LEARNING FROM CRISIS

A series of modular learnings from the 2017-2018 Cape Town water crisis

THE RESILIENCE SHIFT

THE CAPE TOWN DROUGHT RESPONSE LEARNING INITIATIVE

module 7

You can't build yourself out of a drought

During the crisis the city government developed a large-scale emergency augmentation plan to bring additional water sources on line. This turned out to be unfeasible. Demand management was its only option.

Text component of module 7, accompanying the film www.vimeo.com/cinesouth/ctdrli-trs-lfc-module-7

Duration: 23:03

You can't build yourself out of a drought

In mid-2017, in response to the water crisis and driven by the potentially catastrophic consequences for the city of a no-rain scenario, the Cape Town city government conceived a large-scale emergency water supply augmentation plan to build around 500 megalitres a day of new capacity, through desalination, re-use and groundwater. It quickly became clear that this was unfeasible and unrealistic as a solution to the crisis, due to limitations of cost, impact on tariffs in subsequent years, time, procurement capacity, environmental regulation, and professional staffing requirements for implementation. The grand plan was abandoned in favour of three small temporary desalination plants that had no impact on staving off Day Zero: they came on line only after the crisis period when the rainy season had already started, producing insignificant amounts of water, at eight times the cost of surface water. In the end, reduction in demand was the only way to get out of the predicament: restrictions were ramped up dramatically and aggressive pressure management measures were implemented.

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The City developed a plan to build itself out of the drought

Dr Rolfe Eberhard

The timeframes were impossible; the costs were horrendous

Alderman Ian Neilson

There was a very tangible experience by the City that it was not possible to build itself out of the drought

Dr Rolfe Eberhard

Try not to fall into the temptation of believing you can build yourself out of a drought

Barry Wood

EXECUTIVE SUMMARY

- In mid-2017 the Cape Town city government conceived a large-scale augmentation plan in response to the water crisis; the plan was for a build programme to augment the city's water supply capacity by around 500 megalitres a day, through desalination, re-use and groundwater

- This was to be accompanied by steps to drive down the city's demand to 500 megalitres a day, from more than 600 megalitres a day at the time

- The plan was motivated by contemplation of the catastrophic consequences for Cape Town of the no-rain scenario, and the fact that the city was not able to source water from elsewhere

- Furthermore, the city was reliant on the national Department of Water and Sanitation as the bulk supplier of water, as well as on the department's willingness and ability to use its powers to curtail agricultural drawdowns from the dams once agriculture had reached its quota for the year; the city could not assume that the department would curtail agriculture in the summer of 2017/2018 as it had not done so in previous years

- Building 500 megalitres of additional supply capacity turned out to be unfeasible and unrealistic as a solution to the crisis, due to limitations of cost, impact on tariffs in subsequent years, time, procurement capacity, environmental regulation, and professional staffing requirements for implementation

- Cape Town's existing supply capacity is between one billion and one and a half billion litres of water a day, put in place over a two hundred year period; it was just not realistic to think that between a third and a half of that capacity could be replicated within a year

- The experience with desalination was that it turned out to take longer and be more expensive than you expect, particularly temporary desalination plants

- The experience with groundwater in this case was that where water quality was good, volumes were low, and where volumes were high, quality was poor

- The grand plan was abandoned in favour of three small temporary desalination plants that came on line only after the crisis period when the rainy season had already started, producing insignificant amounts of water, at eight times the cost of surface water; these had no impact on staving off Day Zero

- In the end, reduction in demand was the only way to get out of the predicament: dramatically ramped-up restrictions, and aggressive pressure management

Interviewees in order of appearance:

Dr Rolfe Eberhard
Independent public policy advisor

Alderman Ian Neilson
Deputy Mayor: City of Cape Town

Barry Wood
Manager: Bulk Water, City of Cape Town

Craig Kesson
Chief Resilience Officer: City of Cape Town

Claire Pengelly
Water programme manager: GreenCape

Mike Mulcahy
CEO: GreenCape

Dr Piotr Wolski
Research Associate: Climate System Analysis Group, University of Cape Town

Full interviews on Cape Town Drought Response Learning Initiative website

STRUCTURE

00:00:05 Hooks:

- The City developed a plan to build itself out of the drought (RE)
- The timeframes were impossible; the costs were horrendous (IN)
- Very tangible experience by the City that it was not possible to build itself out of the drought (RE)
- Try not to fall into the temptation of believing you can build yourself out of a drought (BW)

00:00:55 **THE 500 / 500 PLAN**

- In 2017, plan accepted by city government to reduce demand to 500 megalitres a day (from more than 600) and build additional supply of 500 megalitres a day from a combination of desalination, re-use and groundwater (CK)
- Driven by: catastrophic consequences for Cape Town of a no-rain scenario, combined with inability to source water from elsewhere (CK); citizen pressure on leadership to be seen to be doing something (BW); lack of trust by the city government in the national Department of Water and Sanitation's capability of supplying water into the system, but specifically its willingness or ability to curtail agricultural drawdowns from the dams, as these had not been curtailed in previous years (CP, MM)

00:08:08 **THE PLAN MUGGED BY REALITY**

- Building 500 megalitres of additional supply capacity turned out to be unfeasible and unrealistic as a solution to the crisis, due to limitations of cost, impact on tariffs in subsequent years, time, procurement capacity, environmental regulation, professional staffing requirements for implementation (CP, IN, PW, CK, BW)
- Experience with desalination turned out to be that it takes longer and is more expensive than you expect, particularly if it's temporary; experience with groundwater in Cape Town turned out to be that where water quality was good, volumes were low, and where volumes were high, quality was poor (MM)
- Grand plan abandoned in favour of three small temporary desalination plants that came on line only after the crisis period when the rainy season had already started, producing insignificant amounts of water, at eight times the cost of surface water (PW, RE)

00:18:16 **THE FALLBACK ON DEMAND MANAGEMENT**

- In the end, demand management turned out to be the only option: extraordinary restrictions + pressure management (PW, CK, RE, BW)

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00:00:55 "We put to the political leadership which had asked us to evaluate the crisis: what happens if it doesn't rain? It was a very simple question. We asked senior officials and senior political leaders: if it doesn't rain, what happens to the City's approach? Is it possible to get water from elsewhere? Is it possible to augment the supply with existing schemes? And the answer was No. At that time, in middle 2017, around May or June, the dams were at a very low level; they'd dropped below 20% percent in Cape Town, which globally would spark, long before that, an emergency response, and as the winter months progressed in Cape Town the rain was not coming, and every week that went by the dams would drop further and further, and so the parameter of if the rains don't fall became the major feature of the planning. Of course there were analyses and rejoinders of, what if the rains do fall, or some of them, which would later become a feature in our risk planning and our adapted approach to augment supply, but for the outer frame of reference, it was a question of: if there's no rain, Cape Town's finished."

"Based on a series of conversations and some data analysis that we did during the week of scenario planning, we came up with the rough figure of approximately 500 megalitres a day, which would become the City's lodestar in the year to come. And essentially we said, well, if 500 megalitres of water a day is required, how much are we using a day, how much have we been historically using a day, and how much do we possibly supply, or could we supply? So it was a very simple way of understanding the complexity of how do you balance two sides of an equation. And that led to a presentation to decision makers to say, ultimately, what we want to secure is 500 megalitres a day, that is via managing demand and hopefully managing supply."

"The plan that was accepted, based on the different options we gave to the leadership, in the first instance was augment the supply by 500 megalitres, in some way, and reduce demand to 500 megalitres. We had risk assessments of how likely we thought that was, but we were essentially reverse-engineering from a scenario of this is what would be needed in order to survive."

00:04:15 "When you talk about more and more severe restrictions, often in the eyes of the public that is deemed to be a failure. I mean: why are you cutting back on our water supply? You've clearly as the local authority not perhaps planned correctly for this. People put aside the drought, they're not thinking of that. So politically it's also quite difficult to give assurance to your constituents that by saving water we're not going to run out, we're going to protect the economy of our city, and that we haven't failed. So, you know, during these times of crisis there's obviously a lot of pressure to do more, and one of the first things that's talked about is, well, let's try and build something. People do that in their houses, you know, I'll install a rainwater tank and harvest rainwater from my roof."

00:05:13 "The city of Cape Town is not the only user of the dams that we rely on. So agriculture is also a significant user; they utilise about a third of the water annually that comes out of the dams but all of that water is used during summer, when we really really need it. And in previous years the national Department of Water and Sanitation, which is responsible for managing the entire system, did not ensure that agriculture was reduced in terms of their allocations despite the fact that the city had been adhering to the restriction levels. So there was a concern that as we were leaving winter, towards mid to late 2017, and we could see that the dam levels were not recovering at the rate that they should, and that in fact we were at a real danger of running out of water during the course of that summer, that there was a risk that agriculture would not be curtailed to the extent that was expected, that the City decided there had to be a way of augmenting and supplementing the existing supply with new supply."

00:06:23 "The result of a lack of trust in the regulator, the Department of Water and Sanitation, meant that the City started to take on more responsibility than is typically required of cities. It is the Department of Water and Sanitation's legal obligation to provide water into the system, whether that water is done through desal, or re-use, or through dams, through ground or surface water, it is the Department of Water and Sanitation's responsibility to provide that. The lack of trust that the City had in the regulator and in the Department of Water and Sanitation's ability to provide that water into the system meant that the City decided that their own augmentation strategy needed to compensate for that, which is why they came up with this number of 500 million litres per day, that the City wanted to begin to investigate and invest in to be able to be comfortable that if it didn't rain again the citizens would be safe and have enough water, and that if the Department of Water and Sanitation didn't provide any further inputs that the City themselves could take responsibility to provide that water."

00:07:38 "The City developed a plan to build itself out of the drought. This plan was to build 500 million litres per day of capacity over a very short period, six months, on the assumption that that capacity could be provided and would be sufficient to meet reduced needs of the city. This capacity was going to come from desalination, temporary desalination, some groundwater, and re-use, also temporary re-use."

00:08:08 "An RFI, or request for information, was sent out in June 2017, and this was really asking for solutions, so, we're facing what could be a very serious water crisis, at that stage the full scale of it hadn't been really understood or quantified, how could you help us solve this? What could you do to help us? And there were dozens of solutions that were, in fact I think there were over a hundred solutions that were put on the table and proposed to the City. On that basis they went out for an actual RFP or for tender to actually see what the price points of those solutions would be, how fast they could be delivered on, etcetera. And I think it was at that stage, once the actual tender responses started coming in, that it was

really starting to be understood that in terms of the cost of this augmentation, it was going to be by far the largest procurement programme any South African entity had ever done, and the speed with which it could be implemented would, even at the fastest rate that the City was able to push through, that in terms of the technical and technological restrictions on it, that it still would be too little too late, that actually it wasn't going to save us from the crisis."

00:09:26 "A risk analysis was conducted and we went backwards and forwards on that, and eventually we came up with a scenario where we would get the consumption down to around 500 megalitres a day, and we would build alternative water supplies that would supply 500 megalitres a day. So that was great in theory. But I think as that progressed further during 2017, timeframes were set by which we would have to have these in place, I think it became increasingly understood that this was an unrealistic programme. That the timeframes were impossible for providing those additional supplies, the costs were horrendous, the projections that were shown on what we would have to increase water tariffs by in subsequent years 200% and more, you know, these just showed that this was to some extent an impossible dream. It was just not realistic to believe that a water supply system that had been built over decades, using the least cost method, could suddenly be replicated within a year. It was just not realisable."

00:11:01 "And one has to put that in perspective. That augmentation plan was to provide 500 million litres of water per day within the next nine months, essentially until the rainy season of 2018, and, you know, if we take that value and compare it with the water supply capacity of the current system, which is above one billion litres of water a day, so it's roughly one and a half billion litres of water per day, that augmentation plan was for one third, perhaps half of the current water supply capacity. And we have to realise that they wanted to build in nine months … considerable part of something that was created within two hundred years, because that's how long it took to bring the Cape Town water supply system to the stage where we are now. So that wasn't particularly realistic, and it was realised pretty soon afterwards that, you know, that it's not going to happen, for many different reasons, partly financial, partly bureaucratic and administrative, and it wasn't happening."

00:12:19 "I think from a professional perspective where the Water Resilience Task Team changed in its approach between June and August / September of 2017 is that once we had recalibrated the costs and the operational and project realities of delivering a 500 megalitre augmentation programme, our professional assessment was that it would be almost impossible to do, and certainly within the timeframes that we were given. And that if you wanted to pursue it, even if you could find additions to the budget, the real problem was capacity. And my biggest concern was getting things through the procurement system, which would have to be reprioritised to accommodate the tremendous burdens that we would be

asking of it in order to do 500 megalitres of augmentation, as well as the actual professional people to deliver such a programme."

00:13:26 "There's a lot of things that go with build programmes, like getting through environmental regulations, the actual infrastructure planning itself, procuring the services of professional service providers, contractors, etcetera. So while you can fast-track it, and the City did really well at pulling down those kind of timeframes, the reality is that it's, practically, it is hard to build quickly, it is difficult and it's almost impossible to bring big quantities of additional water on quickly. If you look back in terms of our consumption at the beginning of 2018, around January 2018 to February of 2018, the city dropped its consumption dramatically – it was around 70 megalitres a day over that time period. You cannot – that was within about two to three months – you cannot build a new plant or a new resource to supply you 70 megalitres a day in three months. It will take you three years."

00:14:32 "The City spent six months in very detailed planning for this programme, with a huge focus on augmentation. It turned out that the augmentation was extremely expensive and could not be delivered in time to make any meaningful impact on the dams during the summer of 2017/2018. In particular the temporary desalination plants were very very expensive, and would not in any way assist in building resilience into the future because they were temporary."

00:15:05 "So after the grand plan of 500 million litres per day, it was realised that that plan was maybe overly ambitious. The City began to build a range of smaller augmentation projects and programmes, and today we're left with three small temporary desal projects that are on line and producing water, a range of aquifer projects that are on line and producing water. The lessons that were learned during that procurement were extremely interesting. The big ones around desal were it takes longer and is a bit more expensive than you think, particularly if you're signing short-term contracts. The lessons around groundwater in the Cape Town case specifically was that where they had higher volumes of water the quality was fairly poor, and where they had high quality of water the volumes were very low. So there's a range of wells that have been sunk, and groundwater will remain part of the City's strategy, but effectively the response from the private sector and the communication about how easy and how fast augmentation could come online was tested and was effectively found to be inaccurate – that it takes longer, is more costly, and in some cases there's less yield than was anticipated."

"In reflection of the 500 million litres per day strategy we realised that it would be several years faster than any of the existing large-scale desal projects to be able to have large-scale desalination on line with those sorts of timeframes."

00:16:51 "You know, in the beginning a couple of initiatives, a couple of augmentation schemes were hailed as a significant achievement. But if we think about a thing

like a small desalination plant that provides 5 million litres of water per day, what it does to the Day Zero, to the day we hit the ten percent of water storage in the dams, it shifts it by minutes, virtually minutes ahead – it's not substantial in any way."

00:17:29 "These capacities are tiny, and the contribution that these plants made to dam levels by the winter of 2018 were absolutely insignificant."

"The relative cost of temporary desalination compared to the surface water scheme – so the temporary desalination would cost about R43 a cubic metre, the surface water schemes on average, including treatment, costs about R5 per cubic metre, so it's a factor of 8 between the two."

"The first water from the temporary desalination plants came on line in June 2018, some eight months after initiation of contracting, which was relatively fast, but clearly not in time to make any difference to the threat of Day Zero during the summer of 2017/2018."

00:18:16 "So after that couple of realisations it came to the situation where we realised that really the only solution to avoid running out of water is to do the demand management and to implement very strong restrictions in the amount of water that people are allowed to use."

00:18:40 "I knew that if we said, well 650 would be OK, that we would still hover above that point. So to get it down realistically to close to 500 megalitres or even just below 600 megalitres we had to ruthlessly push the 500 megalitre figure every single day. And so that was when, in around August 2017, through the task team, we decided to explore more aggressive pressure management interventions, to reduce demand, and to begin modelling those and to understand how they worked, because we would need a change not only in consumer behaviour, which had already been driven for the previous decade, but a change in actually managing how much is going through the system."

00:19:32 "There was a very tangible experience by the City that it was not possible to build itself out of the drought, that once the drought hit, its only real, realistic option was to manage demand to get through the drought. I think the implication of that, or the extended learning from that, is that the City needs to ensure that it has infrastructure in place before it is needed, rather than waiting until it is too late. When low rainfall comes, it is too late to invest in building new infrastructure, because building substantial new infrastructure takes years in planning and construction and implementation, and the only way you can get through a drought is through managing demand."

00:20:19 "My advice to water managers in similar situations is: look to optimising your system, and don't be scared to ask people to use less water. It's always possible to reduce your water use. Try not to fall into the temptation of believing you can build yourself out of a drought. The problem is you don't know how long the drought might be in play for, and also you might find yourself building something that when normality returns is then shelved. You know, there have been other cities in the world where you start a build programme, but you commission it and then it starts to rain."

00:21:01 "Before the leadership met to consider the range of data and scenarios that were put in front of them, including from myself, there were water restrictions in the bylaw only to a certain point. They would later be developed, a greater degree of restriction, I think we developed another three or four levels of them, but they didn't exist before that point, which meant that the level of demand reduction that we were motivating for from a resilience perspective had not been contemplated before. So considering those data points and remember the data point of, if we've got Day Zero over here, and we are trying to balance the equation of 500 supply / 500 demand, but we don't have the mechanisms to match the requirements of such demand reduction, we had to build them into the system – literally, we had to legislate for them. We had to create teams that would go out and physically do the pressure management on the ground in ways that defied their own expectations, and that's what pulled us through. And, of course, the people of Cape Town themselves, without whom the government would not have been able to manage this crisis."

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