Received: 11 October 2018 | Revised: 15 July 2019 | Accepted: 18 July 2019

DOI: 10.1002/wat2.1376

OPINION

WIREs WATER WILEY

Water resilience lessons from Cape Town's water crisis

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Funding information
Social Sciences and Humanities Research Council of Canada; University of British Columbia

Abstract

In the aftermath of the acute water crisis, building resilience in the water sector has become a priority for the City of Cape Town. In this piece, I discuss several emerging lessons from Cape Town's experience and their implications for water resilience more broadly. While having avoided "Day Zero," Cape Town has also demonstrated how unprepared many municipalities might be as they face growing variability and uncertainty in the hydrologic cycle. Second, Cape Town's experience also signals the limits of conventional demand and supply paradigms that focus on high efficiency and overallocation of water resources. Furthermore, Cape Town's deeply unequal waterscape and acutely divisive politics are among the most important factors that shaped not only how the crisis unfolded, but also the ability of governance systems to respond in a timely and adequate manner.

This article is categorized under:

Engineering Water > Planning Water

Human Water > Water Governance

KEYWORDS

Cape Town water crisis, water demand management, water governance, water resilience

1 | INTRODUCTION: CAPE TOWN'S INFAMOUS "DAY ZERO"

Cape Town's unprecedented 2017/18 water crisis and the notion of "Day Zero" seized the world's attention as the city was expected to cut off water supply in April 2018 (although the exact date was revised several times), leaving its 3.7 million residents without tap water. The then-anticipated "Day Zero" scenario painted a picture of thousands of people standing in line to collect up to 25 L of water at about 200 water collection points throughout the metropolis, patrolled by the South African National Defense Force and Police Service. For better or worse, in early 2018, shortly after "Day Zero" was announced, Cape Town received considerable global media coverage. The immense local and global attention to the crisis raised awareness of Cape Town's grave water challenges; however, it also gave rise to many critiques of the governance responses to the drought, exposing deep frictions and inequality in water access across the city.

Many have highlighted the successes of the stringent demand management measures and the heroic efforts of Cape Town's residents who collectively lowered their water consumption by nearly half. Cape Town narrowly escaped the crisis through a combination of measures, including drastic cuts in municipal water consumption, transfers from the agricultural sector (Head, 2018; Said-Moorehouse, 2018), emergency preparedness planning and, eventually, rain. All these measures and factors played different roles at different times during the crisis. For example, in early 2018, farmers from the Overberg region of the Western Cape made a one-time donation of 10 million cubic liters of water to the Western Cape Water Supply region (Head, 2018). This voluntary release of water gave the City of Cape Town enough additional water to push back the estimated date for Day Zero by 18–20 days (Head, 2018). While in retrospect, this may not seem to be a lot, during a time of acute stress and growing

alarm among the residents of Cape Town, this event provided hope and bought just enough additional time to keep working on alternative solutions.

For now, Cape Town has managed to stave off "Day Zero" indefinitely, with the city's dams filling steadily during the 2018 winter rainy season. Some might say this truly is a success story—Cape Town has managed to avoid what could have been an unprecedented water catastrophe. However, is Cape Town indeed resilient or immune to future crises of this magnitude (or worse)? Are other cities? What can we learn from Cape Town's experience?

Much has already been said in response to some of these questions. Opinion pieces in newspapers worldwide are in the hundreds, Google searches return over 15 million results on Cape Town's water crisis, and many academic articles will be out in the coming months. Many scholars in Cape Town and beyond (including Kevin Winter, Gina Ziervogel, Mark New and Piotr Wolski, to name a few) have long been engaged with the City of Cape Town before and during the crisis, and many new insights will continue to emerge from their work (e.g., see Enqvist & Ziervogel, 2019). Much attention in these ongoing and emerging debates is focussed on questions of how exactly the crisis was handled, whose responsibility it was to act and when, and whether we can actually predict these kinds of "surprise" hydrologic events. Most importantly, the looming possibility of "Day Zero" was undeniably hard for those who had to live through it. Ask anyone in Cape Town in the summer of 2017/18—amidst the hot and dry season, the drastic water restrictions posed health risks (Mash, Mahomed, & Peters, 2018), while public shaming and police interventions were among the tools used to pressure residents to reduce water use (Joselow, 2018).

Many questions, however, remain hotly debated, as is often the case after crises. This piece draws on research conducted primarily in 2016/17, with analysis and writing into early 2018. As such, the data collection and much of the analysis was conducted before the height of the crisis, which provides a somewhat different perspective. This water crisis offers many lessons for what "water resilience" might actually mean. The "crisis" also exposed larger scale processes, conditions and assumptions that we take for granted in water management (such as demand management), not only in Cape Town, but also in other contexts that face similar water challenges. It is important to continue to evaluate and critically examine the lessons that emerge from Cape Town's experience. Specifically, this piece challenges, in potentially controversial ways, the limits, both physical and ethical, of demand management, and particularly of drastic consumption reduction, and the politics of reconciling long-term and short-term objectives for water resilience. As will be discussed below, a more productive strategy for Cape Town or other contexts will likely need to focus on developing anticipatory, proactive and more diverse tools and solutions to help alleviate the pressures of potential future water shortages. Furthermore, Cape Town's experience with this drought once again exposed the deeply divisive politics around water, contentious jurisdictions in the water domain, and lack of trust, all of which shaped how the crisis was experienced by different populations and communities. Finally, several invaluable lessons emerge from Cape Town's experience with the 2017/2018 drought, that highlight opportunities for more resilient water management approaches to water risks.

2 | UNCERTAINTY, UNPREDICTABILITY, VARIABILITY

The drought began to unfold in 2015 when there was significantly lower than average rainfall feeding into Cape Town's water supply system (Knight, 2019; Otto, Wolski, Lehner, Tebaldi, et al., 2018; Wolski, 2018). The Western Cape province was not unique in experiencing unusual hydrological conditions, as Southern Africa as a whole has been experiencing longer-term drying trends (Archer et al., 2017). However, as the drought worsened in 2016, the City of Cape Town's water managers remained confident in the system's ability to withstand it (in-person interviews with city officials in 2016, see also Knight, 2019). For example, consider this quote from an interview with an official from the Bulk Water Supply department:

> I think Cape Town's system is fairly resilient in that under different conditions, and especially challenging conditions, we are still able to maintain a fairly uninterrupted supply. And even during this drought, even though there has been a heightened awareness and I guess people being scared that we are going to have supply problems, we have pretty much been able to keep an uninterrupted water supply going to Cape Town (city official, Bulk Water Supply, June 2016. See more in Rodina, 2019b)

In fact, many high-level managers and officials in the Bulk Water Supply department saw Cape Town's water system as highly resilient due to the integrated nature of the water supply system and the successful water demand management efforts to date (Luker & Rodina, 2017; Rodina, 2019b). Indeed, even during the crisis, demand management and consumption targets resulted in nearly 50% reduction in overall water demand (Said-Moorehouse & MezzoFiore, 2018). In addition, water experts in Cape Town had high confidence in the water system based on the city's performance during droughts in the past (interviews

conducted in 2016 with city officials; Rodina, 2019b). Many would indeed argue that it was precisely the drastic collective reduction in water consumption that helped "save" Cape Town from an imminent crisis. But this raises questions about whether or not it was ethical to put such a tremendous burden or the city's residents, or whether we need to think more carefully about proactive contingency planning on the part of the municipalities and city managers. These questions will continue to be debated in the upcoming months.

As the crisis intensified over the next year and a half, it became clear that Cape Town's current water management paradigm was not sufficiently equipped to deal with uncertainty in the hydrologic cycle—a crucial challenge that many other cities are likely to face. At the time, it was uncertain as to whether the regular winter rainfall would be the same or lower than it had been over the last couple of years (see also Knight, 2019). Uncertainty around the precipitation levels year to year during droughts is not unique to Cape Town—California experienced similar challenges during the 2012–2016 drought (Lund, Medellin-Azuara, Durand, & Stone, 2018). Such uncertainty can lead to slower and more poorly coordinated responses, particularly in the context of climate change (Findlater, Donner, Satterfield, & Kandlikar, 2018)—indeed the City of Cape Town issued its most stringent water restrictions months after the dam levels had reached critically low levels (see more below).

Some might be (and indeed have been) quick to judge this is as lack of foresight on part of the city's water managers and decision-makers. Maybe that it is indeed the case, however, it should be noted that, as Milly et al. (2008), Dunn, Brown, Bos, and Bakker (2016) and others have pointed out, water management paradigms traditionally have not been very good at accounting for unpredictability, uncertainty and variability in the hydrological cycle. Conventional water supply and demand approaches tend to rely on past hydrologic data in predicting future trends, and they are thus often ill-equipped to deal with uncertainty (Milly et al., 2008). This shortcoming signals deep institutional vulnerability in dealing effectively with change in hydrologic regimes, which has been recognized as key for resilient water governance (e.g., Bell, Allen, Hofmann, & Teh, 2017; Dunn et al., 2016). Incorporating uncertainty, unpredictability and variability may require a paradigm shift (such as reframing how risk and probability are estimated, e.g., Otto et al., 2018) that, albeit challenging, is becoming a key priority for water utilities worldwide.

3 | LIMITS TO DEMAND MANAGEMENT

Cape Town, and South Africa more broadly, is a particularly insightful context to learn from because of its oft-cited progressive water policies, and prominent international recognition for achievements in water demand management. Cape Town has a long track record in demand management, including concerted efforts to curb overall demand, reduce and repair leaks, manage pressure to reduce the overall toll on the water system, and progressive water pricing to discourage high water consumption. Cape Town's internationally renowned success in water governance and several key national legislations—notably the National Water Act and the Free Basic Water Policy—lay the foundations for progressive and arguably very resilient water governance. To be clear, water conservation and demand management are prudent strategies since water supply expansions (i.e., new dams, dam augmentation schemes, or groundwater) are very expensive, imposing a big fiscal and capital burden than can lead to increased water tariffs—a measure that can be highly problematic in places like Cape Town, where poverty and unemployment levels are very high. Therefore, supply side options for mitigating the risks of water shortages are often untenable, as they incur high costs, and can be maladaptive due to high emissions that contribute further to climate change.

However, consumption reduction targets should not be the *sole strategy* during crises like this one, as it has several key limitations (see also Rodina & Findlater, 2018). Leading up to and during the peak of the 2017/2018 crisis, Cape Town's response was centered primarily on drastic reductions in water consumption long before other actions were implemented. Alternative water supply solutions did not kick in until mid-2018. In late 2017, the City imposed an 87 L per person per day limit on water consumption, which shrunk to 50 L in early 2018. However, even with these strict consumption reductions, Cape Town consistently failed to cut demand below the well-publicized 500 ml daily target needed to keep the system functioning through to the next rainy season assuming no interim rain or additional supplies. The Mayor resorted to using reprimanding rhetoric, accusing the city's residents of wasting water. The difficulties in cutting water consumption, however, should not be seen as a sign that Cape Town's residents were noncompliant with the targets. Instead, this suggests that continuously shrinking water targets might actually be untenable. Of course, this does not mean that water consumption should not be reduced to save water resources; however, it does raise the question of limits. How far can we squeeze consumption without putting alternative solutions in place? What is an acceptable floor on water consumption in a time of crisis? Is it 25 L/p/d? Is it 50? The truth is that we actually do not know, in part because of a lack of historical data on similar cases (there are some, but very few known cases of municipalities running out of water). The City of Cape Town did not actually achieve 50 L per

person per day in real consumption, particularly as some residents were able to supplement their water needs through boreholes or private water reuse systems (Dawson, 2018; Said-Moorehouse & MezzoFiore, 2018).

The successes of demand management have also obscured other downsides. For example, demand management approaches in Cape Town have historically put a disproportionate burden on impoverished households (Mahlanza, Ziervogel, & Scott, 2016). Cape Town has nearly 1 million residents in sprawling informal settlements, as well as a long history of distrust and a racially and spatially segregated water infrastructure and services landscape (Dugard, 2013). Water supply and distribution systems in South Africa have been historically shaped by colonial and apartheid planning, respectively, resulting in a highly uneven waterscape, aspects of which are still lingering today (Beck, Rodina, Luker, & Harris, 2016; Funke et al., 2007; McDonald & Pape, 2002). The now infamous demand management devices were initially installed in impoverished areas of Cape Town, including informal settlements, and have since been loudly critiqued for targeting solely impoverished households, whose water access is already precarious (e.g., Enqvist & Ziervogel, 2019; Dugard, 2013; Mahlanza et al., 2016; Wilson & Pereira, 2012). It was not until the 2017/2018 crisis that the demand management devices were installed in higher income areas as well. However, it is important to remember that the more affluent water consumers in Cape Town were able to access other forms of water supply (either by drilling their own boreholes, or by arranging for trucked water and other private options), and thus to effectively bypass the municipal water grid (Dawson, 2018). In other words, while in theory demand management devices can help individual citizens cut their water use, they are imbued with ethical and equity challenges that can further deepen inequities in access to water infrastructure and services.

There is a potentially optimistic message here as well. During the crisis, the city-wide water restrictions effectively forced the wealthier residents to reduce their water consumption nearer to that to which impoverished residents are quite accustomed. This unveils a vastly uneven underlying waterscape in Cape Town that has typically been obscured by the high service coverage statistics (Rodina, 2016). The crisis served to unveil these disparities, and also to potentially close the gaps between the poor and the wealthy in facing water rationing and the risk of running out of water, even if temporarily. Is it possible that the experience of wealthier communities in having to live on 50 L per person per day (for those that did try) will engender a sense of empathy and deeper acknowledgement of the water inequality that is otherwise often unseen? While it is too early to say with certainty whether this will have longer-term impacts, it raises many important conversations about the politics and ethics of water consumption.

In sum, demand management worked in some ways, but did not in others. In the end, several different events and factors helped push back Day Zero, including unexpected "buffers"—temporary agricultural transfers (Said-Moorehouse, 2018), the rapid installation of small-scale greywater systems and new groundwater sources by residents in the city's wealthier neighborhoods (Dawson, 2018), the eventual supply augmentation actions that the City started to put in place in 2018 and, lastly, rain. Such buffers may ultimately be *more* important for water resilience, as they serve as additional supply during unprecedented times of scarcity, when reducing demand is no longer tenable. Buffer, in this sense, should mean planned, alternative sources of water that can be made available without necessarily pushing residential consumption to its limits. These may include groundwater, water reuse, and various water harvesting techniques. In the case of Cape Town, some argue that transfers from the agricultural sector could in theory help to alleviate the immediate need for more water; however, they are not necessarily a desirable emergency buffer. The social and economic impacts of the drought on the agricultural sector in the Western Cape were significant, and some estimates have indicated that 8–10 years will be needed for the sector to recover (Knight, 2019). Approximately 30,000 jobs were lost during the drought (Knight, 2019), many of which were likely held by migrant workers or other vulnerable populations.

Cape Town's water crisis shows that strict consumption reductions can only go so far. If normal rains had not returned in 2018, would Cape Town have survived another dry year? We cannot know with certainty. However, with long-term and stringent demand management, Cape Town's water system has become highly efficient in economic and hydrologic terms, its capacity finely balanced with the demands of a growing population. Cape Town has leveled demand, reduced leaks, and practiced pressure management and water restrictions for over a decade, resulting in little room for savings or further cuts. Come another dry year, there will be no extra water to draw from. Having utilized almost all conventional surface water supply options (DWAF, 2007; Luker & Rodina, 2017) and unable to "squeeze out" more water savings from its residents, Cape Town's water system has become too constrained. Therefore, such highly efficient systems may be less resilient because there are few reserves to draw from in times of unusual scarcity.

4 | CONCLUSION: LESSONS FOR WATER RESILIENCE

Several key lessons stand out from Cape Town's experience with the water crisis. First, Cape Town has demonstrated how unprepared many municipal departments might be in facing unpredictable variability in the hydrologic cycle, which, as we

have seen from the recent IPCC reports, is likely to become a common problem (Otto et al., 2018). Second, Cape Town's example also shows the limits of conventional demand and supply paradigms and the need for new water buffers through alternative supply sources, such as water reuse, groundwater and stormwater, among others. Indeed, the City of Cape Town began considering these options, but only after the peak of the crisis, which I would argue was too late. This implies moving away from extremely efficient and over allocated water systems. Creating such buffers, however, requires careful long-term planning, involving various stakeholders, and therefore needs to be put in place before times of crisis. This highlights once again the need for proactive planning and anticipating various uncertain future scenarios. Furthermore, a big influence on emerging water resilience portfolios or solutions to water scarcity is the notion of ecological, or nature-based solutions (i.e., green or ecological infrastructure) for increased water resilience. Globally, and in Cape Town specifically, there has been an enhanced interest in addressing water ecosystem health as a key priority in water resilience building efforts, instead of relying on costly and inflexible engineered systems (Armitage et al., 2014). While there is indeed a lot of promise in these approaches, we should also keep in mind how profoundly unequal Cape Town's waterscape is, and how this might interact with any "solutions" to water risks.

In the aftermath of the acute crisis, building resilience in the water sector has become a priority for Cape Town's water management. In general, water resilience is commonly understood as the ability of water systems to withstand a variety of water-related shocks (floods, droughts, changes in water quality) without losing their ability to support key functions, as well as the ability of water systems to transform and adapt to new hydrologic regimes (Johannessen & Wamsler, 2017; Rodina, 2019a). In other words, while water resilience is often framed in relation to risks and hazards, a common resilience framing is broader in orientation, centering on the ability to fundamentally change water use practices. In Cape Town, the language of resilience is present in municipal management circles, as experts and planners are engaged in new strategic goals and partnerships related to the City's participation in the 100 Resilient Cities. The City of Cape Town also framed their effort to respond to the crisis using the language of resilience (i.e., through establishing a Water Resilience Plan). However, I believe the narrow crisis orientation may have hamstringed what could have been a more thoughtful approach to building resilience in the water sector.

"Crisis" narratives can be unproductive, as they tend to enable the consolidation of power or to promote narrow risk management approaches (Pelling & Dill, 2010; Watts, 2016). For example, since the City of Cape Town officially declared the drought a "crisis" situation, many water supply augmentation projects, including groundwater extraction and artificial recharge, water reuse and other options, are at risk of being expedited without necessary social and environmental impact assessments (City of Cape Town, 2017; Luker & Harris, 2018). Furthermore, one of the most productive aquifers considered as part of the emergency supply augmentation schemes is the Cape Flats aquifer (DWAF, 2007). This aquifer is geographically close to the majority of the city's informal settlements and is already serving an important role in local food security, which can potentially be undermined without careful planning and consultation processes in place (Luker & Harris, 2018). This and many other emerging points of tension lead to the concern that building "water resilience" might be captured under discourses of risk and disaster, further side-lining more inclusive politics. Finally, Cape Town has a long history of mistrust and divisive politics that have gravely shaped the waterscape of the city—including lived experiences with water. One key overarching lesson from Cape Town's experience is that in the time of crisis, the lack of trust and cooperation between levels of government, and between government and citizens can produce significant delays in action. This case lends support to often lofty and poorly substantiated messages in the environmental governance literature that argue for inclusive and collaborative governance as key to resilience.

ACKNOWLEDGMENTS

This research benefited from valuable feedback from the EDGES research collaborative, the Program on Water Governance, and the African Climate and Development Institute at the University of Cape Town. I am grateful to the editors and reviewers for their insightful comments. A related opinion piece, co-authored with Dr. Kieran Findlater, was published in *The Conversation* on July 12, 2018. This Opinion draws on research made possible by funding from the Social Science and Humanities Research Council of Canada, as well as the University of British Columbia (Peter Wall Institute for Advanced Studies and Liu Institute for Global issues).

CONFLICT OF INTEREST

The author has declared no conflicts of interest for this article.

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How to cite this article: Rodina L. Water resilience lessons from Cape Town's water crisis. *WIREs Water*. 2019; e1376. https://doi.org/10.1002/wat2.1376