

Fostering water resilience in Cape Town: Groundwater and domestic water use

In 2023, the Water Stressed Cities project team interviewed 14 people whose work relates to groundwater in Cape Town and reviewed relevant reports, websites and news articles to develop an understanding of the context in which households are using groundwater. Here is what we found, together with a set of emerging propositions about building urban water resilience through co-governance that are to be discussed with stakeholders.

In the past decade, groundwater has become an increasingly important supplement to traditional surface water supplies for the city of Cape Town, both for the City authority and for some private users. Groundwater can provide an important buffer at times of scarcity, but the complexity of Cape Town's hydrogeology and different uses raises novel questions for aquifer governance.

Groundwater from springs was a main water source for indigenous people and early European settlers until the late 1880s, after which surface water schemes dominated and almost all households used municipal supplies, with varying levels of access. Groundwater was brought back into the public water supply mix after exploration of the Atlantis and Cape Flats Aquifers in 1970s and 80s and the subsequent construction of the Atlantis Managed Aquifer Recharge (MAR) and supply schemes. Exploration of the Table Mountain Group Aquifer for bulk supplies began in the early 2000s. Droughts have periodically renewed interest in local groundwater, for private and government actors alike, but the 2015–2018 'Day Zero' crisis seems to have marked a step-change. This places new demands on technical management and coordinated decision-making.

Considerable growth and changes in Cape Town's groundwater 'sector' or operating space are evident over the last decade, enabled by strong local expertise, international collaborations and multiple efforts to promote coordination. However, capacity constraints, fragmentation of efforts and piecemeal information remains a problem. Licensing, registration and usage rules in place are not consistently exercised. Public awareness about groundwater, from geohydrology and sustainability to processes and rules, is low and mistrust in government is a hindrance to integrated, adaptive management. Weak connections between land use management and water management mechanisms put groundwater at risk of contamination and over-exploitation if not addressed. This raises new questions of governance and of the role of groundwater in the resilience of Cape Town.

PROPOSITIONS FOR ENHANCING GROUNDWATER SYSTEMS

Propositions for enhancing groundwater systems to strengthen Cape Town's resilience to water stress that have emerged through the research, include:

1. **training for CCT councillors** on CPT groundwater resources, uses, protection measures to build capacity for effectively engaging with the public on these matters;
2. activating public spaces, like planned aquifer park and education centre and historical groundwater sites like springs, for **annual public events celebrating local groundwater systems** to build awareness, understanding and relations;
3. **co-design and test incentives for compliance** with existing groundwater rules when not in crisis-mode, i.e. registering, monitoring, reporting;
4. **data sharing agreements and mechanisms** to feed into a shared database and publicly accessible portal, facilitated through public-private-civic partnership platforms;
5. consolidate and extend **research into long-term trends in recharge rates**;
6. **establish a local business forum for groundwater service providers**, including drillers, to engage with relevant authorities over operating conditions and requirements, as well as updates on the state/health of the groundwater system;
7. **resourcing joint / independent groundwater inspectors** or monitors recognised by the public;
8. **aligning water sensitive urban design and groundwater protection objectives** to strongly inform the review of applications for land use rezoning, property development, as well as event and activity permits.

GROUNDWATER RESILIENCE CONTRIBUTING TO URBAN RESILIENCE

Fostering Cape Town's groundwater **resilience requires balancing** the resilience of local aquifers and their catchments with the resilience of the city or urban system, the local government as an organisation, government facilities (like public hospitals), and the resilience of households and businesses. Resilience is to:

- **Persist and recover** in the face of stresses and disturbances ("bounce back" to status quo after a crisis or disaster), and to
- **Adapt and transform** to be better suited to changing conditions ("bounce forward" to something new that is better suited to emerging conditions).

Most stakeholders interviewed felt the 'Day Zero' experience has marked a significant inflection point or step-change in Cape Town's water system, or hydro-social system.

Resilience is about being able to respond in a crisis, so we have a disaster what do we do, but it is also about that longer-term setting up the systems, that planning work etc. I think the Water Dept. is still in crisis mode, it's still very much about the augmentation plans, it's about ensuring water resilience from the perspective of supply rather than as a system and I suppose maybe it's that maturity journey. (interviewee I, April 2023)

Building water resilience is the primary goal of the City of Cape Town's Water Strategy, shaped by the experience of the 'Day Zero' crisis. Groundwater, and building groundwater resilience, forms part of strengthening water resilience within the wider region, managing all forms of water in an integrated manner, diversifying supplies, managing demands, enhancing the storage, transport and reticulation of water, and enhancing the health of ecosystems that regulate water flows. As a designated Ramsar City, Cape Town has received formal recognition for having wetlands of international importance, adding further incentive to rehabilitate and protect the interconnected surface- and ground-water systems that these wetlands are part of.

A couple of months ago, just when we'd got it sorted out, the City of Cape Town said, we're cutting off the water supply to the Khayelitsha area because of maintenance things, and you're going to be three days without water. Excuse me, what about our hospitals? What are we going to do? But at that one, we had groundwater. So we went through a little mini, mini Day Zero and then groundwater saved the day. (interviewee G, March 2023)

In the domestic context, interviews suggest use is mainly for outdoor, non-potable uses, especially in the summer months. Most interviewees (18/32) did not know how much groundwater they use. Of those that did offer an estimation of their usage, the highest was 5000L per day in the summer, dropping to about 500L/day in winter. These volumes are small compared with the daily abstraction volumes by the City of Cape Town for municipal supplies and by large commercial groundwater users but start to add up as the number of domestic groundwater users grows.

To develop an aggregate picture for integrated, adaptive management purposes, it is necessary to differentiate which aquifers are being drawn from, at which times of year, and their associated recharge rates under various climate and land use conditions, both historically observed and future projected through model simulations.

Local and provincial government, Cape Town businesses and households are increasingly using water from four aquifers:

1. the largely unconfined primary **Cape Flats Aquifer** (multi-layered and semi-confined in parts);
2. the fractured rock **Table Mountain Group Aquifer**, a regional aquifer system (including the Nardouw and Peninsula Aquifers);
3. the sandy, unconfined, primary **Atlantis-Silverstream Aquifer**;
4. and the fractured basement rock **Malmesbury Group Aquifer** that underlies both the Cape Flats and Atlantis aquifers, extending well beyond Cape Town's municipal boundaries.

Disturbances to Cape Town's groundwater systems, requiring resilience, include:

- Inter-annual rainfall variability, including periodic multi-year droughts;
- Increasing pollutant loads from urban and agricultural activities (including sewer leaks);
- Increasing abstractions (partially unregulated and unmonitored);
- Decadal shifts in rainfall and temperature (a drying and warming trend);
- Rising sea levels around Cape Town's coastline.



GROUNDWATER GOVERNANCE ARRANGEMENTS

There has been gradual shift in governance arrangements from unregulated, distributed, localised supplies until the late 1800s, through a century of centralised water supply, largely reliant on surface-water dams and transfer schemes, to an **increasingly decentralised and diversified mix of public and private supplies**. This shift has coincided with increasing democratisation of decision-making in South Africa and various efforts at more consultative and participatory mechanisms to conjunctively and equitably manage water resources. This has seen **Cape Town's groundwater governance space becoming increasingly crowded**, with various public, private and civic organisations stepping in, working but struggling to overcome fragmentation of information, mandates, functions and efforts, with complex and deep-rooted power dynamics and economic logics at play.

The cross-subsidization based on income from 'luxury' water use is less the case now because total water consumption has come down, so there is less in those very top brackets. If you look at the tariffs now there is still very much a progressive step tariff, and there always was... the ability to cross-subsidize to provide for free for a large portion of the population and fund all the things... from the operational to the capital, that is still being quite compromised. And there have been backlashes. There was a big backlash straight after the drought when the fixed monthly came in. Funding is still quite constrained now. (interviewee M, October 2023)

During the drought, when the tariffs went sky high, I think a lot of property owners got caught unaware. A lot of the very wealthy suburbs with large gardens suddenly realised that previously they were getting water bills of almost insignificant for those kind of income levels and then all of a sudden, they'd be getting bills of 18,000 or 20-something thousand. And then as soon as they were getting those kinds of bills, it would make economic sense to rather put that money into a borehole. (interviewee M, October 2023)

Departments and branches of the City of Cape Town, the Western Cape Provincial Government and the national Department of Water and Sanitation have all been grappling with delivering on their service delivery and regulatory mandates and cooperative governance requirements pertaining to groundwater, within **considerable resource and capacity constraints**. International financial and technical support for groundwater-related activities has been provided by the French Development Agency and the Danish Embassy, as well as private companies, like ABInBev.

Extensive groundwater-related **technical expertise exists in local consultancies** servicing government entities and the private sector, including households. Intermediary organisations, like GreenCape and the Western Cape Economic Development Partnership (EDP), have been adding value in the groundwater governance space by **brokering engagements and transferring information**. As have non-governmental and civic organisations, like WWF, the Green Anglicans, GreenPop, the PHA Campaign and the Umvoto Foundation, who have been active on groundwater issues in various local communities across Cape Town. Scientific expertise across local universities have been providing knowledge and training that supports the growth of the groundwater sector in Cape Town and raising sustainability and resilience concerns.

Various forums established over the last decade, including the Table Mountain Strategic Water Source Area Partnership, Greater Cape Town Water Fund, Western Cape Water Supply System User Forum and the two Aquifer Monitoring Committees set up to oversee monitoring of the City of Cape Town's wellfields, are fostering information sharing and opportunities to collaborate, but are still struggling to overcome divergent interests and functions.

So we are having a lot of money in treating through five different treatment plants, CFA water and then an even more expensive aquifer recharge scheme where we are treating Cape Flats wastewater treatment effluent to pretty much potable standards and injecting that back into the aquifer. Now, that very expensive water - which is pretty close to the cost of desal - to be using that source, you know, kilometres away from... Constantia gardens, taking that water free out of the aquifer, without any monitoring, is not a situation I can see sustaining over time. So I think we're just at the beginning of a realisation that groundwater management, especially of the Cape Flats Aquifer, is actually a pretty central policy issue for the city and for our long term water supply. (interviewee K, June 2023)



CHALLENGES TO ADAPTIVE, COLLABORATIVE GROUNDWATER GOVERNANCE

1. **Intermittent funding streams** undermine the continuity of partnership efforts.
2. Use of alternative water sources impacting **municipal tariff models** for water and sewage.
3. **Backlogs and long delays** in processing water use authorisations and borehole registrations undermining trust in the regulatory system.
4. Patchy reporting of abstraction volumes by private users and **poor data integration, management and sharing** of usage and monitoring data.
5. **Fragmented knowledge base** (across organisations and disciplines), including proprietary numerical models of groundwater systems held by different consultancies, and limited translation of technical knowledge for public understanding.
6. **Illegal dumping and land use activities** posing a risk to groundwater quality, with minimal compliance checking and enforcement capacities.
7. **Theft, vandalism and illicit use** of infrastructure and equipment increasing costs.
8. **Capacity constraints in DWS and CCT**, as well as grey zones in overlapping mandates, make cooperation difficult and slow.
9. **Pressure to promote business activities and urban property development** to provide more jobs and houses often overrides ecological conservation and water sustainability objectives.

“My worry is that... if we push everyone into groundwater, then who's actually going to pay for the infrastructure? We'll have to put up the tariffs, more people will go offline. You risk that thing, and then the cross subsidisation gets harder. (interviewee L, July 2023)”

“The other key point... is on providing information about... the health of the aquifers. The more that we can provide that sort of information to people who are using the aquifers, the more responsibly I think they would use it. But... individuals will do what suits individuals. So, if they can get away with it, and they really need a green lawn when everyone else around them doesn't have one, then they will do it... Awareness raising is going to be more effective than regulations. The stronger the regulations, the more people will find loopholes around it. And... we can't just continue beefing up enforcement. We need to rely on people making decisions in their own spaces. (interviewee N, November 2023)”

OPPORTUNITIES FOR MORE ADAPTIVE, COLLABORATIVE GROUNDWATER GOVERNANCE

1. Local groundwater **technical and scientific expertise** and international support are available.
2. **More groundwater data is being collected** and historical data exists in places.
3. **Considerable experience** exists of installing local groundwater systems and practical lessons have been learnt, some of which have been well documented.
4. **Numerous collaborative and engagement platforms now exist** to be further strengthened and exercised, including the Aquifer Monitoring Committees, the Table Mountain Strategic Water Source Partnership, the Western Cape Water Supply System User Forum; and the Greater Cape Town Water Fund.
5. **Borehole and wellpoint registration processes are in place** that can be further activated.
6. Groundwater protection zones for the City's public wellfields have been delineated and integrated into **spatial planning tools**.
7. **Public awareness campaigns** and materials have been developed and could be scaled up, linking art, education, stewardship, skills development and work creation opportunities.
8. The **Ramsar City status** and the Mayor's Advisory Committee on Water Quality in Wetlands and Waterways provides impetus to link groundwater and surface water sustainability concerns with political will.
9. Plans to establish an **Aquifer Park linked to the CFA scheme** to provide an opportunity for enhancing awareness, education and engagement around local groundwater issues.
10. **Conditions and requirements of Water Use Licences and Water Service Intermediary contracts** could be aligned and reporting streamlined to make resulting data available for regular analysis.

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