

WATER DEMAND MANAGEMENT

Two thirsty cities' successful attempts to consume less water

An increasing number of cities around the world are facing water scarcity. Petro Kotzé looks at the water demand strategies of Cape Town and San Francisco.

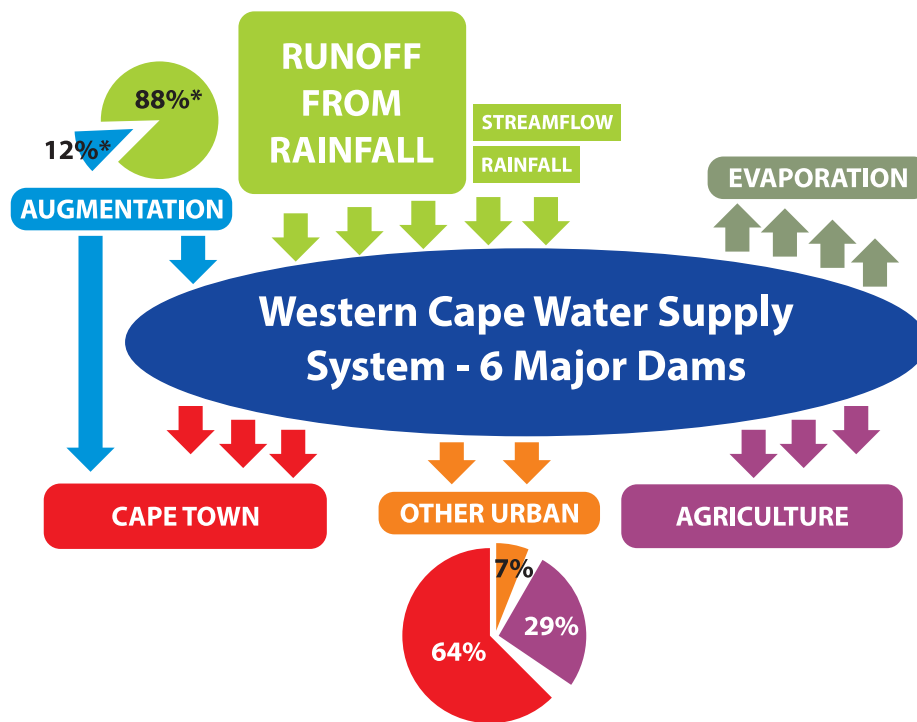


Today, there are more people on the planet than ever before; a trend that is most acutely felt in cities. More than half (55%) of the world's population live in urban areas, a percentage that is set to increase to 68% by 2050. The accumulation of millions of people is putting pressure on the local resources available to sustain them, especially since climatic conditions are becoming more unpredictable.

In particular, the availability of water is becoming an increasing concern, and reports of urban areas grappling with water-insecurity is streaming in from across the globe. Cities that have been listed in international media as facing extreme water shortfalls in future include Tokyo (Japan), São Paulo (Brazil), Bangalore (India), Beijing (China), Cairo (Egypt), Jakarta (Indonesia), Moscow (Russia), Istanbul (Turkey), Mexico City (Mexico), London (United Kingdom) and Miami (United States), and lately Cape Town.

This situation necessitates management authorities reach further than before in search of water. Strategies involve selective development and exploitation of conventional and non-conventional water supplies, with water being piped from further away, increasingly taken from underground, recycled, or extracted from the sea. However, supplying more water is only part of the overall solution. "As the saying goes: you can't build yourself out of a drought," says Priya Reddy, City of Cape Town's Director of Communications. Dropping the demand for water is crucial to help prevent big cities from running out of water, a role that is well recognised internationally.

Water demand management (WDM) is recognised as key to the survival strategies of two cities that have recently experienced extreme drought. The City of Cape Town (CCT) has been successfully applying WDM for many years, and as a result could drop water use dramatically in a short time when crisis recently hit. Similarly, San Francisco (California, United States) recently



The Western Cape Water Supply System.

emerged relatively unscathed from extreme drought without tapping into new water sources. Both cities serve as examples of burgeoning urban areas in dry climates that are grappling with water scarcity, but emerging more resilient due to the successful application of WDM, and moving forward towards the creation of water wise cities.

What is water demand management?

Successful water demand management (WDM) entails comprehensive reforms and actions to optimise existing water supplies. It is a long-term, integrated approach to water management that aims to conserve water by controlling use, influencing demand and promoting efficient use. WDM involves various role-players across governance structures, technical expertise and a cultural mind-shift to recognise the importance of water and the cumulative impact of individual use (whether it is urban residents, industry or agricultural users) on each other and the water source. The aim is to minimise loss and waste, to protect the water resources and to use water efficiently and effectively.

Managing the demand for water in Cape Town

Cape Town has about 4.2 million residents, with about 610 000 registered residential accounts, in addition to water supply to business, industrial and government users. The City of Cape Town (CCT) is part of the Western Cape Water Supply System (WCWSS), which gets most of its water from a system of dams.

The City of Cape Town's WDM and conservation programme started in the early 2000s, and has been scaled up considerably over the past few years. "The city has been ahead of the curve in many regards, and the pre-existing water demand management programme was an important advantage and foundation for a rapid drought response," says Reddy. As a result, the CCT could

facilitate a drop in water use by almost one third in only three years, to prevent the city from running out of water midst an unprecedented three-year drought (with the lowest rainfall in the past 30 years and 2017 measuring the lowest rainfall since the early 1900s).

In February 2015, CCT's peak summer consumption was 1 200 million liters per day (MLD), reduced to 1 100 MLD (under level 2 restrictions) by summer 2015/16. By summer of 2016/17, a peak of 900 MLD was achieved (under level 3 restrictions), stabilising at 600 MLD between June and December 2017. Since January 2018, demand has further been reduced closer to 500 MLD, a saving of 68% during peak summer usage and a saving of 45% on average over the year.

Reducing water demand by managing the distribution system

Though water restrictions have contributed immensely to curbing immediate water demand, some of the most important tools in the CCT's arsenal of WDM strategy has been optimising the distribution system. Among the management actions applied, advanced pressure management has had the biggest impact, contributing an average saving of 55 MLD, says Reddy. First initiated more than a decade ago, pressure reduction has been accelerated and expanded, with the implementation of more automated pressure zones across the metro. Pressure zones force down consumption by throttling zones to the extent of partial supply if user behaviour in the zone is high. Automated pressure zones are at the heart of the programme, allowing the CCT to adjust water pressure remotely.

The CCT has also been in the lead of curbing water losses, currently logging the lowest overall losses of any South Africa metro at 16% in comparison to the national average of 36%.

Reddy says this is thanks to proactive management of resources and the application of innovative technology. Not only does the CCT fix the leaks of indigent households, but advanced equipment such as a robotic crawler is employed. Fitted with an on-board camera and remotely controlled, the crawler monitors water and sanitation infrastructure, identifying cracks, leaks and obstructions inside a pipeline.

Household flow regulators have also been installed for many years, but will be ramped up to connections of high water users to restrict daily household consumption and safeguard against the impact of leaks. Warning letters are sent to identified users with their municipal bills, which has an important impact on water use behaviour.

CCT is also continuously clearing alien vegetation in the catchments and on city land.

Reducing consumer demand for water

The CCT has been running ongoing, successful and sustained awareness programmes, and maintains a multi-faceted, multi-platform water communication approach to drive demand down and to keep consumption at appropriate levels as the situation requires, says Reddy. This includes extensive messaging and education in a wide range of media and interventions, as part of a dedicated stakeholder engagement philosophy. The CCT website has been of particular importance in this strategy, as “all city water-saving or drought collateral was and continues to be made available in open format to anyone who requests it.”

In February 2016, level 6 water and sanitation tariffs was introduced in a further effort to drive behavioural change, but also to recuperate the immense loss in revenue due to usage reduction. At the end of May, new level 6 tariffs were approved, with level 7 disaster scenario tariffs in place. “The idea is that we could move between these tariffs as the situation requires,” says Reddy.

“WDM is not just about technology, but about people working together towards a shared objective.”



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Managing the demand for water in San Francisco

Compare Cape Town’s performance with that to San Francisco, a city of 2.7 million residents, served by the San Francisco Public Utilities Commission (SFPUC). In San Francisco, about 68% of residential housing units are in multi-family buildings. Of this, about 30% are two-to-four dwelling unit buildings and 70% are in dwellings over five units. Most residential water use in San Francisco is indoors, and residential outdoor use is typically concentrated in neighborhoods comprised of single family homes with irrigated landscapes.

The SFPUC owns and operates the Hetch Hetchy Regional Water System (RWS), which collects high-quality drinking water from the Tuolumne River watershed (85%) in the Sierra Nevada and protected local watersheds in the East Bay and Peninsula (15%). In 2018, the SFPUC began blending groundwater with surface water supplies to serve in-city retail water customers.

The SFPUC has been running a comprehensive water conservation programme for over 25 years, and has applied almost the entire range of WDM strategies, resulting in significant water use reductions. “Demand management continues to be an important component of our water-supply management approach,” says Steven R Ritchie, SFPUC Assistant General Manager, Water.

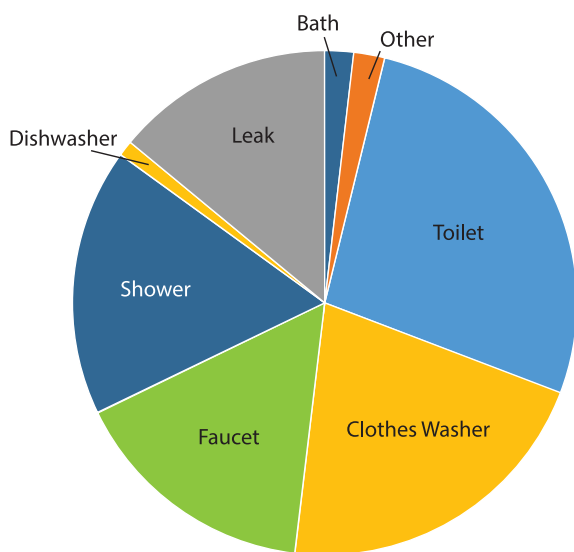
The state of California is no stranger to drought, but the most recent (2012 – 2016) broke records. A drought state of emergency was declared for California in January 2014, and lifted in April 2017, seeing both the region’s driest and warmest year on record (2014), followed by the second driest and hottest (2015).

Ritchie says that demand prior to the drought was already depressed from the estimated 1205 MLD (265 million gallons per day (MGD)) planning level of demand for the RWS, due to the 2008-2009 financial crisis. In 2013, demand was at around 1018 MLD (224 MGD). SFPUC has total system storage triggers to declare rationing, but these were preceded by the declaration of drought emergency. At the height of the drought, SFPUC delivered 822 MLD (181 MGD), with about three years of water supply available in storage.



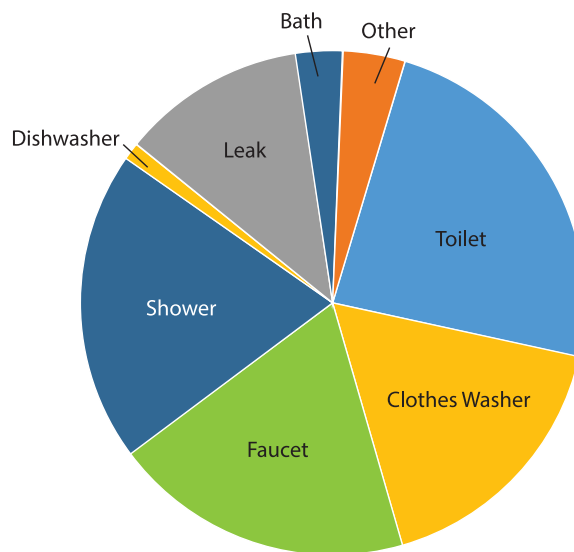
Over the past 20 years, the replacement of old, high-volume toilets and washing machines have played a major role in reducing indoor water use in San Francisco.

Typical Indoor Residential Water Use in the 1990s



Note: Residential End Uses of Water Study (REUWS) published in 1999 by the American Water Works Association (AWWA) and the AWWA Research Foundation.

Typical Indoor Residential Water Use in the 2015



Note: Water Research Foundation "Residential End Uses of Water. Version 2"

Services of the San Francisco Public Utilities Commission.

In 2013, (pre-drought) in-city residential water use per person per day was approximately 185 litres (49 gallons). In 2017 (during drought), this dropped to 155 litres (41 gallons). After the drought, in 2018, the figure rose again slightly, reaching around 162 litres (43 gallons) – still, says Ritchie, "one of lowest in the State and almost half the statewide average."

Reducing water demand by managing the distribution system

Some of the most significant reductions achieved by the SFPUC are pinned down to the replacement of old fixtures with water-efficient models. Over the past 20 years, the replacement of old, high-volume toilets and washing machines have played a major role in reducing indoor water use. "Nationwide, the amount of water used for toilets and clothes washers in a typical home has shrunk from about 50% in the 1990s to about 40% today in houses that have new fixtures," says Ritchie.

Elements essential to the success of the SFPUC's WDM programme include:

- **Plumbing code requirements:** Most water savings are attributed to plumbing codes that require efficient fixtures such as toilets, aerators and shower heads;
- **A sound process for estimating potential for water savings and evaluating the effectiveness of different conservation measures,** to determine what mix would be the most practical, cost-effective, and result in the most water savings and other benefits;
- **A water conservation plan** that includes a timeline for activities, the necessary resources and budget, the ability to procure the staff, resources and necessary budget, and a plan to measure effectiveness and adjust accordingly; and

- **An intimate understanding of the customers:** A good understanding of the population you are trying to reach and their water use patterns, and a thoughtful selection of conservation measures that helps meet these needs.

Reducing consumer demand for water

The SFPUC launched a number of outreach efforts to inform San Franciscans about the need to save water and resources available to help, including presentations at neighborhood groups and door-to-door outreach along commercial corridors. These ran along with extensive statewide media coverage about the drought.

In June 2014, the SFPUC launched a multilingual 'Water Conservation is Smart and Sexy' city-wide public education campaign to capture public attention and present everyday water conservation tips and information about the drought. The campaign continued throughout the drought with new artwork and messages communicated through a combination of television, newspaper, billboard, bus, commuter transit station, and social media advertisements. The campaign encouraged individuals to adjust their water use practices and pursue water-efficient plumbing fixture upgrades. It also advised individuals to visit the SFPUC website to learn more about conservation services that are offered. Shortly after launching the campaign, SFPUC water conservation web traffic increased by close to 25%, and was extended to the wholesale service area as well.

The outreach efforts were seen as very effective in motivating residents to use less water, says Ritchie.

Looking back and moving forward

For both water management utilities, the future of their WDM

strategies entail much of the same, while moving ever forward towards building more resilient cities.

For the CCT, all efforts to date are seen as successful overall and would be repeated if they had to start over, though they might relook timing or scale of certain approaches (for example, how to introduce or communicate initiatives, how to maximise effectiveness and the required implementation capacity).

Similarly, for the SFPUC, “come rain or shine”, the focus of their conservation programme will continue to be helping customers use water wisely and avoid water waste from leaks, old or broken equipment, and inefficient water use practices.

Both highlight that a successful WDM strategy is multi-faceted. For the CCT, Reddy says a combination of factors will always be applied, since people are motivated to change behavior differently – for some by a sense of social responsibility, and for others, cost or fear. Measures applied by the SFPUC during times of drought will again including extensive outreach and media campaigns in collaboration with potential mandatory rationing and excess-use fees, home water use monitoring tools, and water-saving incentive programs.

Reddy lists collaboration as integral to the CCT’s success. Driving awareness is a sustained, long-term drive to change behavior, and it is critical that the CCT is supported by a range of partners who share the same key messages, she says.

At the same time, the custodian of water supply, such as the CCT, should continue to lead by example and ensures that infrastructure is maintained, innovation is applied and water is considered in all operations across the city. Ritchie adds to this, when listing accountability as a critical element of any water-saving incentive program. For the SFPUC, this means no longer offering measures that provide substantial rebates and incentives for water saving fixtures, devices and equipment without pre- or post- inspection by SFPUC staff to ensure that these are installed and functions correctly.

Going forward, both water management authorities are focusing on long term measures to secure long-term water supply, including water infrastructure, water supply diversification, water

transfers, water conservation and water recycling.

Both cities are also embracing new tools and approaches to water resources management. While Cape Town is refocusing its approach towards the more comprehensive concept of ‘a water-sensitive city’, the SFPUC has adopted an **OneWaterSF** approach to managing water resources for long-term resiliency and reliability. According to Ritchie, “The SFPUC has successfully cultivated a shift at the utility from thinking about one project at a time to thinking holistically about the synergies and resource potential across water, wastewater, and energy boundaries, exemplified in the promotion of on-site non-potable water systems that collect, treat, and use alternate water sources for non-potable uses within individual buildings or across multiple properties.”

Such future plans are in-line with global perceptions of how cities should function to ensure a sustainable future. According to manager for the International Water Association (IWA) Cities of the Future programme, Corinne Trommsdorff, the application of successful WDM is multi-faceted. Water-wise citizens, decision makers, and professionals should be shaped. Action should also take place at basin level; assessing constraints and the means to minimise risk to water shortage. The way that buildings and neighbourhoods are designed should be reassessed, allowing for minimal consumption while maintaining high livability. The implementation of improvements or modifications to water services – water loss reduction, reuse for different purposes and rain water harvesting – are essential. “WDM is not just about technology, but about people working together towards a shared objective.”

Sources and further information:

- www.capetown.gov.za/thinkwater
- www.gwp.org – The Global Water Partnership
- www.iwa-network.org/ - The International Water Association (IWA)
- <http://sfwater.org>



Launched in 2014, the San Francisco ‘Water conservation is smart and sexy campaign’ captured public attention and presented everyday water conservation tips and information about the drought.

