontein West, Strandfontein North and East, Philippi, Hanover Park, Bishop Lavis and Swartklip. The scheme will include artificial recharge of the aquifer by injecting high-standard treated effluent, as well as a seawater intrusion barrier. The water abstracted from the aquifer will require further treatment prior to injection into the water supply system. DWS has imposed licence conditions on groundwater abstraction from the Cape Flats aquifer to ensure the sustainability of the

resource. Environmental monitoring committees will be set up to oversee longer-term sustainability, while water monitoring protocols will be put in place to ensure water quality compliance.

Table Mountain Group aquifer (phases 1 to 3).

The Table Mountain Group aquifer is a hard rock aquifer. Boreholes are usually drilled to a depth of 250-700 m. Water abstracted from the Table Mountain Group aquifer is of a relatively good quality, but may require pre-treatment to remove iron and manganese before being discharged into surface water sources, such as Steenbras Upper dam, from where it will undergo further treatment. Wellfields currently being targeted are in the vicinity of Steenbras dam, Nuweberg and Groenlandberg (near Theewaterskloof dam). DWS has imposed licence conditions on groundwater abstraction from the Table Mountain Group aquifer to ensure the sustainability of the resource. Environmental monitoring committees will be set up to oversee longer-term sustainability.

Atlantis aquifer.

This existing groundwater scheme with artificial recharge has been successfully operated for over 30 years. The proposed project entails optimisation and expansion of the existing wellfields. The project also includes the refurbishment of the existing wellfields to restore them to the level of yield at which they previously operated.

Water reuse: Faure new water scheme.

It is proposed that a permanent 70 Mℓ/day water reuse plant be constructed at the existing Faure water treatment works. Initial advanced treatment of the effluent from the Zandvliet wastewater treatment works will take place at Zandvliet, after which it will be pumped to the Faure new water scheme. Here, the highly treated effluent will be treated further, and then discharged into the inlet of the Faure water treatment works, where it will be blended with water from Theewaterskloof or Steenbras Upper dam before undergoing further, conventional water treatment. The proposed new water scheme will be designed and operated in accordance with international best practice and associated water safety protocols.

Desalination.

Siting, feasibility and water quality investigations are under way for a desalination plant with a capacity of between 50 and 150 million litres per day. A full environmental impact assessment will need to be undertaken prior to the implementation of large-scale desalination. The City will also further investigate the most appropriate funding and implementation mechanism.

Future flexible – Adaptable programme

The purpose of the adaptable programme is to plan schemes that will be needed in the future, but for which an immediate implementation decision is not required. Based on emerging information on demand bounce-back and rainfall, the City would be able to shift the adaptable programme forward or backward. The adaptable interventions that form part of the new water programme are shown in table 2. They comprise additional groundwater abstraction, reuse and desalination, as well as surface water augmentation.

TABLE 2: ADAPTABLE NEW WATER PROGRAMME WITH INDICATIVE SUPPLY VOLUMES*

Intervention*	Supply (Mℓ/day)
Groundwater (further phases)	50
Reuse schemes ph 2	30
Desalination (further phases)	100
Surface water (new schemes)	100
Total	280

* Volumes are subject to change.

Preparatory work for the schemes in the adaptable programme – for instance, securing and permitting sites, and preparing designs and bid documents – will be done in advance so that the City can implement the schemes more quickly if needed. (See the section "Increasing robustness and adaptability".)

Future fit – The quality of Cape Town's water

All water entering Cape Town's piped network and intended for drinking is treated to meet the minimum national water quality standards in terms of SANS 241. (See "Quality of service" under commitment 1.) The quality of the source water (called "raw water" in the water industry) determines the treatment required and what it would cost. Cape Town is fortunate to get most of its raw water from rain-fed dams, which are in near-pristine condition, with little or no pollution. Treatment costs are therefore relatively low. On the other hand, new water sources (wastewater, groundwater and seawater) need more treatment, which costs more. The City has a capable Scientific Services Branch, which monitors the quality of raw and treated water, allowing for suitable management actions to maintain consistently high-quality standards for water supplied to customers. This function will become even more important in treating wastewater to potable standards and blending it with raw water, desalinating seawater (requiring remineralisation) and managing water quality in the Cape Flats and other aquifers, including aquifer recharge. See annexure A.

Stress testing for robustness and adaptability

In light of the significant uncertainty in the three areas of rainfall, future water use and institutional effectiveness, the new water programme has been stress-tested to see whether the programme and outcomes would be robust enough if the future turns out to be different from that anticipated for the base case planning scenario. The conclusions of the stress tests (shown in annexure C) may be summarised as follows:

Business as usual (high demand). Demand rebounds to pre-drought levels, and rainfall patterns in the near future largely reflect the past distribution of rainfall (gradual climate change, only a small reduction in rainfall). In this scenario, supply can be met through the planned programme at a 1-in-50-year (98%) level of assurance. This is acceptable, because the ability to restrict demand will not have been reduced as a result of the drought.

Water-wise. Demand remains low after the drought, while rainfall patterns in the near future largely reflect the past distribution of rainfall (gradual climate change, only a small reduction in rainfall). In this scenario, components of the planned programme can be delayed, because supply will exceed demand if the programme is implemented as planned.

Climate stress. There is a step change in the climate (low rainfall), and demand remains low after the drought. In this case, the planned programme will only be able to meet the City's basic needs in the early years, requiring significant restrictions. In this scenario, the programme will be accelerated. (See the section "Increasing robustness and adaptability" below.)

Future-proofing the future – Increasing robustness and adaptability

Measures to increase the robustness and adaptability of the new water programme are set out in annexure D. In particular, the measures enable and support the acceleration of the new build programme, if needed (climate stress scenario). This potentially includes the development of permitted desalination parks to allow for the rapid deployment of desalination capacity at scale.

WHAT IMPACT WILL THE NEW WATER PROGRAMME HAVE ON TARIFFS?

Water and sanitation tariffs will change. Both the structure and level of water and sanitation tariffs will change over time to better reflect actual costs and provide appropriate signals for efficient water use and investment in additional supplies. The fixed charge will increase to cover the fixed costs of managing and maintaining the distribution network. 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.

Cape Town water tariffs will decrease from the very high levels imposed during restrictions in early 2018. Future tariffs will be lower than those experienced during the drought, and the volumetric tariff will settle at the cost of providing additional desalinated water. The cost of desalinated water is expected to be in the region of R15 to R25 per kilolitre, depending on how efficiently it is procured. (The volumetric water tariff is currently higher than this.)

Poor households will continue to receive subsidies. Every person needs access to at least a basic amount of water every day. This is a human right, and the City provides this basic amount for free to those who cannot afford to pay (approximately 1,5 million people, making up more than a third of the total population of Cape Town). Subsidies will be used to keep water and sanitation services for basic needs affordable for poor households.

See “Translating the strategy into action”, page 54.

WATER RESTRICTIONS

Will there be water restrictions in future?

Because the majority of Cape Town's water will still come from rain-fed dams over the next ten years and more, the City will still have to implement restrictions during drought periods, when rainfall is low. If the new water programme is successfully implemented (commitment 3) and the other commitments are also carried out (commitments 2, 4 and 5), the frequency and severity of restrictions will be much less than in the recent past. This is a key objective of this strategy. Nevertheless, restrictions are likely to remain necessary to some extent. Feedback from residents and stakeholders is that they clearly understood the need for past water restrictions, but found the many levels of restrictions the City implemented confusing. This system will be simplified going forward.

The difference between water restrictions and demand management

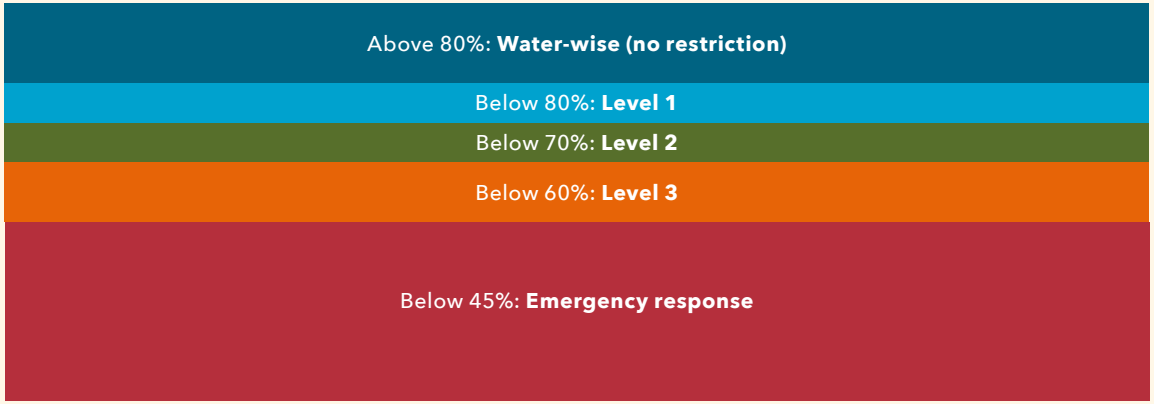
Water restrictions are usually punitive and focus on demand reduction in the short term, often with a significant impact on the consumer. Water conservation and water demand management, on the other hand, focus on the sustained reduction and minimisation of wasteful water use, and efficient and fit-for-purpose water use over the medium to long term. These measures should not negatively affect water users and have been discussed under commitment 2.

Three restriction levels

The City plans to implement three restriction levels (see table 3), and to provide for an emergency response if needed. When recovering from a drought, the approach to lifting restrictions will be more conservative than the rules for implementing higher-level restrictions. Restriction levels will be reviewed annually.

TABLE 3: INDICATIVE DAM LEVELS FOR IMPLEMENTATION OF RESTRICTION LEVELS AT BEGINNING OF HYDROLOGICAL YEAR

Dam level at 1 November

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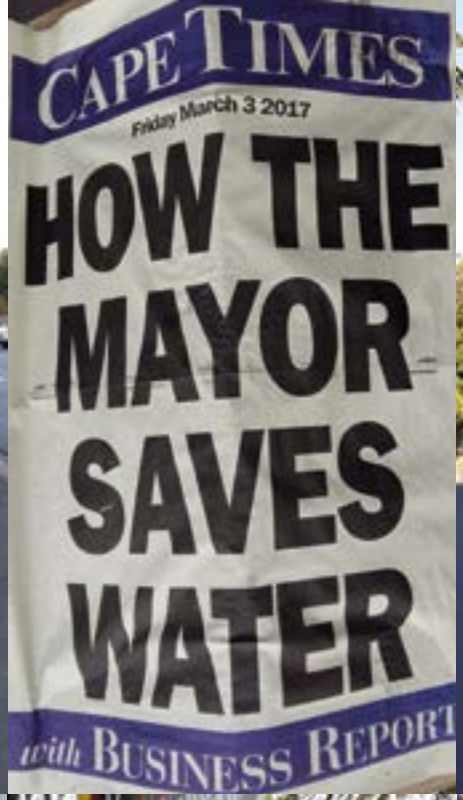
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Verlaag watergebruik nou!
Isilumkiso sentlekele
yokunqongophala kwamanzi:
Nciphisa usetyenziso
lwamanzi ngoku!


CAPE TIMES
WHO'S NEXT FOR WATER PRESSURE CLAMPS
with BUSINESS REPORT


ONDAY
Cape Argus
WATER WASTERS BE DAMNED
TO SUBSCRIBE TEL 0800 220 770


WEDNESDAY
Cape Argus
WATER RED ALERT KICKS IN

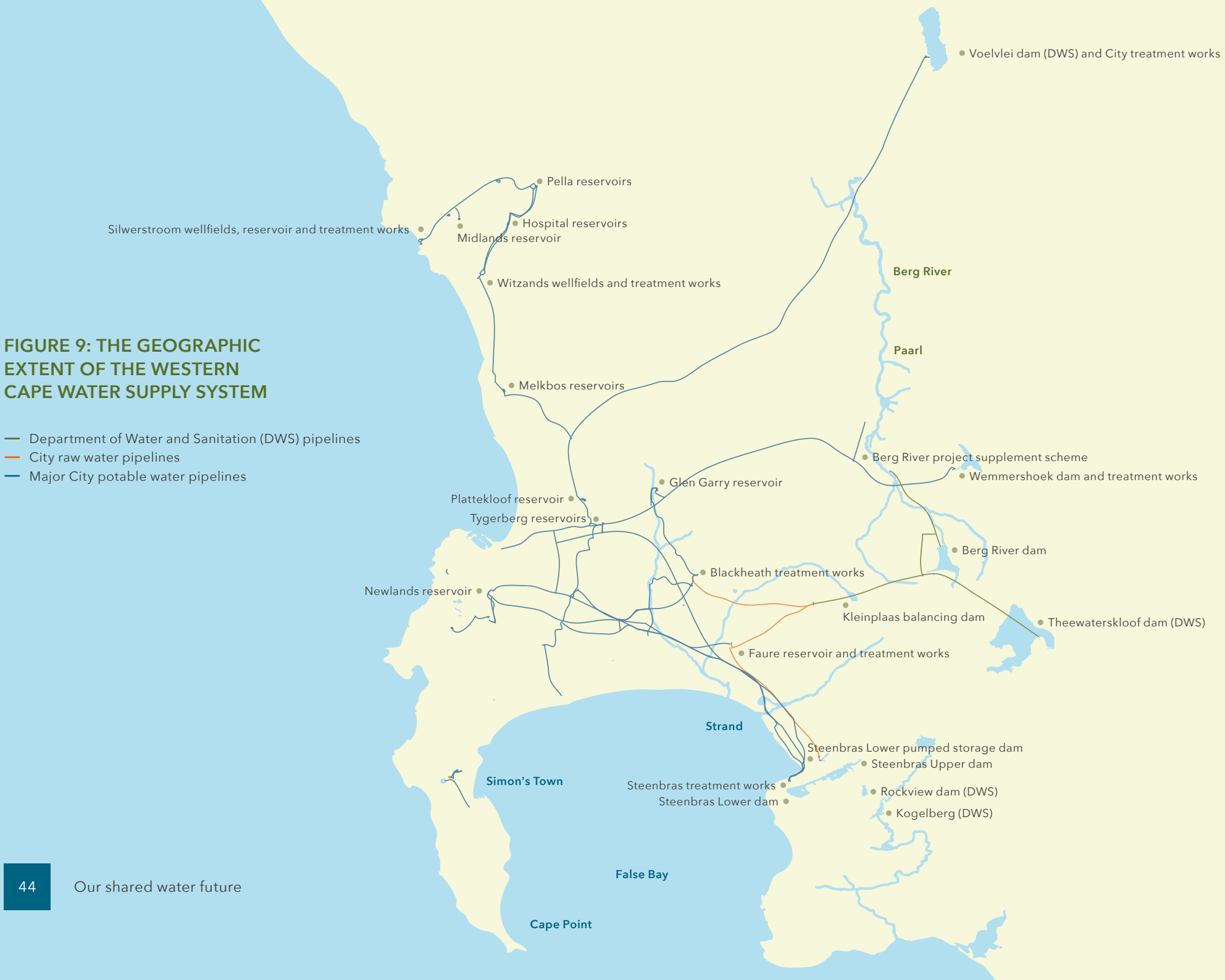

CAPE TIMES
DAY ZERO FOR WATER EARLY 2018
with BUSINESS REPORT

COMMITMENT 4:

SHARED BENEFITS FROM REGIONAL WATER RESOURCES

The City will work with key stakeholders and partners, including other urban and agriculture water users and other spheres of government, to make the most of the opportunities to optimise the economic, social and ecological benefits of regional water resources, and to reduce the risks. The City will do this through collaborative processes.

FIGURE 9: THE GEOGRAPHIC EXTENT OF THE WESTERN CAPE WATER SUPPLY SYSTEM



A SHARED RESOURCE THAT IS CHANGING

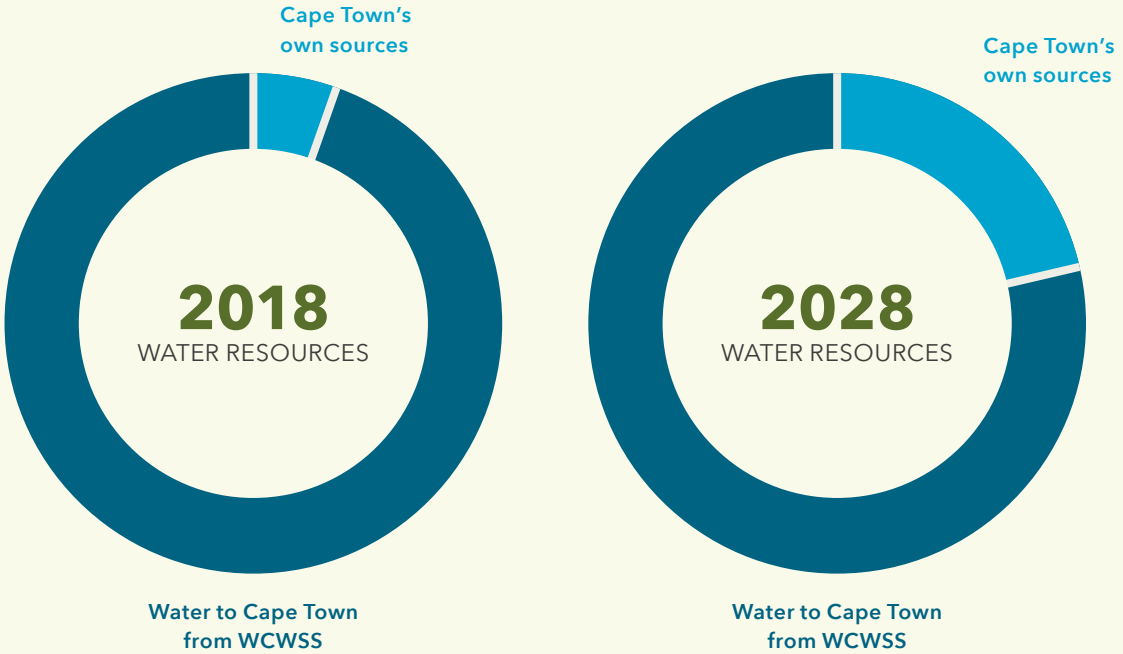
Cape Town receives a significant share of its water from the Western Cape water supply system, an integrated surface water system (figure 9).

This surface water system is shared with other users – Cape Town uses 64%, other urban users 7%, and agriculture 29% in a normal non-drought year.

However, the relationship between water users in the Western Cape Water Supply System will change. The City, the system's largest user, will build substantial water supply schemes of its own, as opposed to relying almost entirely on the Western Cape Water Supply System (figure 10). Moreover, water schemes with very different costs and technical characteristics (such as desalination plants and aquifer recharge) now need to be considered for the first time.

Given the changes in technologies, costs and relationships between users, it is necessary to consider what arrangements would be best suited to manage the Western Cape Water Supply System and its interface with other bulk water production and storage systems, such as those that the City plans to build, going forward.

FIGURE 10: CAPE TOWN'S WATER RESOURCES IN 2018 AND PLANNED FOR 2028



SHARED BENEFITS

Water benefits people, the economy and the environment in multiple ways. Water supports all life. Sufficient water is necessary for households to support basic needs and enhance quality of life. Water is necessary to support commerce and industry, and agriculture. Water supports the natural environment including the riverine and wetland ecosystems. All users of the system stand to gain collectively as the opportunities to maximise the benefits of water are realised.[33]

The Department of Water and Sanitation (DWS) is the sector regulator and custodian of water resources in South Africa. The City will collaborate closely with DWS in ensuring integrated planning in the region.

The economic and social costs of severe water restrictions imposed in the WCWSS were very high. Job losses in agriculture were very significant, and reduced investments and tourism, also led to job losses in other sectors.

SHARED RISKS

The following management-related issues affect water availability from the WCWSS:

- the spread of invasive alien vegetation (reducing runoff into the dams);
- delays in providing additional surface water supply;
- reduced water availability (lower dam levels) as a result of infrastructure maintenance challenges (pump stations, pipelines, canal cleaning, etc.);
- reduced water availability (lower dam levels) as a result of inefficiencies in the operation of the system (timing of transfers and releases, etc.);
- potential over-allocations reducing water availability; and,
- implementing water restrictions in accordance with the defined rules.

From the City's perspective, another risk is that the WCWSS could be operated so as to transfer the benefits of the City's increased reliability to other users of the system, at the City's expense. The intention is to address this concern together with DWS and other users.

All users of the system have an interest in a predictable, secure set of water rights that they can depend on, and have a right to know that the allocation of water rights is managed in a transparent and fair way, including adherence to existing legal agreements.

The experience of the drought showed that insufficient water hurt the whole region, and the economic impact is likely to have been experienced at a national level as well. So, in future, all stakeholders will benefit if the regional water management and supply area is governed in a more integrated and collaborative way.

OPTIONS FOR THE FUTURE

Options to consider along with other users and stakeholders include:

- amending existing and developing new legal agreements that specify water rights in the system in clearer, more enforceable terms;
- promoting not just better information on the management of the system, but also the sharing of that information with all users and the public;
- ensuring adequate funding for the effective operation of the system (including staffing and maintenance);
- professionalising the management of system operations;
- ensuring that the management of system operations is optimised, including improved metering and monitoring; and,
- making full use of the existing governance structures for the Western Cape Water Supply System and, together with the Department of Water and Sanitation and other water users, exploring any possible improvements to these governance structures.

A COLLABORATIVE APPROACH

As the biggest water user in the system in terms of both water allocation and infrastructure, the City will work collaboratively with stakeholders and partners to:

- enhance integrated planning with other actors in the Western Cape Water Supply System and the province,[34] in partnership with the Department of Water and Sanitation;
- improve the analytical information base for water resource management decisions and include economic factors into these considerations more explicitly;
- build stronger relationships between the key stakeholders by sharing expertise, information, infrastructure and finances to ensure better planning and cost-effective investments;
- optimise the overall economic and social benefit of water;
- improve water resource management approaches and practices to ensure resilient outcomes;
- explore and evolve contractual, institutional, financial and governance arrangements between users (urban and agricultural) and the Department of Water and Sanitation given that the City is planning for higher assurance of supply; and,
- ensure more robust and transparent management of system water resources.

COMMITMENT 5:

A WATER-SENSITIVE CITY

The City will actively facilitate the transition of Cape Town over time into a water-sensitive city with diverse water resources, diversified infrastructure and one that makes optimal use of stormwater and urban waterways for the purposes of flood control, aquifer recharge, water reuse and recreation, and that is based on sound ecological principles. This will be done through new incentives and regulatory mechanisms as well as through the way the City invests in new infrastructure.

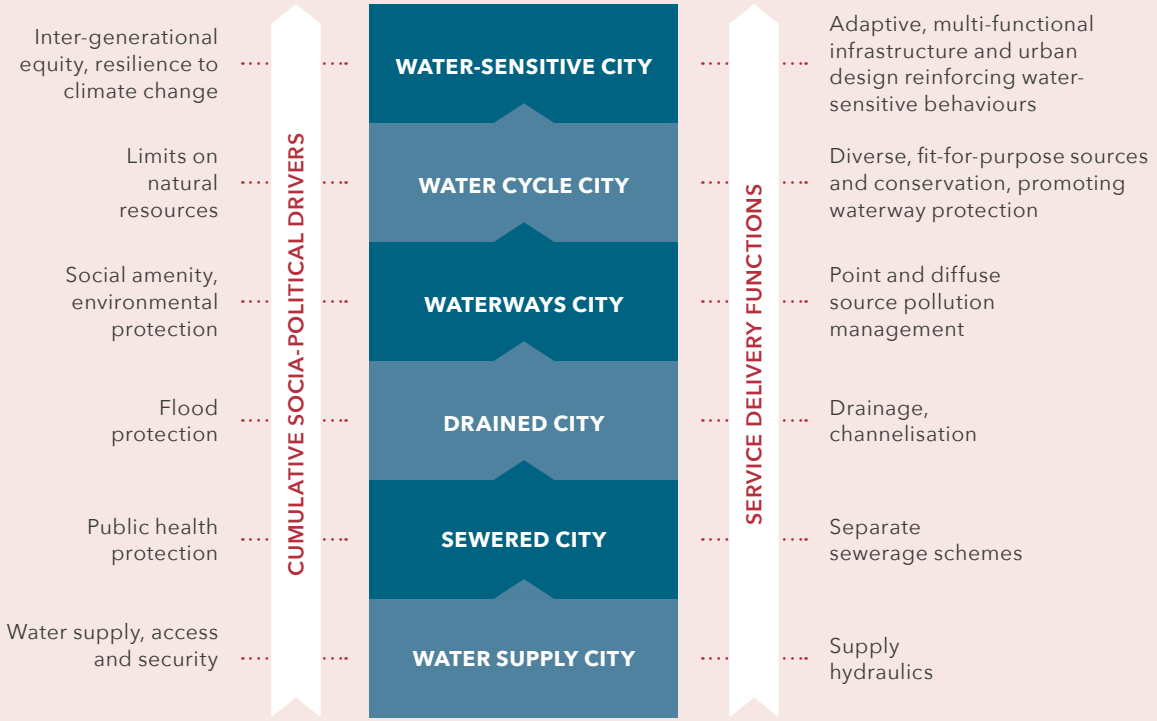
VISION

The overarching vision informing this strategy is that, by 2040, Cape Town will become a water-sensitive city that optimises and integrates the management of water resources to improve resilience, competitiveness and liveability for the prosperity of the city's people.

This multidimensional and complex process is illustrated in figure 11. The City will model the future form of the built and natural environment to inform its plans, using a scenario-based approach.

Cape Town has largely met the water supply challenge. It also manages a sewer network and treats wastewater for almost all formalised properties. Nevertheless, some significant service challenges remain, as discussed under commitment 1. The City is in the midst of a major upgrade of its wastewater treatment facilities to improve their capacity and performance. Cape Town also experiences serious challenges with respect to flood management on the Cape Flats, and many of its waterways are heavily polluted. The transformation of Cape Town into a water-sensitive city will be challenging and is a medium-term objective.

FIGURE 11: THE TRANSITION FROM A WATER SUPPLY CITY TO A WATER-SENSITIVE CITY[35]



This strategy sets out the principles and approaches for an integrated urban water management approach that will transform Cape Town into a water-sensitive city over time; a city that makes use of the opportunities presented by stormwater and urban waterways.

Water-sensitive cities – a process and a destination

In its broadest context, water-sensitive urban design encompasses all aspects of integrated urban water cycle management, including water supply, sewerage and stormwater management. It represents a significant shift in the way in which water and related environmental resources and water infrastructure are considered in the planning and design of cities and towns, at all scales and densities. Increasingly, the terms "water-sensitive urban design" and "water-sensitive cities" are used interchangeably. However, there is a subtle yet important distinction between the two: While "water-sensitive urban design" refers to the process, "water-sensitive city" refers to the destination (the objective) (Fletcher et al., 2014).

THE CHALLENGES

Stormwater and urban waterways are often considered a costly problem – water is polluted, and the adjoining areas are often unsafe and remain unused. However, they also present an opportunity. Stormwater can be managed to reduce the threat of flooding, and can also serve as a resource to, for example, recharge aquifers.

Cape Town is home to an extensive network of rivers and wetlands. These freshwater systems fulfil a dual function, serving as havens for plant and animal life, as well as ecological infrastructure networks for the management, treatment and conveyance of stormwater and treated effluent. The "built" stormwater infrastructure – roadside gutters, kerb inlets and pipes – interfaces directly with Cape Town's receiving freshwater and coastal environments. An integrated understanding of, and approach to, the management of these connected systems are essential for the protection of the receiving environment. The ongoing organic and inorganic pollution and littering of Cape Town's stormwater and freshwater systems poses a threat to both biodiversity and human health.

Improved stormwater management is vital for protecting the citizens of Cape Town from localised and more widespread flooding. Notably, citizens in informal settlements face the brunt of localised flooding, while they have the least means to prepare and recover from such events. The City has a particular duty to ensure the safety of the most vulnerable residents of Cape Town. This also presents an opportunity for the capture and storage of stormwater for productive use.

The health of our urban water ecosystems tells part of the story of rivers and wetlands. They are generally not suitable for recreation, and unsightly in places, making them undesirable as public gathering spaces. Another part of the story of our rivers and wetlands is that many are regarded as unsafe due to criminality. These systems are largely ignored by Capetonians, while they are in fact rich with possibility.

Recently, the City significantly increased its ten-year investment programme to upgrade wastewater treatment works in order to achieve an even higher effluent quality standard and to provide capacity upgrades to support city development.

In addition, the extension of the treated wastewater effluent distribution system is proceeding annually, steadily increasing the diversity of the City's water resources by replacing potable water use and reducing the volume of discharge into Cape Town's rivers and urban waterways.

FIRST THINGS FIRST – THE PRINCIPLES OF WATER-SENSITIVE URBAN DESIGN THAT GUIDE US

Protect natural systems. Protect and enhance natural water systems.

Protect water quality. Improve the quality of water draining from the urban area.

Integrate stormwater treatment with the landscape. Use stormwater treatment systems in the landscape for multiple uses and with multiple benefits, such as water quality treatment, wildlife habitat, public open space as well as recreational and visual amenity.

Reduce runoff and peak flows. Reduce peak flows through on-site temporary storage measures (with potential for reuse) and minimise impervious areas.

Add value while minimising development costs. Minimise the drainage infrastructure cost of development.

Reduce potable water demand. Use stormwater as a resource by capturing and reusing it for non-potable purposes (toilet flushing, garden irrigation, laundry, etc.).

Source: Melbourne Water

THREE TOOLS TO HELP US TRANSITION INTO A WATER-SENSITIVE CITY:

- **Economic and financial incentives** – the way in which the City levies taxes and service charges
- **Regulatory mechanisms** – changing the rules of the game through, for example, land use permissions and building codes
- **Direct investment in infrastructure**

In all three of these areas, the City will ensure that the benefits of any initiative will exceed the costs.

TRANSLATING THE STRATEGY INTO ACTION

INCREASING CAPABILITY

The lion's share of the City's commitments set out in this strategy will be undertaken by Cape Town Water, in partnership and collaboration with fellow City directorates and other stakeholders.

Onwards and upwards

Cape Town Water is undergoing a transition from a municipal engineering department to a modern, fit-for-purpose, world-class water services provider, in line with international best practice. This transition cuts across all aspects of the organisation and focuses on customer service, efficiency and effectiveness. To achieve this transition, a **Cape Town Water transition plan** will be developed and implemented. Key components of the transition plan, subject to refinement, are set out below, building on existing strengths.

Putting customers first

Cape Town Water will make every effort to ensure that customers are happy with the services they receive. The City will make its operations and performance more transparent and accountable to customers. The City will adopt a proactive approach to its customers. This will involve establishing a Customer Services Branch that will be suitably structured and staffed, and managed by a customer relations management specialist. The customer relations management policy for water and sanitation will be reviewed and improved. As much attention will be given to listening to customers' needs and perspectives, as to communicating with customers. More use will be made of multiple and multi-language media platforms including radio phone-ins. The annual customer surveys will be improved and the published results made more accessible.

The customer service charter is at the heart of the City's agreement with the customer. Cape Town Water will review this charter to ensure that it is both more visible and credible, including clear and measurable commitments to delivering realistic service standards.

Contact centre performance will be substantially improved, including the time to answer the phone, text messages (SMS or WhatsApp) and emails, the contact experience as well as timely resolution of queries. Problem resolution tracking and workflows will be improved to enhance effectiveness and speed up problem resolution. All frontline staff will be selected for customer service aptitude and skills, and be specifically trained in customer service best practice.

Cape Town Water will improve services provided to key customers by establishing a Key Customer Unit to better manage the complex demands of customers with a large number of meters and large sales volumes. The meter replacement programme will also be accelerated.

Complaints relating to sewer blockages and overflows tend to outnumber complaints relating to water. This was the case even during the drought. In addition to its ongoing programme to replace sewer pipes, Cape Town Water will therefore embark on a concerted campaign to improve customer awareness of the causes of sewer blockages, and how these can be avoided, and will continue to attend to timely sewer upgrades and replacements.

Improving water and sanitation services in informal settlements

The significant challenges involved in improving water and sanitation services in Cape Town's many informal settlements are described under commitment 1. The City is committed to finding better ways to provide safe water and sanitation services through processes that build dignity, trust and social cohesion. This will require multidisciplinary approaches that extend beyond the scope and mandate of Cape Town Water alone. The challenges are as much social and political as they are technical. Therefore, Cape Town Water will develop a multidisciplinary and learning-oriented approach to service provision in informal settlements.

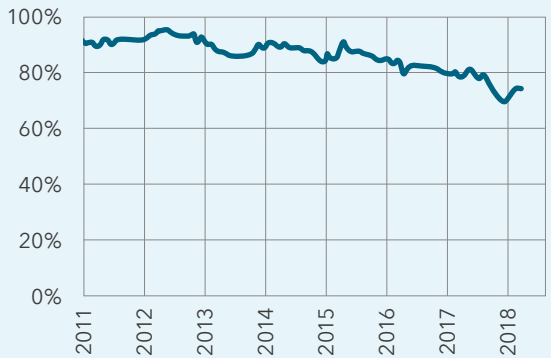
Investing in people

The most important resource available to Cape Town Water is its people. Cape Town Water will build an organisational culture based on the values of integrity, excellence in execution, and diversity. The organisational structure will be revised to ensure it is fit for purpose, with regular subsequent reviews. The best person for each job will be appointed. This will be done paying particular attention to the skills required to implement this strategy, and embracing the employment equity targets that support diversity and enable the City to better reflect its customer profile. Organised labour will be engaged throughout this process. Emphasis will be placed on increasing fluidity and speed of execution within the organisation, particularly with respect to decision making, appointments and procurement. Vacancy rates and the time taken to fill vacancies will be substantially reduced. Procurement processes will be optimised, with particular attention to value for money and the time taken to contract. Standard operating procedures will be reviewed and improved to retain institutional memory and ensure effective training. Talent management for succession planning and staff development will be emphasised. The working environment will be improved.

Improving cash collection

Cash collections have declined from over 90% in 2012/13 to a low of 70% in 2017/18. Although exceptional circumstances contributed to poor performance during the 2018 financial year, there is a need to turn performance around to achieve 95% or more over the next three years. This will require substantially reducing the number of estimated meter readings, improving billing accuracy, making bills easier to understand, making it easier for customers to pay, and resolving account queries speedily.

FIGURE 12: CASH COLLECTED AS % BILLED (WATER)



Improving operational efficiency and effectiveness of network management

A key function of Cape Town Water is to manage the water and sewer networks, comprising over 20 000 km of pipes. Attention will be paid to ongoing operational improvements in effectiveness and efficiency, in line with international best practice.

Expanding and managing bulk water and wastewater infrastructure

Cape Town Water is embarking on a substantial new build programme (commitment 3). This is in addition to upgrading and expanding existing wastewater treatment works (to ensure compliance with licence conditions and cater for increasing demand) and managing extensive bulk infrastructure. Attention will be paid to efficient capital expenditure, timely commissioning of projects, and operational efficiency in line with the master plan, network modelling and international best practice.

Maximising benefits and reducing risks of shared regional water resources

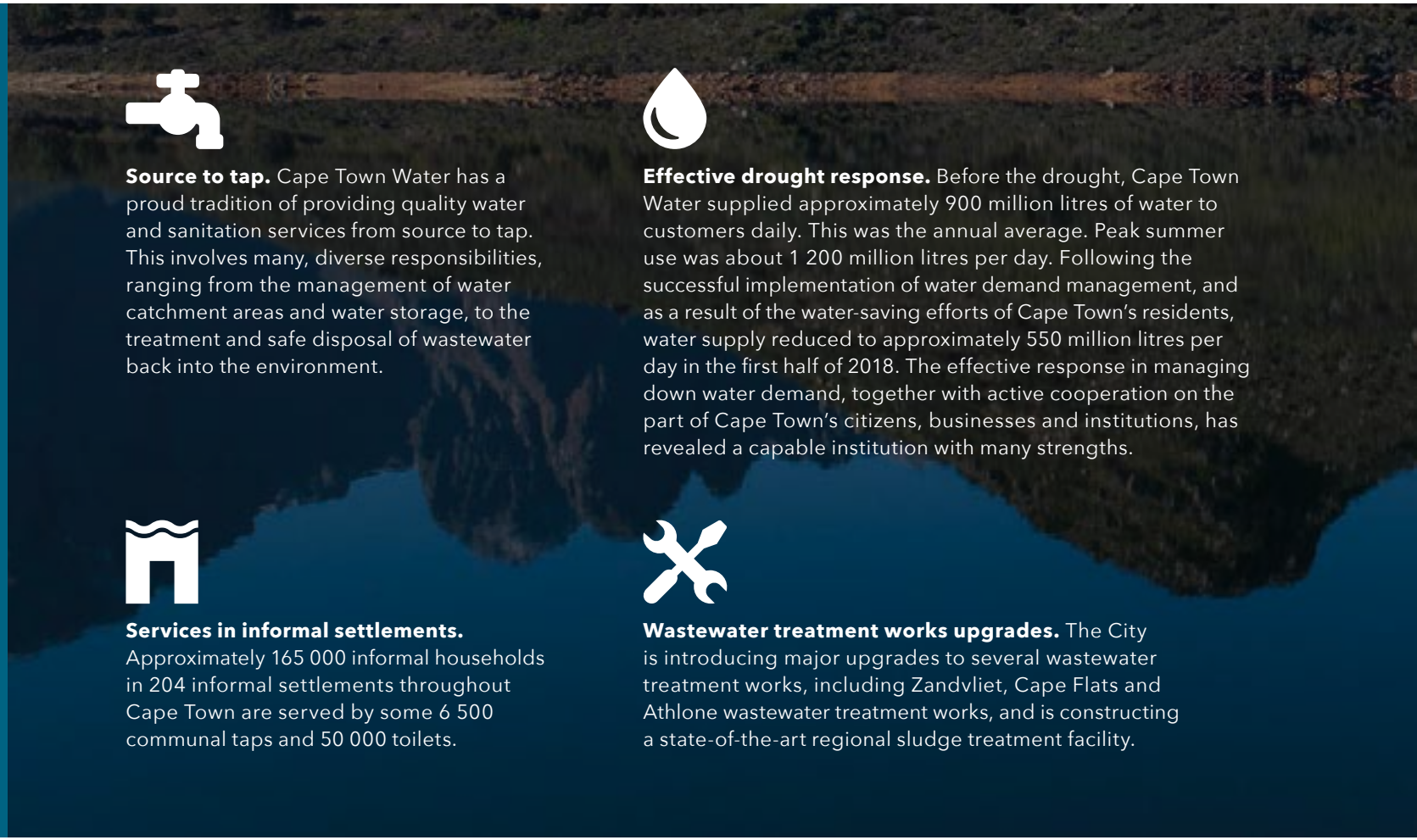
Cape Town Water will ensure that it is suitably staffed and resourced to work effectively and collaboratively with stakeholders and partners on:

- improving the information base and understanding;
- building stronger relationships between key stakeholders;
- optimising the overall economic and social benefit of water;
- improving water resource management approaches and practices to ensure resilient outcomes and reduce risks;
- strengthening institutional and governance arrangements between users (urban and agricultural) and the national Department of Water and Sanitation; and
- ensuring more robust and transparent management of water resources.

Supporting the transition to a water-sensitive city

To achieve the vision of a water-sensitive city, the relationship between Capetonians and water will have to change. All forms of water in the city – rain, stormwater, groundwater, greywater and blackwater, canals and rivers – need to be managed in an integrated way that makes the best, sustainable use of this scarce resource and reduces the risk and impact of flooding. As part of this transition, the responsibility for stormwater management has already been moved across from the Roads Department to Cape Town Water. The mechanisms at the City's disposal to facilitate and influence this transition are taxes and service charges, land use permissions, planning requirements and by-laws, and direct investment in infrastructure. Cape Town Water will ensure that it has the appropriate human and other resources to work effectively, collaborate and follow a multidisciplinary, learning-oriented approach to implement the vision of a water-sensitive city. The City will seek to leverage available and relevant know-how and resources, both within and beyond Cape Town. This will be complemented with an ongoing action learning research agenda in collaboration with relevant stakeholders and partners to improve the effectiveness and impact of the City's efforts to facilitate a transition to a water-sensitive Cape Town.

CAPE TOWN WATER PERFORMANCE



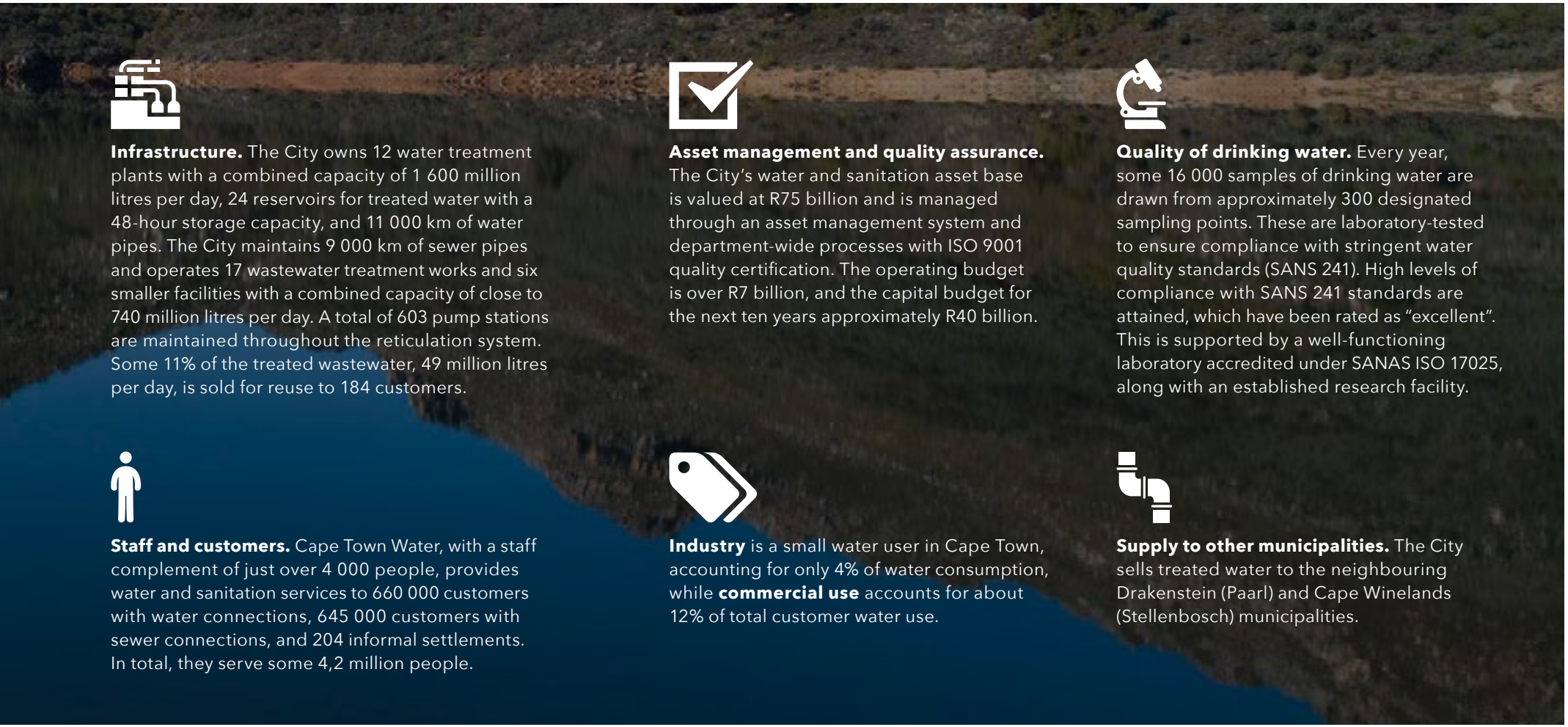
Source to tap. Cape Town Water has a proud tradition of providing quality water and sanitation services from source to tap. This involves many, diverse responsibilities, ranging from the management of water catchment areas and water storage, to the treatment and safe disposal of wastewater back into the environment.

Effective drought response. Before the drought, Cape Town Water supplied approximately 900 million litres of water to customers daily. This was the annual average. Peak summer use was about 1 200 million litres per day. Following the successful implementation of water demand management, and as a result of the water-saving efforts of Cape Town's residents, water supply reduced to approximately 550 million litres per day in the first half of 2018. The effective response in managing down water demand, together with active cooperation on the part of Cape Town's citizens, businesses and institutions, has revealed a capable institution with many strengths.

Services in informal settlements. Approximately 165 000 informal households in 204 informal settlements throughout Cape Town are served by some 6 500 communal taps and 50 000 toilets.

Wastewater treatment works upgrades. The City is introducing major upgrades to several wastewater treatment works, including Zandvliet, Cape Flats and Athlone wastewater treatment works, and is constructing a state-of-the-art regional sludge treatment facility.

Source: Water Services and the Cape Town Urban Water Cycle (November 2017) (Latest version on the website is Aug 2018) (Ref in end note)



Infrastructure. The City owns 12 water treatment plants with a combined capacity of 1 600 million litres per day, 24 reservoirs for treated water with a 48-hour storage capacity, and 11 000 km of water pipes. The City maintains 9 000 km of sewer pipes and operates 17 wastewater treatment works and six smaller facilities with a combined capacity of close to 740 million litres per day. A total of 603 pump stations are maintained throughout the reticulation system. Some 11% of the treated wastewater, 49 million litres per day, is sold for reuse to 184 customers.

Asset management and quality assurance. The City's water and sanitation asset base is valued at R75 billion and is managed through an asset management system and department-wide processes with ISO 9001 quality certification. The operating budget is over R7 billion, and the capital budget for the next ten years approximately R40 billion.

Quality of drinking water. Every year, some 16 000 samples of drinking water are drawn from approximately 300 designated sampling points. These are laboratory-tested to ensure compliance with stringent water quality standards (SANS 241). High levels of compliance with SANS 241 standards are attained, which have been rated as "excellent". This is supported by a well-functioning laboratory accredited under SANAS ISO 17025, along with an established research facility.

Staff and customers. Cape Town Water, with a staff complement of just over 4 000 people, provides water and sanitation services to 660 000 customers with water connections, 645 000 customers with sewer connections, and 204 informal settlements. In total, they serve some 4,2 million people.

Industry is a small water user in Cape Town, accounting for only 4% of water consumption, while **commercial use** accounts for about 12% of total customer water use.

Supply to other municipalities. The City sells treated water to the neighbouring Drakenstein (Paarl) and Cape Winelands (Stellenbosch) municipalities.

FINANCING CAPITAL COSTS AND SETTING TARIFFS

Creating a sustainable water and sanitation service

Currently, water and sanitation services are not sustainable. Expenditure is insufficient to maintain and replace existing infrastructure as well as increase capacity. As a result, the existing assets are becoming less reliable, and due to low cash collections, revenues do not translate into sufficient cash to meet expenses.

To achieve sustainability, each of the following components is necessary, working together as an integrated whole:

- An **investment plan** with the required capital expenditure to meet growing needs and sustain the service by continually upgrading and/or replacing assets as they reach the end of their useful life
- **Efficient, cost-effective spending** of the capital budget, and on operations and maintenance, with incremental and ongoing improvements in service performance and efficiency
- **A revenue model** comprising tariff revenues, grants and other revenue sources to meet revenue requirements
- **A tariff model** that is able to generate the necessary tariff revenues
- **Efficient cash collection** to meet the City's cash requirements so that it can pay for all its expenses, including repayment of capital costs

Collectively, these contribute to the City's business plan that forms part of the Water Services Development Plan required by law.

Financing the capital budget

The committed new water programme (commitment 3) will require capital expenditure of approximately R5,8 billion over ten years (including initiatives relating to water conservation and demand management). The total capital budget for water and sanitation services (including the new water programme) over that period far exceeds that amount.

Financial modelling shows that this budget can be financed by the City cost-effectively based on its balance sheet and from its sources of rates and tariff income. Capital grants will be used to prioritise access to basic services. The City is able to achieve efficient financing of capex through a pooled City financing strategy. Projects can also be financed through project finance which will be considered for new plant if it is shown to offer greater value for money overall, such as reduced construction and operating risk and more efficient delivery.

Subsidies for poor households

Subsidies will be used to keep water and sanitation services for basic needs affordable for poor households. In the first instance, this subsidy will come from an appropriate share of the National Government equitable share grant. If this is insufficient, the cost of providing this water will be cross-subsidised from the rates account and other water and sanitation users.

Tariff principles

In terms of the law,[36] tariffs must reflect the cost of providing the service and promote the economical, efficient and effective use of resources. Tariffs must also be transparent and fair. Fixed charges can be used to recover the fixed-cost component of a service. At the same time, fixed charges also increase the predictability of revenue and the ability to sustain revenue during droughts. Tariffs should also promote water demand management and conservation. Tariffs should be easily understood and not be administratively complex nor expensive to administer.

Cape Town water tariff policies

The City will adopt the following key water tariff policies:

- **Residential customers who have been classified as indigent** (by property value or other means)[37] will receive a free allocation of basic water each month. Water use above the basic amount will have the same tariff as other residential customers.
- **Other residential customers** will be charged a multipart tariff consisting of a fixed charge and a three-tier volumetric tariff. In general, basic usage will be charged at historical cost, and higher usage at average incremental cost or conservation tariff levels.
- **Non-residential customers** will be charged a two-part tariff consisting of a fixed charge and a flat-rate volumetric tariff. All categories of non-residential customers will have the same tariff. This tariff will recover the full cost of providing water. The volumetric tariff will be set at the average incremental cost of the service.
- **Fixed charges** will be set with a view, over time, to recover the fixed costs of the water reticulation business.[38]
- **Revenue-neutral during restrictions.** The tariffs will be designed to be revenue-neutral during periods of restriction. Three restriction tariffs will be developed. Separate arrangements will be made for payment for services in an emergency.
- **Tariff stabilisation.** Tariff stabilisation mechanisms will be investigated. (See text box alongside.)

A "RAINLESS DAY" FUND?

The City's current policy of staying revenue-neutral while drought restrictions are in force has placed a financial burden on its customers. Under the level-6B tariffs imposed in February 2018, the first block in the residential tariff band increased more than six-fold to R30/kℓ.

Looking forward, it may be more reasonable for the City (instead of its residents) to manage the financial risk of future drought-imposed restrictions. After all, the City has better access to credit and is better able to save than most residents. The City could do this by designing a "rainless day" fund, in which reserves are set aside for City use in rainless years so that the entire burden does not need to be passed on to customers. Such funds have already been adopted by utilities in the United States (see the American Water Works Association's "Cash Reserve Policy Guidelines").

Cape Town sanitation tariff policies

Alternative methods of charging for sanitation are being investigated. The intention is for the sanitation charges to follow the water tariff policies, also consisting of fixed charges and a volumetric tariff. The water volume to which the sanitation charge will be applied will be capped for residential customers.

Future water tariff levels

The City imposed high tariffs during the drought to create strong incentives to reduce and save water. Cape Town's future water tariffs will vary during periods of water restriction, but will in total yield the current level of revenue, adjusted for normal inflation in costs and the increased capital budget. **Cape Town water tariffs will decrease from the very high levels imposed during restrictions in early 2018.** The cost of desalinated water is estimated to be between R15 and R25 per kilolitre.[39] To this, one must add the costs of managing the water network.[40] Costs and tariffs are likely to become more predictable over the next two to three years, when demand has rebounded and cost data are more certain. Greater tariff certainty will be provided during the development of the Cape Town Water transition plan.

Future wastewater tariffs

Future wastewater tariffs will also increase in real terms, but not to the same extent as the water tariff.

The cost of becoming a water-sensitive city

It has taken Singapore more than 50 years to reach a stage where it can be regarded a water-sensitive city. Keep in mind the Singaporean context: water security and integrated urban water management were top political priorities, a world-class water provider was leading the way, and available financial resources were ten times greater than those available in South Africa.[41] Therefore, it is unrealistic to expect Cape Town to be transformed into a water-sensitive city through public investment in infrastructure and natural ecosystems in a short period of time. Instead, this transformation will take place over many years, and primarily through changing the incentives that influence the nature and location of both public and private investment in the built infrastructure making up Cape Town.

SUPPLYING YOUR OWN DRINKING WATER

Cape Town Water has a constitutional obligation to provide safe drinking water to the city's residents and is the legally mandated water services authority. During the drought, customers approached the City with requests to invest in supplementary water supplies, or to substitute their municipal supply. The City conditionally entered into water services intermediary agreements with some customers, who proceeded to invest in alternative supplies. These investments mitigated some of the risks of the drought for some customers, but did not relieve the City of its legal obligation.

The current position with regard to water service intermediaries is as follows:

- Existing water service intermediary agreements will be reviewed at the end of the agreed period stated in the agreement. New agreements end on 30 June 2021, after which they will be reviewed.
- Reviews of existing agreements and the consideration of new applications will be based on:
  - a lack of City water supply infrastructure; and
  - the status of water restrictions and disaster declarations.
- Application to become a water service intermediary must be made prior to embarking on an actual investment in packaged, on-site water treatment facilities at unserviced remote locations and/or shorter-duration technologies, and connecting such produced water to the City's water supply. Non-compliance will trigger legal action against the perpetrator.
- Entities that provide essential services, such as public health institutions, are encouraged to have back-up systems in place that meet regulatory requirements.
- Cost recovery for services rendered or made available will be applied as stated in the City's tariff policies.

Further details will be set out in the City's water policies and bylaws, which will be reviewed periodically and revised as necessary.

BUILDING RESILIENCE THROUGH PARTNERING AND COLLABORATION

Successfully translating the City's commitments in this strategy into meaningful outcomes requires a whole-of-government and whole-of-society approach. Ultimately, while the City has made clear commitments, it cannot transition to a water resilient city on its own.

The City recognises that collaborative relationships need to be built and maintained at many different levels of the Cape Town water system, including between:

- citizens and the City;
- customers and Cape Town Water;
- citizens and political leaders;
- officials and politicians;
- different City departments;
- different spheres of government;
- business and the City;
- the City and the scientific community; and
- the City and other users of the WCWSS.

Collaborative relationships are based on trust, and trust is built where there is transparency and mutual accountability, and where all partners' stated intentions are consistently translated into action.

Based on the intensive engagement during the drought, and the lessons learnt from it, the City will promote and facilitate the building of trust in the following tangible ways:

Engaging citizens and civil society

The City will endeavour to create an enabling environment to be responsive to citizen-led water initiatives by continuing to work with social partners and collaborative intermediary organisations. Regular social surveys will be undertaken to better understand citizens' needs and perceptions, and the City will also work with research institutions, non-governmental and neighbourhood organisations that have established processes for documenting community water use and needs, perceptions and attitudes.

Engaging business

The City will continue to work with collaborative intermediary organisations such as Wesgro, GreenCape and the World Wide Fund for Nature to better understand business needs and perceptions, and improve communication between the City and business.

Engaging government

The City will continue to work with collaborative intermediaries such as the Western Cape Economic Development Partnership and National Treasury's Cities Support Programme to facilitate productive relationships with other spheres of government, including Province, various departments of National Government and municipalities that rely on or are affected by the Western Cape Water Supply System.

Engaging labour

The City will continue to work with organised labour as a key partner in service delivery to ensure that workers' rights are protected.

Engaging researchers

The City will continue to engage with research groups to develop and pursue applied research and evidence-based decision making to help the City better fulfil its mandate and implement this strategy. The City will also explore a transdisciplinary research approach and partner with researchers to co-design research agendas and projects for the City.

Engaging key customers

The City will set up a Key Customers Unit to be more responsive to their needs.

Engaging international expertise and experience

The City will enhance existing and develop new knowledge-sharing partnerships with national and international bodies that are able to share relevant knowledge and experience so that this strategy can be implemented more effectively. Where appropriate, the City will make use of collaborative intermediaries to support this effort. In addition, the City is committed to sharing its own experiences with these institutions to contribute to the global community of practice.

Effective partnering

A partnering approach enables joint problem identification, co-design and co-implementation of solutions, joint monitoring and evaluation, and shared learning and adaptation. When developing partnerships, the City, working with its partners, will ensure that there are clear mandates, a suitable convenor, the right people in the room to make decisions, regular meetings for effective communication and mutual accountability for implementation, with consequences for non-performance.

LET'S BE CLEAR

Clear communication is critical in building a water resilient city, both within the municipality itself and externally with the public. Communication is as much about listening to and understanding the needs of others, as it is about conveying information or key messages to them.

In this regard, at least three components are important, namely:

1. communicating and educating people about the value of water;
2. educating people about climate futures, the need to plan for extremes, and how this affects communities,
3. and communicating behaviour change.

The City will identify key communication partners, use and develop existing communication channels (including political platforms and forums), harness the power of social media, practise creative storytelling, and develop adaptive messaging based on different needs and situations.

LEARNING

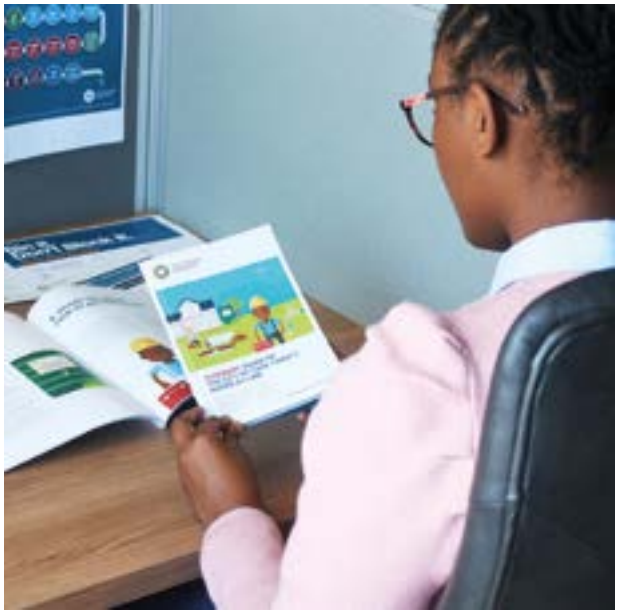
Institutional learning ensures that different types and sources of knowledge are valued and considered when developing solutions. This is needed to experiment and take risks. Learning by doing is required to test alternative approaches and reflect on them, which is central to building a resilient approach. During the drought, the City was able to create and/or participate in some spaces for learning but the practice of learning is not well institutionalised. To adapt to a rapidly changing world, skills to facilitate a learning approach, and to institutionalise this, are needed.[42]

The City will seek ways to develop a learning culture within the organisation, and to institutionalise this as it implements this strategy. In doing so, it will explore different learning streams and communities of practice.[43]

The City will support and encourage learning through:[44]

- supporting long-term monitoring of key social and ecological components;
- providing opportunities for interaction that enable extended engagement between participants;
- engaging a variety of participants;
- promoting ways to share knowledge;
- ensuring sufficient resources for learning processes to take place; and
- enabling people to network and create communities of practice.

In summary, learning ensures that different types and sources of knowledge are valued and considered when developing solutions, which leads to greater willingness to experiment and take risks.



IMPLEMENTING

A **Cape Town Water transition plan** will be developed and implemented to transform Cape Town Water into a modern, fit-for-purpose water services provider, which will lead key elements of the implementation of this strategy.

The **Water Services Development Plan** will incorporate the augmentation plan and all formal planning-related aspects of the water and sanitation business. This forms part of the City's Integrated Development Plan and serves as the City's legal planning instrument. All the City's water-related capital projects are included in the Integrated Development Plan. The Water Services Development Plan is revised every five years, and reviewed and updated annually.

The **Collaborative Resilience Action Plan** will create a multi-stakeholder platform to coordinate efforts and improve governance and decision making during any crisis. This plan will build on the section 80 Water Resilience Advisory Committee established by the City during the recent drought.

The platform will provide monitoring to support the City during strategy implementation. The whole-of-society approach of this initiative is based on the fundamental principles of sustainability and resilience, reinstates the critical importance and value of partnerships, communication and cooperation, and speaks directly to the United Nations sustainable development goals as well.

MONITORING IMPLEMENTATION AND REVIEWING THE STRATEGY

The Cape Town Water Strategy will be reviewed regularly as part of the formal Water Services Development Plan annual review process.

The implementation of the strategy will be monitored through existing planning instruments. Public engagement will take place through existing processes linked to the Integrated Development Plan and the Water Services Development Plan.


Avocado

ANNEXURE A:

WATER QUALITY

SAFETY FIRST

Drinking water quality (including springs, groundwater, reclamation and desalination)

The City will adhere to the regulations relating to compulsory national standards (SANS 241) for the provision of quality of drinking water. Each water resource will have its own specific "water safety plan", which will form part of an integrated water quality management plan. Each water safety plan will include a risk assessment.

The water safety plans will be reviewed annually to better ensure that drinking water supplied poses no significant health risk to consumers. The City acknowledges the limitations of the current SANS 241 standards for the quality of drinking water. Therefore, it will extend its screening and monitoring of water quality to include potential waterborne pathogens and other harmful compounds for new, alternative water resources, such as groundwater, reclamation and desalination.

The water safety plan will also include:

- sufficient monitoring data through the risk-based monitoring programme to verify that mitigation measures have been taken to remove or minimise a significant risk of supplying water that poses a risk to human health; and

- an incident management protocol that details the management of incidents that may affect the supply of drinking water, including quality.

The City will ensure that processes for the treatment of drinking water are adequately managed, and that effective and credible water treatment technologies are applied for alternative water resources. Annual inspections and process audits of water treatment plants will protect public health and ensure the production of safe drinking water.

In the case of water tankers used in emergencies, the City will ensure safe water quality by:

- testing water samples from the water source to check that water is fit for human consumption before distribution;
- testing water samples from the tankers (and, where the tanker is divided into compartments, from each compartment) to ensure that tankers are fit to be used for the distribution of drinking water; and
- developing a dedicated water quality monitoring programme for the tankers, and providing analysis results for the determinands[45] listed in SANS 241 as well as other risk determinands, as informed by risk assessments.

Environmental water (including rivers, dams, vleis, beaches, stormwater, wetlands and wastewater discharge)

An effective water quality monitoring programme will be developed and implemented to monitor the quality of environmental or raw water associated with alternative water resources. This will be done in accordance with the requirements of the Blue and Green Drop regulations and risk assessment. In addition to the mandatory regulatory requirements, water quality monitoring for alternative water resources will be extended to include screening and monitoring of possible risk determinands/compounds as well as high-risk waterborne pathogens that may cause illness/disease in humans and livestock. For environmental waters, especially those associated with wastewater discharge, toxicity tests will also be conducted to assess the impact of chemicals on aquatic ecosystems. The City will ensure that wastewater treatment processes are adequately managed, and that effective and credible water treatment technologies are applied to ensure that the final effluent is safe for both humans and the environment.

Currently, the City monitors the quality of river water associated with wastewater discharge to ascertain the impact on receiving water bodies, as required by wastewater treatment plant operating licence conditions. The river monitoring programme will now be extended to incorporate toxicity and pathogens testing to protect public health and the associated environment.

Groundwater will be recharged using good-quality treated effluent so as not to pose a risk of groundwater contamination. Groundwater from the aquifers will be treated in a dedicated groundwater treatment plant facility, specifically designed to handle problematic groundwater determinands, as informed by water quality risk assessments. Annual water quality performance statistics will be made available to the public and relevant stakeholders.

ANNEXURE B:

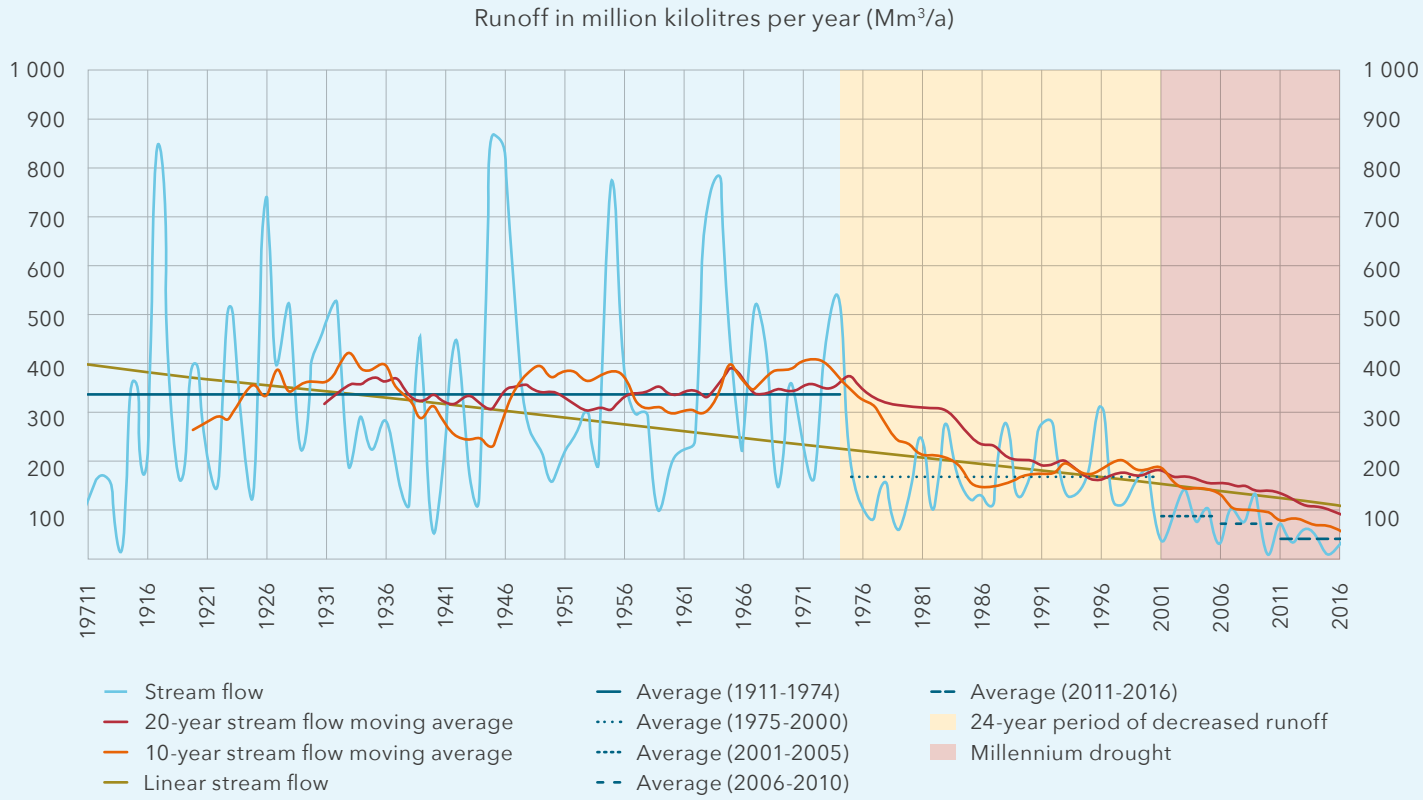
RAINFALL UNCERTAINTY

It is wise to consider the possibility of a step change in rainfall for Cape Town.

A significant step change in runoff was experienced in Perth around 1976. Perth is situated in the south-western corner of Australia, just three degrees further north than Cape Town.[46]

While a historical analysis for the Western Cape water supply system does not show a step change in rainfall or runoff, this does not rule out the possibility that the Western Cape water supply system has recently experienced a "step change" in climate. Although the impact of climate change is uncertain, it is prudent for Cape Town to develop plans that take this uncertainty into account. This requires a scenario-based planning approach, since the climate is beyond the City's control.

FIGURE 13: HISTORICAL STREAM FLOWS FOR PERTH



Source: Water Corporation, 2018.

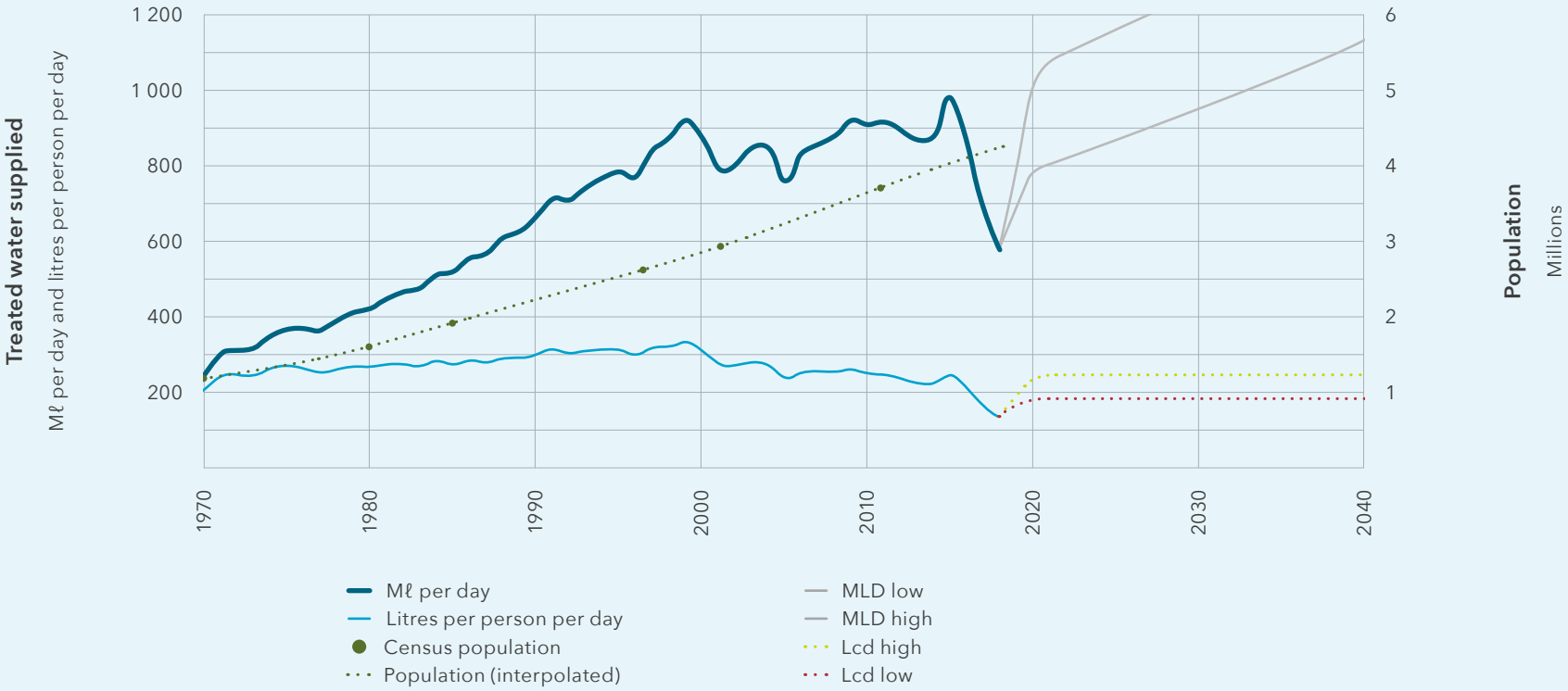
DEMAND UNCERTAINTY

From 2015 to 2017, water use was reduced by over 40%. At the same time, both the population and the economy continued to grow. Water has also become much more expensive, which affects use.

The combined impact of these factors on future water use is not known with any certainty. In the past, water use did not return to previous levels after a drought. However, the extent of demand reduction experienced by Cape Town during the most recent drought was unprecedented. While demand can be influenced by City actions, users' behavioural choices are beyond the City's direct control, and there is a high degree of uncertainty as to what the cumulative effect of these choices will be going forward (figure 14). The band of this uncertainty is significant, an average of approximately 300 Mℓ per day for the year, which is close to 40% of the lower-use band.

FIGURE 14: FUTURE WATER DEMAND IS HIGHLY UNCERTAIN

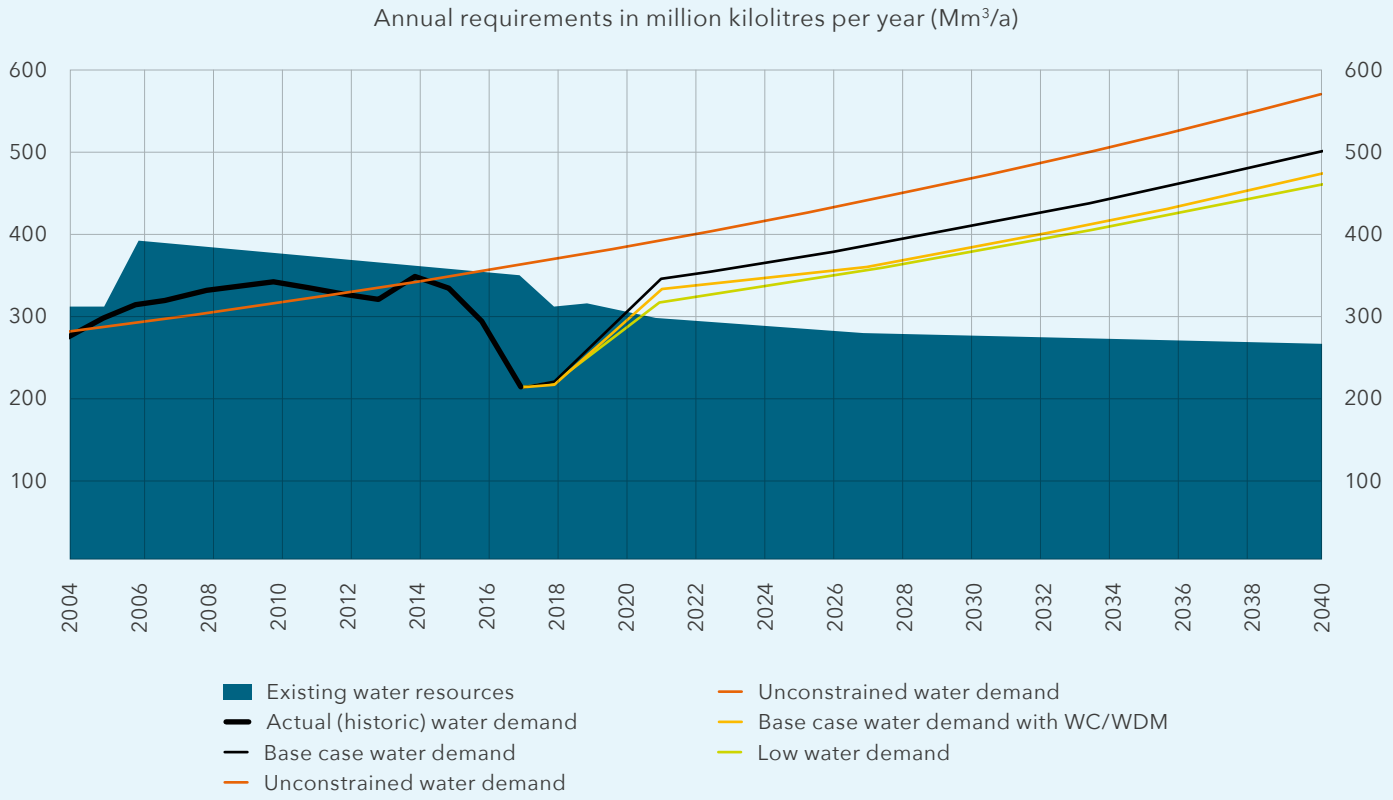
Annual requirements in million kilolitres per year (Mm^3/a)



THE "DO NOTHING" OPTION WITH 99,5% ASSURANCE OF SUPPLY

The relationship between water availability and demand is shown in figure 15. Water availability increased in 2006 as a result of the commissioning of the Berg River dam. Since then, however, water availability has declined as a result of the increase in invasive alien vegetation, suboptimal management of the system, the inclusion of the recent drought in the hydrological records, a reduction in Cape Town's water allocation, and the City's proposed increase in assurance of supply.

FIGURE 15: BASE CASE PLANNING SCENARIO WITH DECLINING WATER AVAILABILITY AND MODERATE DEMAND



ANNEXURE C:

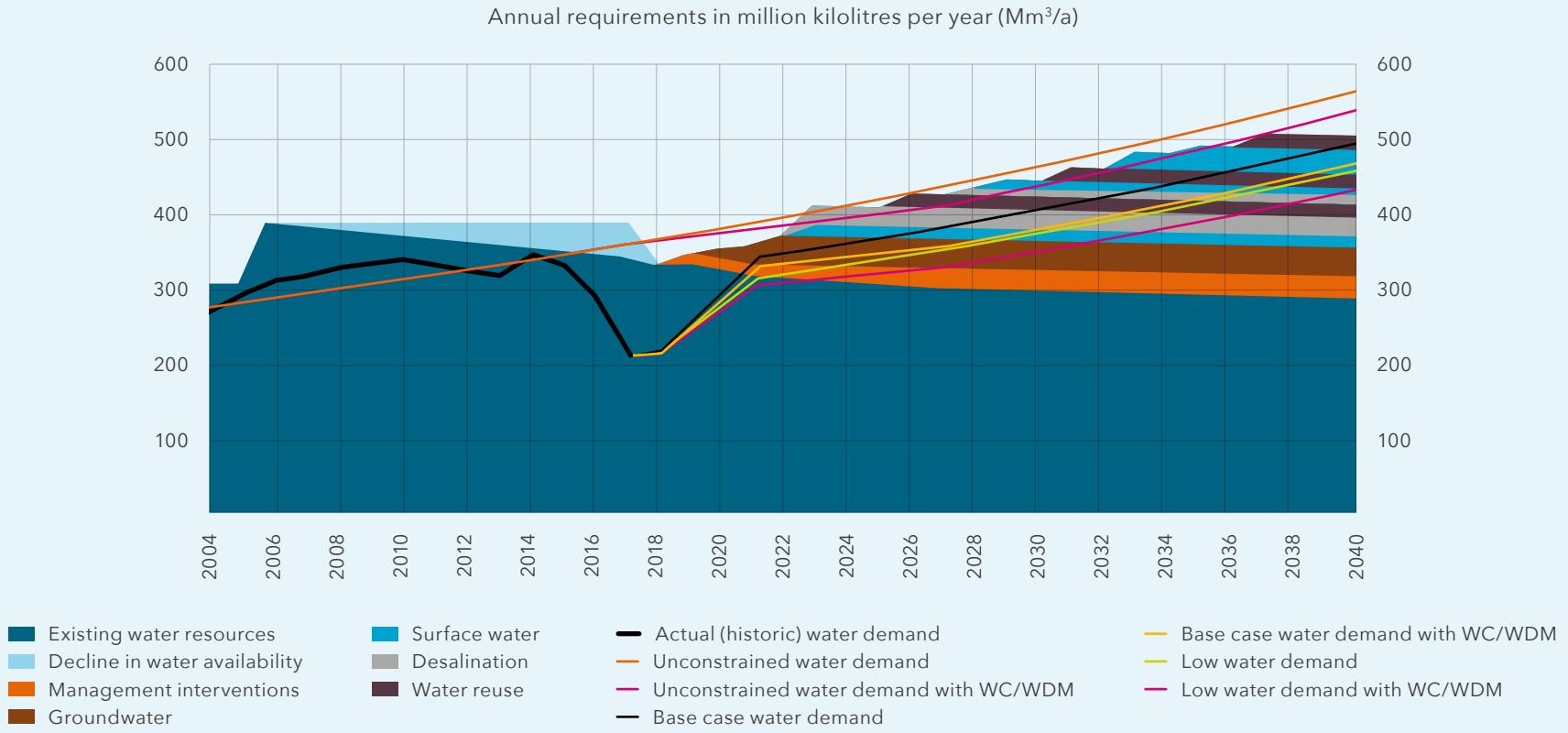
STRESS TEST 1:

BUSINESS AS USUAL – HIGH WATER DEMAND AND GRADUAL CLIMATE CHANGE

In this scenario, the City's ability to curtail water requirements would not decrease as is expected for the base case scenario augmentation plan. Therefore, it would still be reasonable to supply water at the current (1-in-50-year) level of assurance, and not increase assurance to 1 in 200 years as is planned for the base case.

Figure 16 shows that the planned augmentation programme would be able to meet demand under an unconstrained demand growth scenario, at current assurance of supply. Should this scenario become a reality, the City would have the option of accelerating the implementation of augmentation schemes to increase assurance of supply and system resilience, if desired.

FIGURE 16: BUSINESS-AS-USUAL STRESS TEST: HIGH DEMAND AND GRADUAL CLIMATE CHANGE WITH 1:50 ASSURANCE OF SUPPLY

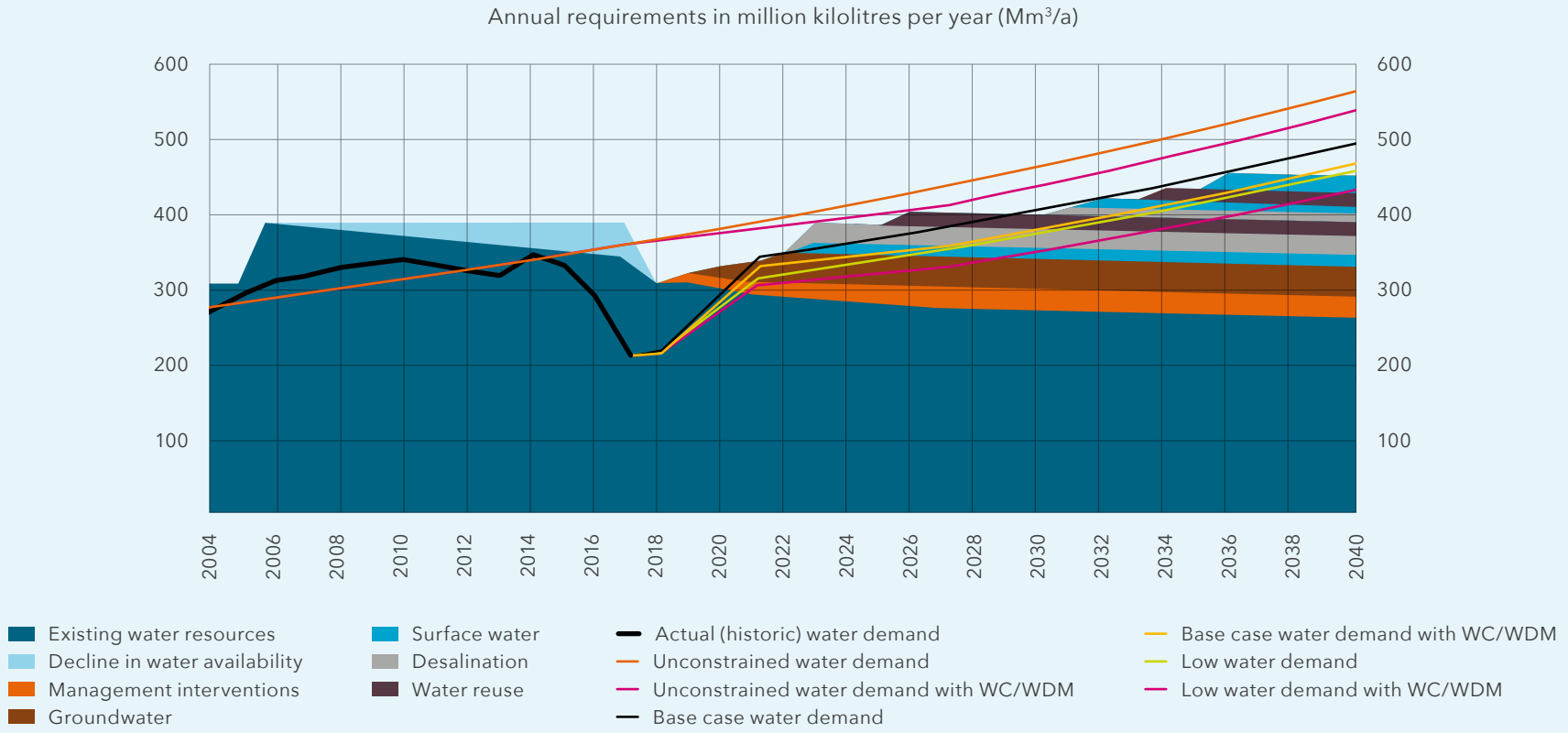


STRESS TEST 2:

LOW DEMAND WITH GRADUAL CLIMATE CHANGE

In the case of lower water demand, if following an implementation programme based on the base case scenario augmentation plan, the City would have a surplus of supply, as shown in figure 16 on the previous page. Should this scenario materialise, the City would be able to delay the implementation of additional augmentation for which commitments have not already been made by three years, as shown in figure 17.

FIGURE 17: LOW-DEMAND STRESS TEST: LOW DEMAND REBOUND AND GRADUAL CLIMATE CHANGE



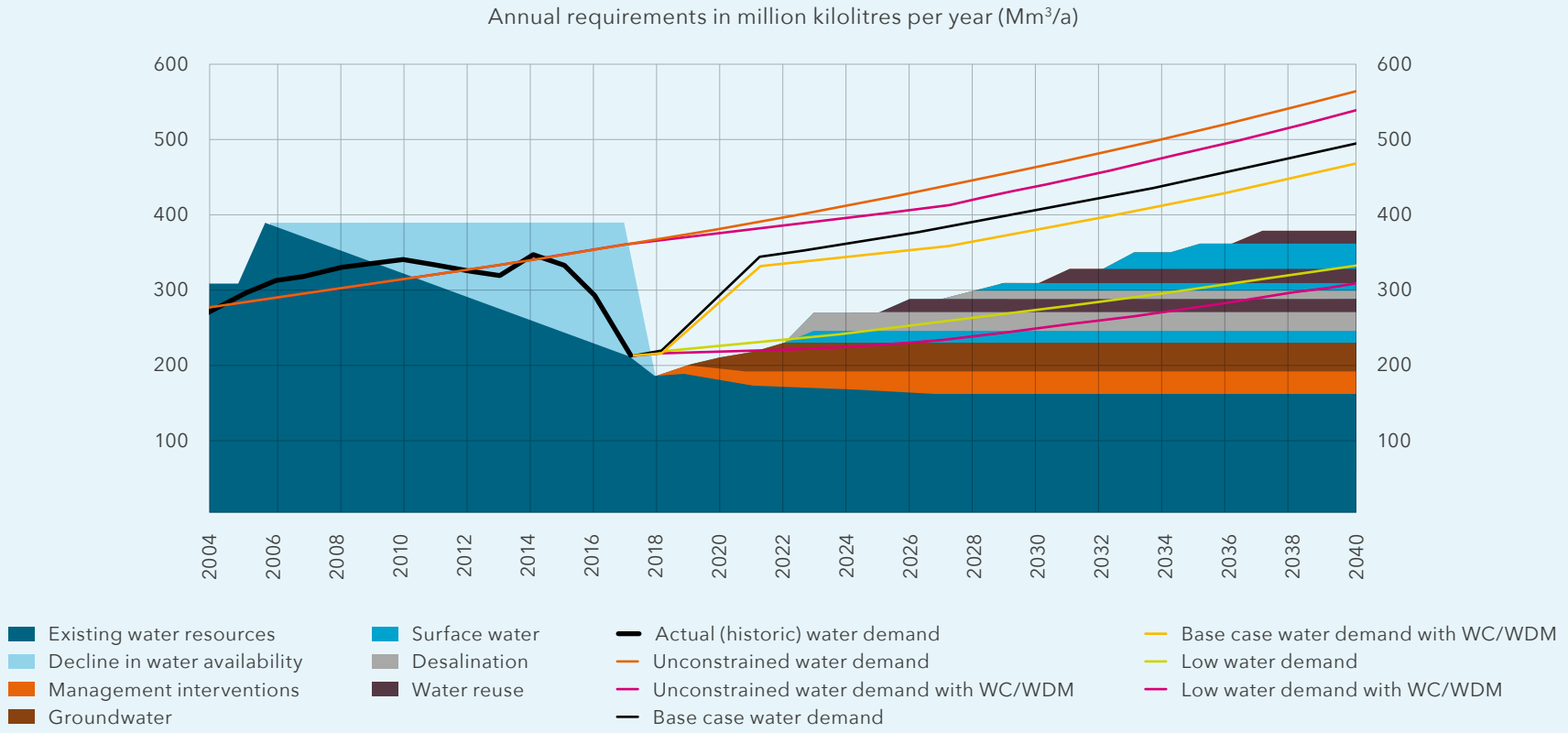
STRESS TEST 3:

CLIMATE STRESS – STEP CHANGE IN CLIMATE, WITH LOW DEMAND

A downward step change in rainfall means that inflows (runoff) to the six major dams of the WCWSS (before accounting for growth in invasive alien plant species) will be more or less similar to the inflows in the three years 2015 to 2017. While climate scientists do not see evidence of a step change in rainfall, they also cannot say for certain that such a change has not occurred. As such, it is worthwhile to stress-test the base scenario augmentation plan against an alternate scenario that assumes low rainfall, to see how far forward the adaptable programme would need to be moved to meet the City's desired reliability of supply.

In the event of a step change in climate, with the rainfall of 2015 to 2017 repeated continuously going forward, the planned augmentation programme would meet only the City's basic water needs (figure 18). In other words, significant restrictions would have to remain in place until planned augmentation exceeds growth in water demand. In this scenario, the City will accelerate the implementation of augmentation schemes. In view of the risks posed by this scenario, the City will implement measures to increase the robustness and adaptability of the programme, as set out in annexure D. These measures will include the establishment of permitted desalination parks to allow for the rapid deployment of desalination capacity at scale, if needed.

FIGURE 18: STRESS TEST OF THE PLANNED AUGMENTATION SCHEME AGAINST A STEP CHANGE IN CLIMATE



ANNEXURE D:

MEASURES TO INCREASE ROBUSTNESS AND ADAPTABILITY

The City will implement the following measures to increase the robustness and adaptability of the programme:

- **Monitor.** The City will carefully monitor rainfall and water demand data.
- **Update demand-and-supply reconciliations.** The City will regularly update data on water demand and supply, and refine demand-and-supply reconciliations accordingly.
- **Learn by doing.** Where the City knows which augmentation options are cheapest, it will maximise supply from these options. However, cost data for schemes are still uncertain in many cases. In this context, learning by doing as well as diversification to increase resilience are sufficient justification to do multiple projects for each supply option.
- **Increase adaptability** by being able to advance or delay projects as required by circumstances. As a general principle, projects will be conceived, designed and contracted so as to enable more rapid implementation or project delay, depending on emerging circumstances.
- **Undertake project preparation in advance.** The City will proceed with project preparation well in advance of when projects may actually be needed, in case projects need to be accelerated.

Project preparation will include feasibility studies as well as the necessary regulatory permissions, such as water use licences, environmental impact assessments, etc.

- **Include desalination as part of the supply mix.** Desalination, which is scalable and least dependent on rainfall, is an important technology to develop and learn about. Desalination can ensure reliable supply with certainty when no other options are available.
- **Investigate the merits of a desalination park.** The City will investigate the merits of establishing one or more desalination parks.[47] These would be permitted, and would allow for the rapid deployment of desalination capacity if required in an emergency.
- **Mitigate social risks.** The direct reuse of wastewater for drinking purposes in non-emergency circumstances may face strong social resistance. The City will embark on a proactive process to engage citizens on the benefits and risks of direct wastewater reuse, and will also consider non-direct reuse options, learning from other countries' experience in the process.
- **Mitigate environmental risks.** The City will ensure that the environmental risks associated with new water supplies are considered holistically. Surface water, groundwater, wastewater reuse and desalination all have different risk profiles, and the choice between these water sources is accompanied by cost and other trade-offs. Over time, the City will come to rely on all these water sources. The fear is often greater than the lived experience, so the City will learn by doing, and mitigate environmental risks in the process.
- **Mitigate procurement and implementation risks.** Public procurement of large infrastructure is time-consuming and transaction-intensive in the South African regulatory context. Procurement delays pose a significant risk to the programme. The City will mitigate these risks by pursuing a range of procurement strategies, including the use of private-sector capacity for project management and implementation. It will also engage with stakeholders to improve the procurement environment to ensure timely, cost-effective and corruption-free procurement and project implementation.
- **Risk-based dispatch.** The City will plan for 99,5% assurance of supply. When rainfall is average or high (or even below average), the City may not need some or all of the added capacity. The City's desire to provide sufficient water for responsible use, with higher assurance of supply, makes risk-based dispatch essential. In the past, the operating cost of an additional unit of rain-fed water was low (approximately R5/m^3, including treatment). The operating costs of future new plants are projected to be higher (R10/m^3 or more). Therefore, in periods of historically average or plentiful rainfall, it makes sense to largely rely on dam water, while avoiding the operating costs of the more expensive alternative plants. On the other hand, as dam levels start to fall, progressively more expensive alternative sources should be operated to preserve the assurance of supply provided by adequate dam storage levels. The City will need to develop operating rules for all new schemes identified, as well as for the conjunctive use of groundwater and surface water. The City will learn from risk-based dispatch regimes adopted in other cities, such as Sydney, Australia, and Barcelona, Spain (see "Risk-based dispatch and restrictions" on page 84).
- **Mitigating tariff impact on customers.** The City will continue to seek full recovery of the cost of delivering the service through tariffs. Funding required to implement projects will be planned in advance to allow for tariff certainty, but will only be built into the tariff upon the implementation of projects/programmes.

RISK-BASED DISPATCH AND RESTRICTIONS

The City's future operations will necessitate the risk-based dispatch of plants and implementation of restrictions. This is because, in "normal" rainfall years (based on the long-term historical average), the City will have much more water production capacity than it needs.

If the City plans for 99,5% assurance of supply, it will have more than enough water available to meet its needs 99,5% of the time. Therefore, during average, high or even below-average rainfall (just not so low that the City's allocations from the WCWSS dams cannot be met), the City may not need some or all of the planned augmentations. In contrast, if assurance of supply was set lower – for instance, 60% – the City would need most or all of its available resources in normal rainfall years. In below-normal rainfall years, the City would soon need to impose restrictions.

Given the City's desire to provide abundant water for responsible use, a higher assurance of supply is required, which necessitates risk-based dispatch.

Therefore, in periods of normal or plentiful rainfall, it makes sense to largely rely on dam water, while avoiding the operating costs of the more expensive alternative plants. Yet as dam levels start to fall, progressively more expensive alternative sources should be operated to preserve the assurance of supply provided by adequate dam storage levels. Restrictions should also be imposed, as needed.

The City stands to learn valuable lessons from the risk-based dispatch regimes adopted in Sydney, Australia, and Barcelona, Spain, as described below.

Lessons learnt from Sydney, Australia

Sydney has five years of available water supply in dams located in the Blue Mountains, situated west of the city. During the Millennium Drought from 2001 to 2009, low rainfall meant that dam levels fell continuously, prompting fears that Sydney would run out of water. To forestall that risk, Sydney built a desalination plant. They committed to this plant just as dam levels approached the 30% storage mark, on the basis that this would allow the plant to come on stream in time to avert a crisis. The desalination plant was designed as a risk management tool to be run when needed, not continuously.

Other risk management tools included transfers from another dam (Shoalhaven), construction of additional desalination capacity, as well as demand restriction measures. The regime for implementing these risk management measures was tightly specified.

Because the drought broke soon after construction of the desalination plant started, Sydney's plant has never run. Nevertheless, it serves a useful purpose as an insurance policy against future drought. Because the desalination plant cannot supply all of Sydney's demand, it will start to operate when dams reach 60% so as to slow the rate of drawdown on storage and buy time for the rain to fall or, ultimately, for the construction of additional desalination capacity.

The desalination plant has significant start-up and shut-down costs. This is why, once started (at 60%), it will be shut down only when dams reach 70%.

Barcelona, Spain

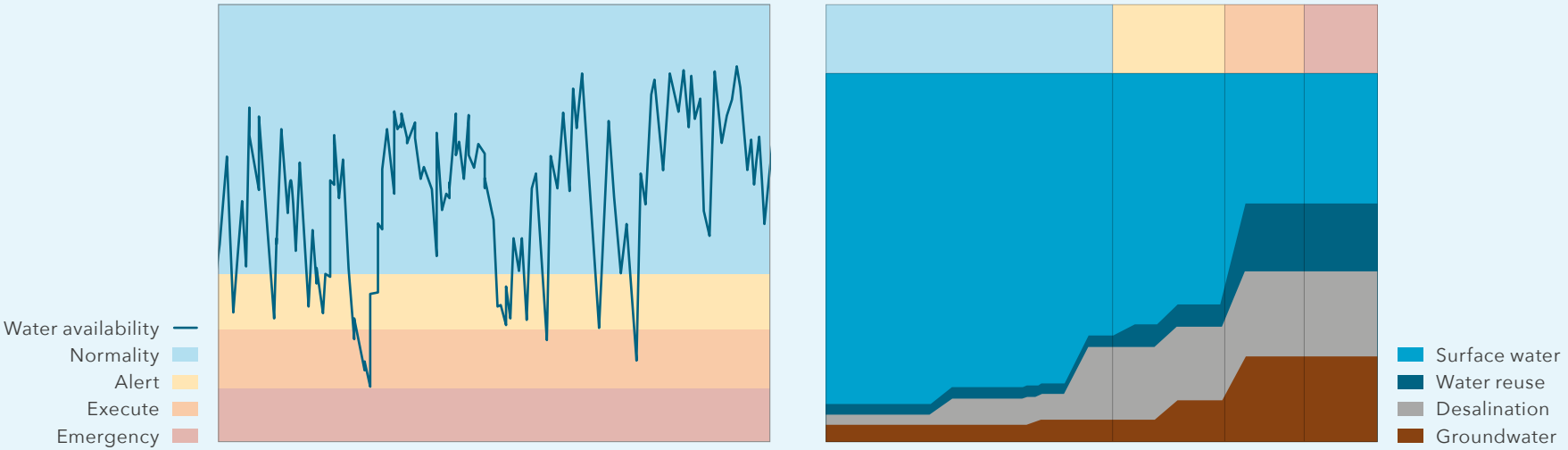
Like Sydney, Barcelona too experienced a severe drought in 2008, which necessitated demand restrictions as well as the shipping of drinking water from France.

Barcelona responded through the integrated management of underground and surface water sources, modernisation plans to promote efficient water use, improved detection of spillage and illegal water extraction, wastewater reuse and the management of rainwater.

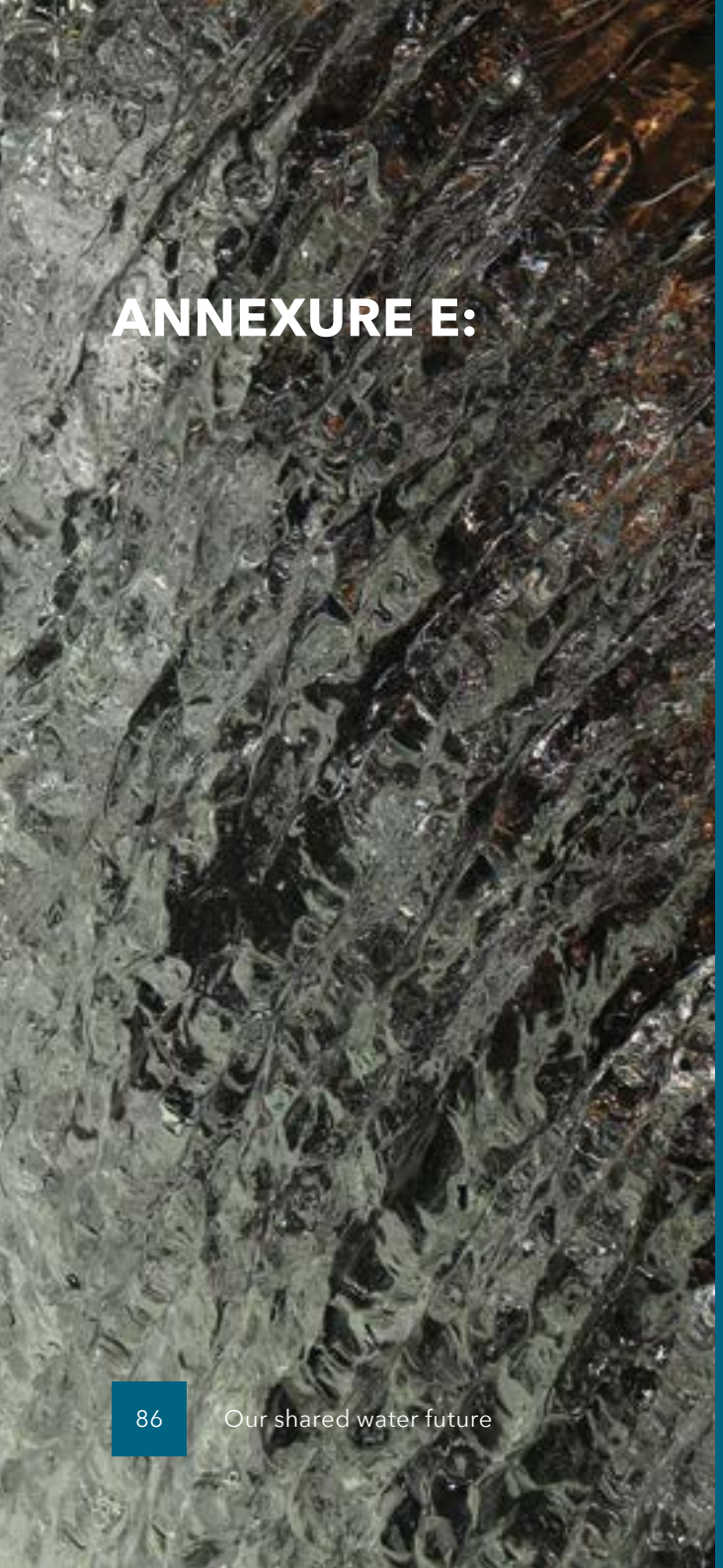
In addition, they introduced a clear set of triggers for the use of additional water sources as dam storage levels fell. As illustrated in figure 19, triggers would lead to a progressive increase in the use of desalinated water, groundwater and treated wastewater to curtail demands on water in the dams.

Cape Town could adopt a similar dispatch and restrictions plan to these models, with plants being commissioned in order of unit operating cost (that is, commissioning the plant with the lowest operating cost per m^3 first).

FIGURE 19: BARCELONA DROUGHT RESPONSE THRESHOLDS



Source: Manuel Mariño, "Cape Town Water Crisis 2017 Analysis from International Experience" presentation.



ANNEXURE E:

WATER CONSERVATION AND WATER DEMAND MANAGEMENT

LOOKING BACK TO MOVE FORWARD

As early as 1995, the City committed itself to a 10% saving on the historical growth in demand of 4% per annum. An integrated water resource planning study carried out in 2001 indicated that various water conservation and water demand management initiatives are the most feasible water augmentation options to meet Cape Town's growing demand for water.

In 2001, the City developed a water conservation and water demand management policy and strategy based on the outcome of the integrated water resource planning study. Several water conservation and water demand management projects were implemented. Some of these, such as the Khayelitsha pressure management project, were very successful and received widespread recognition. The implementation of the strategy, however, was unsustainable and, due to numerous institutional challenges, the initial water conservation and water demand management commitment and resources were significantly reduced in 2003, 2004 and again in 2006. The City then developed a comprehensive ten-year water conservation and water demand management strategy, and the programme was approved in May 2007. The water conservation and water demand management strategy targeted water savings of approximately 90 million m^3/a by 2016/17. It detailed the interventions required to ensure that the demand is maintained below the low water demand curve set out in the raw water supply agreement between the City and the Department of

Water and Sanitation. Progress against the planned water savings targets and low water demand curve is reviewed annually and submitted to the national Department of Water and Sanitation.

The City reviewed the strategy in 2010 and 2011. The aim was to assess progress against the initial planned savings, and to set new targets for the next ten years with a revised cumulative targeted saving of 120 million m^3 by 2021/22 (including proposed savings set in 2007/8).

In 2017, during the drought, the interventions and associated savings were reviewed for the next decade. Assuming all objectives are met, the revised water conservation and water demand management programme assumes a potential saving of 184 Mℓ/day over the ten years from 2017 to 2027. One of the biggest interventions, the recycling of treated effluent, assumes a potential "saving" of 66 Mℓ/day. It is estimated that only 30% of this "saving" replaces potable water use, which means that the total potential saving from all the water conservation and water demand management interventions is 138 Mℓ/day. Given the uncertainty regarding the implementation and effectiveness of all the water conservation and water demand management measures, it has been assumed for the purposes of this strategy that the water conservation and water demand management programme will achieve 50% of the targeted savings over the ten-year period. This translates into a saving of 69 Mℓ/day.

ANNEXURE F:

THE OUTCOMES OF THE WATER RESILIENCE COLLABORATION LABORATORY (COLAB)

SOME POSSIBLE SOLUTIONS

Mobile co-design labs

By eliciting participation in informal settlements, small collaboration laboratories (CoLabs) enable more inclusive and proactive governance, working with communities on the design of critical infrastructure at community and household level. In addition, early community involvement renders stakeholders more accountable in project design and implementation. CoLabs will draw on international best practice to promote creative and safe spaces that address pressing resilience challenges, including flooding, inadequate sanitation, lack of social cohesion, and trauma. See commitment 1.

Community-generated data

With organised groups in informal settlements already collecting a wide range of quantitative and qualitative data regarding their communities, this initiative offers a way for comprehensive data collected by the City and by communities to be combined. This would enable better decisions on interventions in informal settlements. Forums for reflection and discussion will be created to assess data and provide critical input into City budgeting and planning cycles.

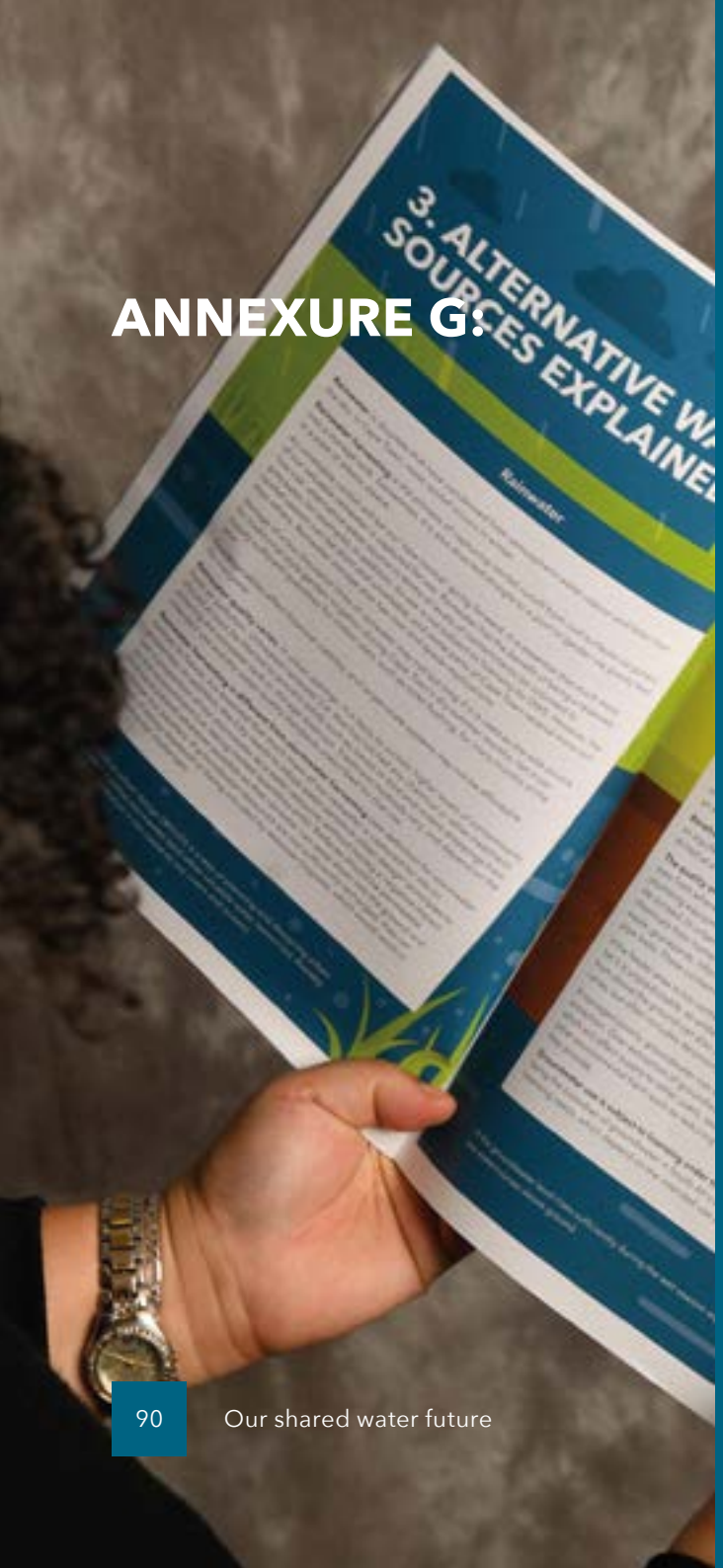
Liveable waterways

Local water corridors are largely unliveable. However, if transformed through interventions such as a series of biofilters and a network of canals controlled by communities, these green-blue corridors could be invaluable for cooling Cape Town and cleaning riverways. This initiative will engage citizens and build social cohesion. See commitment 5.

Business water collaborative

Hit hard by punitive tariffs and restrictions during the drought, water-intensive industries significantly augmented their supply with groundwater (which has had a reverberating impact on municipal revenue and groundwater resources). In order to minimise future water shocks, help improve the competitiveness of Cape Town industry, enhance resilience, and also reduce reliance on groundwater, this initiative proposes a City-managed, diversified water portfolio for certain economic nodes. Private-sector investment may be utilised to establish shared infrastructure to meet collective (alternative) water needs. Supply would follow a holistic water resource model, leaning heavily on alternative sources (i.e. rainwater, treated effluent and seawater in addition to groundwater and municipal supply).

Source: 100RC Water CoLab, Cape Town, September 2018



ANNEXURE G: FURTHER READING AND RELATED REFERENCES

National policies, plans and legislation

- Disaster Management Act 57 of 2002, as amended
- Integrated Resource Plan (IRP) for Electricity 2010-2030: Update Report (Department of Energy, 2013)
- Integrated Resource Plan Update: Assumptions, Base Case and Observations, Draft (Department of Energy, 2016)
- National Adaptation Strategy
- National Climate Change Bill, 2018
- National Climate Change Response White Paper (2011)
- National Desalination Strategy (DWS, 2011)
- National Environmental Management Act 107 of 1998
- National Environmental Management: Biodiversity Act 10 of 2004
- National Sanitation Policy (DWS, 2016)
- National Water Act 36 of 1998
- National Water Resources Strategy (version 2) (2013)
- National Water Resources Strategy (DWS, 2014)
- Water and Sanitation Master Plan (DWS, 2017)
- Water Services Act 108 of 1997

City of Cape Town

- City of Cape Town Climate Change Policy, 2017
- City of Cape Town Data Strategy, 2017
- City of Cape Town Environmental Strategy, 2017
- City of Cape Town Floodplain and River Corridor Management Policy, 2009
- City of Cape Town Inland & Coastal Water Quality Improvement Strategy & Implementation Plan, 2012
- City of Cape Town Integrated Development Plan, 2017-2022
- City of Cape Town Management of Urban Stormwater Impacts Policy, 2009
- City of Cape Town Preliminary Resilience Assessment, 2018
- City of Cape Town Stormwater By-law, 2005
- The following documents are available at **www.capetown.gov.za:**
  - City of Cape Town Water Conservation & Water Demand Management Programme/Strategy, 2007, updated 2014/15
  - City of Cape Town Water Demand Management and Strategy Review, 2015/16
  - City of Cape Town Water Services Development Plan, 2017/18-2021/22
  - City of Cape Town 2017/18 Water and Sanitation Annual Audit Report
- Various resources are available on the ThinkWater landing page (**https://www.capetown.gov.za/thinkwater**).

Relevant international programmes

- Sustainable development goals, notably goals 6 and 11

A NOTE TO THE READER:

MAKING SENSE OF WATER VOLUMES AND COSTS

Newspaper articles and reports refer to various volumes of water – litres, kilolitres, cubic metres, megalitres, million cubic metres – and it is hard to keep track of these terms and understand what they mean in different contexts. This is a short guide to water volumes and other terms and concepts used in this strategy.

What is a cubic metre?

A cubic metre (m^3) is 1 000 litres. One cubic metre is equal to one kilolitre (kℓ).

How much is a megalitre?

A megalitre (Mℓ) is one million litres.

How much water does Cape Town use (in megalitres, or millions of litres)?

Before the drought, in 2014/15, Cape Town used an average of 980 million litres of water per day (980 megalitres). During the drought, water use was reduced to just over 500 million litres per day (500 megalitres).

How much water do individuals use (in litres per person per day, and kilolitres per month)?

Total water use for Cape Town as a whole was about 230 litres per person before the drought. This was reduced to about 130 litres per person per day during the drought. Total use includes all uses and losses. At a household level, at least 50 litres of water is required per person every day for basic needs. Households can maintain a good standard of living using 100 litres per person per day. This is the typical household use for many European cities.

A household of four people using 100 litres per person per day will use 12 000 litres in a month (12 kℓ or 12 m^3).

How did the water resources that serve Cape Town develop?

Cape Town's recorded water history started in 1834, when the growing city was served by 36 free-flowing fountains. The first reservoirs were constructed in 1850 to make better use of spring and surface water. Whenever demand exceeded supply, more storage capacity was conceived. Small dams were constructed on Table Mountain, but the additional yields provided could not keep pace with demand. For this reason, the six large dams that provide water to the WCWSS were constructed between 1920 (Steenbras) and 2006 (Berg River).

For nearly 170 years, Cape Town and surrounds relied on surface water as its sole water source. Historically, rainfall has been variable year on year as well as across catchments. The supply system stretches from Voëlvlei dam in the north to Theewaterskloof in the east. Typically, better rainfall is experienced in some areas than in others within the same season. Theewaterskloof is the largest dam and catchment, and usually takes two years to fill with average rainfall, while the balance of the dams fills in a single season.

How big are our dams?

The six large dams supplying the City hold 900 000 million litres (900 000 megalitres). When the numbers are large like this, the preferred unit is a million cubic metres. A million cubic metres equal 1 000 megalitres. This means that the volume of the dams may also be indicated as 900 million cubic metres.

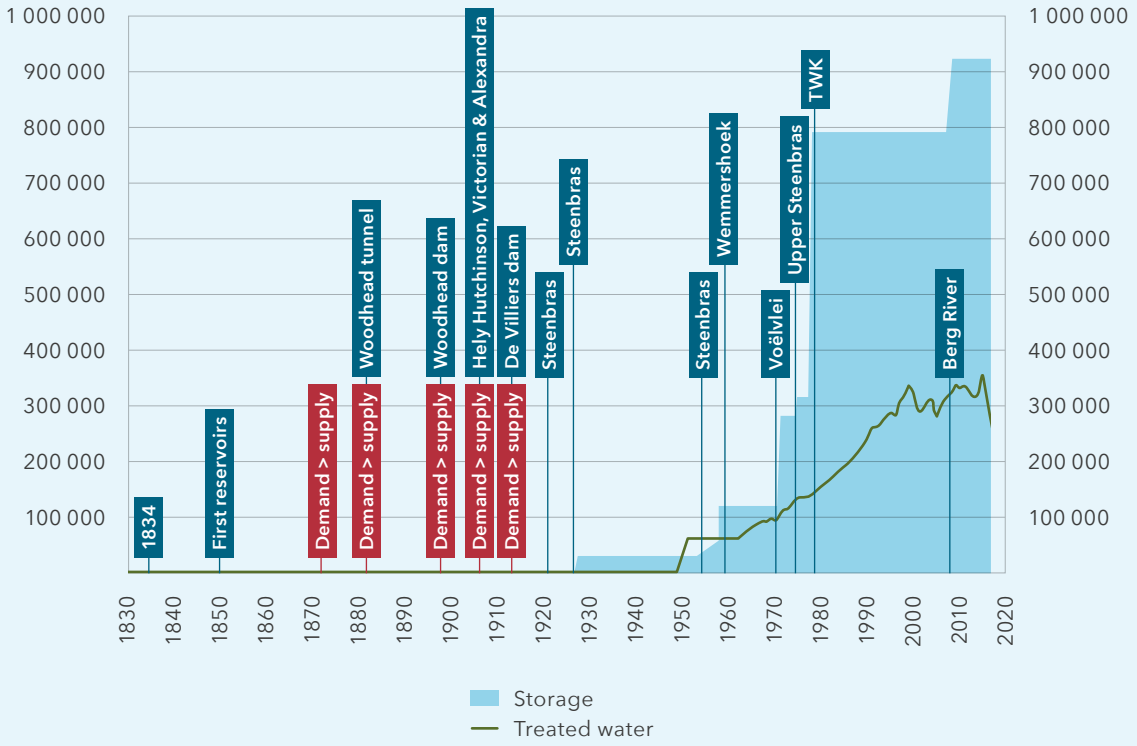
How long can the water in the dams last?

If the City was the only user of the water in the dams, and there were no evaporation losses, full dams would last 1 000 days (less than three years) at a usage level of 900 million litres per day, and 1 800 days (a bit less than five years) at a usage level of 500 million litres per day. But the dams lose over 200 million litres per day from evaporation on hot summer days, and about a third of the total water use each year is consumed by agriculture. For some of the larger dams in the system, it is difficult to access the water when the dams are less than 10% full. In practice, then, the time that the full dams can last is less than two years for normal, unrestricted usage. As a point of comparison, Sydney's dams contain five years of average (unrestricted) water use.

How did the water resources that serve Cape Town develop?

1834: 36 free flowing fountains
1840: Municipal responsibility for water supply
1881: Demand > supply: first restrictions 4 to 3 hours/day
1889: District Waterworks Co. formed
1892: Table Mountain's dams construction started
1912: Water rationing to 12 hrs/day
1913: Greater Cape Town munipality
1916: Water rationing to 4 hrs/day
1956: Promulgation of Water Act
1997: Local government restructuring

FIGURE 20: CAPE TOWN'S WATER SUPPLY HISTORY, 1823-2016



DEFINITIONS

Aquifer: An underground formation that contains sufficient saturated permeable material to yield economic quantities of water to boreholes and springs.

Aquifer recharge: The intentional recharge of water to suitable aquifers for subsequent recovery, or to achieve environmental benefits. This ensures adequate protection of human health and the environment.

Collaborative intermediary organisation: Organisations that create platforms for deliberation and collaboration between diverse stakeholders.

Consumer: Any end user who receives water services from a water services institution, including an end user in an informal settlement.

Desalination: Removal of salt (sodium chloride) and other minerals from water (usually seawater) to make it suitable for human consumption and/or industrial use.

Ecological infrastructure: Naturally functioning ecosystems that deliver valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction.

Groundwater: The water found underground in the cracks and spaces in soil, sand and rock. It is stored in, and moves slowly through, geological formations of soil, sand and rocks called aquifers.

Invasive alien vegetation: Plants brought to South Africa from other countries, both intentionally and unintentionally, that cause human, environmental or economic harm.

Resilience: The capacity of individuals, communities, institutions, businesses and systems to survive, adapt and grow, no matter what kinds of chronic stresses and acute shocks they experience.

Social cohesion: The end product of more stable and participatory democracies, greater economic productivity and growth, inclusivity and tolerance, effective conflict management and resolution, and a generally better quality of life for people.

Stormwater: Surface water in abnormal quantity resulting from heavy falls of rain or snow.

Wastewater: Spent or used water with dissolved or suspended solids, discharged from homes, commercial establishments, farms and industries.

Water catchment: An area where water is collected by the natural landscape.

Water conservation: The practice of using water efficiently to reduce unnecessary use.

Water reuse: The use of treated wastewater for beneficial purposes, increasing a community's available water supply. Water can be reused either directly by injecting water that has been treated to potable standards into the bulk water supply system, or indirectly to recharge aquifers. Current reuse in Cape Town consists of treated effluent supplied for industrial use, construction and irrigation.

Water-sensitive city: The destination of water-sensitive urban design (see below) .

Water-sensitive urban design: Encompasses all aspects of integrated urban water cycle management, including water supply, sewerage and stormwater management. It represents a significant shift in the way water and related environmental resources and water infrastructure are considered in the planning and design of cities and towns, at all scales and densities. (Fletcher et al., 2014).

ABBREVIATIONS

DWS: National Department of Water and Sanitation

kℓ: kilolitre = one thousand litres = 1 m^3

m^3: cubic metre = one thousand litres = 1 kℓ

MLD: million litres per day

Mℓ: million litres

WCWSS: Western Cape Water Supply System

ENDNOTES

[1] Day Zero would have hit if the total dam level in the supply system reached 13,5% of storage capacity. That would have provided an allocation of 25 litres per capita per day to four million Capetonians for three months before dam levels reached 10%, at which point extraction from dams would have become progressively more challenging.

[2] Cape Town's metropolitan municipality, referred to as "the City".

[3] "Urban resilience is the capacity of individuals, communities, institutions, businesses and systems in a city to survive, overcome, adapt and grow, no matter what kind of chronic stresses and acute shocks they experience." (Cape Town Integrated Development Plan 2017-2022).

[4] "Regional" refers to the region served by the Western Cape Water Supply System.

[5] Becoming a water-sensitive city is a vision based on holistic management of the integrated water cycle. It seeks to protect and enhance the health of receiving waterways, reduce flood risk and create public spaces that harvest, clean and recycle water. It advocates fit-for-purpose water use and delivery through both centralised and decentralised infrastructure. Ultimately, the water-sensitive city vision integrates water and urban planning to facilitate a more liveable Cape Town by enhancing biodiversity and providing increased public green space, healthy waterways and connected communities. Source: **https://watersensitivecities.org.au/**.

[6] All costs in this strategy are subject to revision as new information comes to light and circumstances change. The cost per person is an indicative cost. Not all people pay for water.

[7] Competitiveness refers to the city's economic competitiveness to attract investment, stimulate job creation and encourage tourism.

[8] Adapted from the UN High-Level Panel on Water's outcome document Making every drop count: An agenda for water action (2018).

[9] Ibid.

[10] Sometimes referred to as ecological infrastructure, referring to naturally functioning ecosystems that deliver valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction. Source: **www.sanbi.org/**.

[11] The City had already implemented a water conservation and demand management strategy before the drought, which encouraged the use of groundwater and greywater as well as rainfall harvesting. The municipality also recently updated and published guidelines for the installation of alternative water systems.

[12] Currently known as the City's Water and Sanitation Department.

[13] "Safe water" is defined in the national quality standard for drinking water, SANS 241:2015.

[14] Resilient Cape Town - Preliminary Resilience Assessment report available at **http://resource.capetown.gov.za/documentcentre/**.

[15] Cape Town Integrated Development Plan 2017-2022 available at **http://resource.capetown.gov.za/ipd/**.

[16] Wise water use refers to all types of water use, including potable and non-potable use as well as water reuse.

[17] All uses include both domestic and non-domestic use, such as commerce and industry.

[18] Total water use is the total treated water supplied to Cape Town and includes water sold to other small municipalities. This encompasses all water uses – domestic, commercial and industrial – as well as water losses.

[19] **www.un.org/** (water for life decade).

[20] Households who live in properties with a current municipal value greater than R400 000 and are registered as indigent also receive this free allocation of water.

[21] The average incremental cost is the average of the future cost incurred in adding additional supplies, and can be calculated by dividing the discounted value of future supply costs by the (similarly discounted) amount of additional water to be produced (Bahl and Linn, 1992).

[22] Existing policies and practices with respect to the use of decentralised treatment will be reviewed.

[23] The Credit Control and Debt Management Policy provides for incentives that include the repair of leaks and debt write-off for indigent households. During the drought, the City undertook additional leak repair initiatives, including the installation of water-efficient fittings in indigent households.

[24] The City provides treated wastewater effluent to industrial consumers, the construction industry, sport and recreational centres, urban parks and large complexes, where the water is used for irrigation, industrial use and toilet flushing. The City currently recycles about 11% of all water back to these consumers after it has been treated at wastewater works. This helps offset the demand for drinking water. The aim is to extend the City's treated-effluent distribution networks to reach additional consumers, upgrade wastewater works to increase the availability and quality of treated water, and increase water reuse for non-drinking purposes to 30% in the medium term. Efforts will also continue to ensure the optimal use of spring-water resources. The City has surveyed springs within its jurisdiction and evaluated more than 60 springs for potential use. Where feasible, the City will facilitate the use of spring water to augment drinking water supply, for irrigation and non-drinking purposes, and for distribution to the public at spring-water collection points.

[25] Non-revenue water is water that has been supplied into the water network, but has not been provided to customers as either free water (in terms of Cape Town's free water policy) or billed. Non-revenue water includes physical water losses and apparent losses (for example through unauthorised connections or due to metering inaccuracies).

[26] Data from DWS.

[27] "Urban resilience is the capacity of individuals, communities, institutions, businesses and systems in a city to survive, overcome, adapt and grow, no matter what kind of chronic stresses and acute shocks they experience." (Cape Town Integrated Development Plan 2017-2022)

[28] Report commissioned by the City.

[29] The level of rainfall is the primary driver of water availability in the dams. However, temperature and wind also affect evaporation from dams and the relationship between rain and runoff.

[30] The net present value would be approximately R14 billion at 98% assurance, compared to R16,7 billion at 99,5% assurance.

[31] The 2040 yield of the WCWSS was estimated assuming a 10% reduction in the runoff from the WCWSS's catchments. This will result in an average decrease in water availability to the City of 1 million m^3 per year. See annexure B.

[32] City of Cape Town water conservation and water demand management strategy.

[33] Various initiatives are under way or have been undertaken to better understand water use in the region. Any proposed studies will build on existing work.

[34] The WCWSS comprises Province's agriculture and environment departments as well as others, who attend as and when necessary. The Provincial Joint Tactical Centre was established on 1 October 2018. It is chaired by the Western Cape MEC for Local Government, Environmental Affairs and Development Planning. The Provincial Joint Tactical Centre, which comprises regional and national DWS, water boards, catchment management agencies and representatives from Province and City, aims to enhance integrated planning and implementation monitoring of water and sanitation delivery in line with relevant provincial ordinances and plans, including the Western Cape Sustainable Water Management Plan, Climate Change Response Strategy, and Water and Sanitation Policy. The City also collaborated with Province to develop the "Directions for the determination of bulk raw water availability and implementation of restrictions on the use of potable water for domestic and industrial purposes", which were published in the Government Gazette of 4 August 2017.

[35] Brown, R., Keath, N. & Wong, T. 2008. "Transitioning to water-sensitive cities: Historical, current and future transition states". In: Proceedings of the 11th International Conference on Urban Drainage, 31 August-5 September 2008, Edinburgh International Conference Centre, Scotland. Edinburgh: IAHR/IWA.

[36] Tariff principles for municipal services are set out in the Municipal Systems Act, and those for water and sanitation services are contained in the Water Services Act.

[37] As per the City's Indigent Tariff Policy.

[38] Fully recovering all fixed costs through fixed charges may make water services unaffordable for poor and middle-class residential customers. The City may wish to set fixed charges below total fixed costs, and set volumetric charges (except the lowest block) above the average incremental cost. The City will explore this trade-off as it develops its plan for financial stability.

[39] The cost of desalinated water depends on a number of factors, not least the cost effectiveness of procurement – in other words, the extent to which competitive procurement processes are able to deliver internationally competitive prices.

[40] To the extent that a fixed charge recovers the cost of the water network, the volumetric water tariff is likely to be in the lower range of the estimated band.

[41] Singapore has a per-capita GDP of $52 906 compared to South Africa's $5 273 (2016), according to the World Bank.

[42] Gina Ziervogel, personal communication, 2018.

[43] "Applying resilience thinking: Seven principles for building resilience in social-ecological systems". **www.stockholmresilience.org**.

[44] Ibid.

[45] "Determinands" refer to chemicals of which the occurrence in a water body is determined as an indication of pollution. The term should not be confused with "determinants", which refer to elements that identify or determine the nature of something. Haastrup, P. & Würtz, J. (eds). Environmental Data Exchange Network for Inland Water. Amsterdam: Elsevier.

[46] Perth is at a latitude of 31 degrees south, and Cape Town is at 34 degrees south. See Smith, I. & Power, S. 2014. "Past and future changes to inflows into Perth (Western Australia) dams". Journal of Hydrology: Regional Studies, 2 (November): 84-96.

[47] Desalination parks are sites prepared specifically for desalination plants to be developed rapidly if additional supply is required. Common infrastructure can be constructed upfront, while plants can be added in modules in the region of 50 MLD.

THINK WATER
CARE A LITTLE. SAVE A LOT.

Don't delay: Report burst pipes, faulty meters and water restriction offences:

- Call **0860 103 089** (choose option 2: water-related faults)
- SMS **31373** (max of 160 characters)
- Email **water@capetown.gov.za**
- Online through our Service Requests tool at **www.capetown.gov.za/servicerequests**

Further resources and information on the current status of our water system are available at **www.capetown.gov.za/thinkwater**

Produced by the Water and Sanitation Department of the City of Cape Town.

Making progress possible. Together.