Report on management of water on UCT campus

Report to Council (October 2018)

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1. INTRODUCTION

In April 2017 the Vice-Chancellor's Management Advisory Forum raised the need for the university to respond to an increasing possibility that Cape Town could run out of water in 2018. At the time, the City of Cape Town (CoCT) appeared to be ill-prepared to deal with the pending crisis. Following the Advisory Forum, DVC Professor Ferris was tasked with establishing a UCT Water Task Team (WTT) with a request to address three questions. These were put to the newly-formed Task Team at its inaugural meeting (25 May 2017):

- What can UCT do to immediately conserve water and contribute to the City of Cape Town's strategy of conserving water?
- How do we start looking at crisis scenarios?
- How can UCT look at long-term sustainability of water security?

A small group of UCT volunteers met at the inaugural meeting which was represented by academics, researchers, and Properties and Services personnel. The immediate task for the WTT was to ensure that UCT complied with the CoCT's new water restrictions to be imposed on 1 June 2017. Subsequently, ongoing restrictions culminated in the highest level ever, Level 6B, which restricted users to a daily limit per capita of 50 litres.

At the WTT inaugural meeting it was noted that there was a degree of uncertainty and confusion about how the CoCT intended to manage the water crisis and potential prospects for intended augmentation projects. In addition, at the time comprehensive plans for managing the crisis were not forthcoming from the national Department of Water and Sanitation and the Western Cape provincial

government. In all this confusion, it was simply expected that Higher Education institutions would be able to adjust and adapt to uncertainty, and to do with limited support. By January 2018 the potential for Cape Town to move to a Day Zero scenario shifted from possibility to a probably (following an announcement by Mayor Patricia de Lille on 18 January 2018). UCT is highly dependent on municipal water for its operations, but there were no arrangements in place to enable UCT to continue if Day Zero had become a reality.
At the peak of the crisis, the Water Task Team met each month from July to November 2017, and then quarterly in 2018. The Task Team increased its membership since the inaugural meeting, with the notable inclusion of student representatives from residences, the Green Campus Initiative, and academics from all faculties.

2. AIMS AND OBJECTIVES OF THE TASK TEAM

The WTT formed on the premise that it would act as an advisory team and, where possible, would assist with communications, generation of knowledge and information, support to Properties and Services, and in enabling UCT to develop a long-term vision for its water security and sustainability.
UCT's Executive recognised the need for developing a broad range of strategies to build a resilient and sustainable approach to manage its long-term water scarcity, along with the likelihood that the Western Cape region would become more drought-prone, and the cost of water and water services become increasingly expensive.

The intention for the WTT was to assist in providing a comprehensive strategy for managing water for the immediate period during the crisis, as well as a long-term plan. The plan, aligned to a realistic budget, should aim to:

1. Provide clear, realistic and attainable goals for improving water management on all the campuses, and a roadmap for getting there.
2. Provide a clear understanding of water resource services and usage on all the campuses, including the identification of risks and opportunities.
3. Define the Capex and Opex requirements of each project/programme.
4. Define the benefits of each project/programme.
5. Prioritise project/programme implementation and align these interventions with the anticipated CoCT water management programme.
6. Allocate roles and responsibilities for each project/programme and understanding of capacities of roleplayers within the various management divisions.
7. Establish a review/oversight mechanism to monitor the implementation of water strategies, and measures to report on how each objective is met.

The seven-point plan remains open-ended. It requires an adjustment to management structures at UCT. While the WTT can contribute towards the development of a high-level conceptual plan, most of these points require interventions, monitoring and financial support. Current structures are not in place to achieve these outcomes. It is hoped that the new appointment of a director for Environmental Sustainability will become an important catalyst for achieving a more water-secure campus, but also to link energy and waste into the overall sustainability programme for UCT. The capacity of the WTT

is limited to volunteers, but there is potential to draw from a much wider UCT community once the Directorship for Environmental Sustainability is in place.

The WTT developed an overarching strategy in carrying out its broad aim. The strategy was published in UCT News on the Water Crisis page, and in numerous presentations at the different campus, as well as among faculty and PASS staff (Figure 1).

The approach begins with voluntary appointment and agreement of water champions across all campuses. In all, approximately 42 people agreed to serve for a limited period. Their task was to receive and share information, and contribute news about UCT's efforts to conserve and manage water. The strategy made sense to many who participated in the exercise and some comfort was drawn from the fact that UCT had an approach. It was also argued that the work of water champions and commitment from the Executive Management improved the potential impact.
The approach also highlighted the importance of measurement, introducing the slogan "You can't manage what you don't measure". The call elevated UCT Properties and Services' need to better understand and improve its water measurement.
Finally, the approach from the WTT was to resist the temptation to invest in new water sources to augment municipal supplies. The reasoning was that interventions are costly and it would make little sense to add more complexity to the water system before improvements could be made to manage the existing municipal supply.

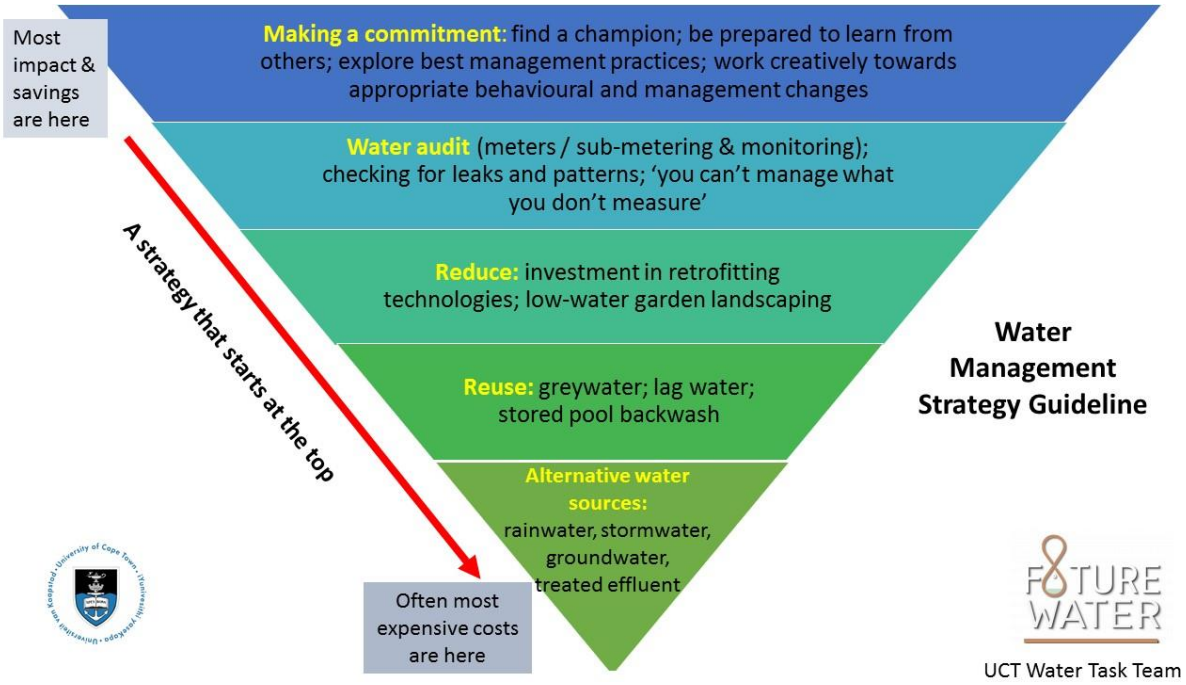

Figure 1: A strategy and approach to managing UCT's water security

3. THREAT OF DAY ZERO AND RISK TO UCT

UCT has a long history of introducing water management strategies, most especially from 1995 with

the advent of new technologies. Investments in water-saving devices have been ongoing and include installation of low-flow showerheads, dual-flushing toilet systems and urinal control devices into existing buildings on the campuses, including new buildings and student residences. Records of water use show a significant annual reduction of 501 465.40 Kℓ in 1996 to the 194 607.24 Kℓ in 2016 – of over 60%.

Day Zero a game changer

The Western Cape region is in its third year of one of the most severe droughts on record because of these three successive years of well below average winter rainfall since 2015. At the height of Cape Town's water crisis in April 2018, there was a steady decline in surface water storage volumes. At that stage, the city was heading for a disaster with less than 20% of water in the six main dams supplying Cape Town. The fear was real and it is not easy to forget the anxiety of the situation. With no significant rainfall and if planned interventions for augmentation were not forthcoming, it appeared as if the city was heading for failure.

Despite the crisis, the University of Cape Town continued to be one of the top water users in the city. Little had been done to raise awareness of water use on the campuses, although some efforts had started in the residences earlier in 2017. Properties and Services were unable to access the full account of water use as recorded by the CoCT each month and did not have much capacity to intervene. The difficulty of managing water across the campuses became apparent. Most UCT buildings are not sub-metered and could not be isolated from the bulk water system. Furthermore, the CoCT water by-law which requires an annual water audit of large water users does not appear to be exercised. If it did, then it could have helped P&S to stay more informed about water use and management. In addition, the Green Campus Action Plan (2009-10) suggests that little progress is being made to access information on the existing water reticulation system. In general, water monitoring remains tied to old analogue devices that are unable to provide feedback at a scale and timeframe that is helpful to users and building managers. A starting point for building a water sensitive campus is to improve the understanding of the water system and to monitor future progress.

The water crisis presents an opportunity. UCT has an opportunity to use the impetus to develop strategies and plans for improving its long-term water management and security. UCT will need to build on the momentum of the water crisis in order to become more innovative in the re-use of water, to demonstrate what can be achieved within its current operations and infrastructure, and implement plans that are deliberately aimed at enhancing the value and role of a water security and sustainability in a water-stressed region.

Current challenges

Since 1995, UCT has doubled its staff and student population to over 30 000. The threat of Day Zero was a wake-up call for the CoCT but also for UCT and its management. The thread has helped to identify a number of shortcomings at UCT that are ongoing challenges and require further attention. Some of the earliest challenges facing the WTT are listed below and discussed in more detail later in the report:

(a) **Validation of CoCT and UCT water meters**
There is some uncertainty in the CoCT's billing data and water meters. An up-to-date physical

map of UCT's water reticulation system and metering is required to compare the serial numbers with the CoCT's database and billing system.

(b) **City of Cape Town support**

Throughout 2017 the WTT felt the City was not giving UCT Executive Management sufficient support to manage the business risk. Plans and strategies in preparation for Day Zero were not forthcoming or, at the least, were evolving too slowly for UCT to plan for 2018. The threat of Day Zero posed a significant reputational risk to UCT as an institution of learning, and placed undue pressure on staff and students in dealing with uncertainty.

(c) Response from UCT Executive management

At a meeting of the VC Executive Management Advisory Forum, it was agreed that UCT required much more decisive efforts to deal with its water demand and improve its strategy. The Forum agreed to:

1. Offer stronger support from the Executive leadership at UCT.
2. Enhance the awareness and response from the UCT community as a whole.
3. A long-term business plan and investment in water management plans and strategies for UCT.
4. Need to adapt much faster in achieving a water-resilient, water-secure vision at UCT.
5. Need to strengthen the capacity to manage water better and build a stronger commitment to water conservation and saving.
6. Need to encourage research-led interventions and demonstration projects in water based-technologies, water studies, behavioural studies, etc.

In response, Executive Management helped to facilitate various structures that were essential to support the work of the WTT:

- Properties and Services drafted a risk management plan.
- A UCT Water Desk position was established to help drive the information and communications about UCT water campaign.
- Agreement to appoint consultants to develop a water management plan for UCT.
- UCT initiated discussion with the City and the Premier's office, in conjunction with other universities, to discuss how institutions could prepare for Day Zero, and to consider contingency plans.

4. SHORT-TERM ACHIEVEMENTS AND TASKS (PAST 12 MONTHS)

This section contains an account of some the work involving the WTT and observations of matters requiring further attention.

1. **UCT dam:** In February 2018 the estimated stored volume of the dam was less than 10% (total capacity of the dam 81 M/m^3). Observations of the stormwater drainage channels feeding the dam showed that the main channel had been damaged by erosion and obstructed by fallen trees and build-up of sediment. In addition, the area from Rhodes Memorial was overgrown with alien vegetation that obstructed surface flow to the dam. Gardening Service and Maintenance cleared the channels in August 2017 and a group of volunteer students responded to an invitation to clear and lay a temporary plastic sheet along the length of the main stormwater channel. Arrangements are temporary. A long-term

plan is necessary to manage the dam and maintain the infrastructure. Stored water in the dam is used to irrigate sportsfields and is a critical source of water for firefighting.

2. **Buckets for residences:** Glenn von Zeil (manager of Student Housing Division) and member of the WTT has requested support to purchase 2675 plastic buckets for residence students to capture shower water and to use this for flushing. Potentially, a 90-second shower of 30 litres could catch as much as 30% of the water in these buckets. This initiative, together with student involvement in the campaign in residences, has helped to reduce water use by 55% (compared to 2015 records).
3. **Groundwater use on Upper campus:** A borehole located next to the 'C' Rugby field was assessed in July 2017. The yields were disappointing. Subsequently, a geo-resistivity survey was conducted by a consulting company. Six alternate sites were recommended for further exploration. The WTT will provide quotes and will explore possible interventions and costs.
4. **Treated effluent:** The City has a treated effluent pipeline that extends from Athlone WWTW to the Rondebosch Common area. The CoCT informed the WTT that it will take some time before this pipeline will be available to the Upper Campus. P&S has been asked to apply to get access to this treated water for irrigation purposes.
5. **Risk Management Plan:** P&S drafted a health and safety Water Risk Plan which specifically addresses contingency plans and risk in the case of a Day Zero scenario.
6. **Awareness raising:** Initially the WTT coordinated the roll-out of an awareness campaign to all campuses and residences. A set of small "stickers" were printed and distributed together with banners that were installed in various parts of campuses. These efforts were never sufficient to create a strong message. The campaign improved significantly with the grant of R2million from UCT's Council. This enabled the Communications and Marketing Department to use a portion of the award to develop a coherent set of messages and a variety of posters and web-based information that resulted in "wall-to-wall' awareness that UCT was earnest in its campaign to address the water crisis.
7. **Installation of sub-metering digital water meters:** The remainder of the UCT Council grant of R2m was allocated to the installation real-time water measurements. In total, 65 meters were installed in residences and some campus buildings. The value of the exercise has yet to be realised, but a programme is being developed to build a competition between residences. The information from each digital water meter is comprehensive and accounts for costs, volume of use every 30 minutes, and a reporting dashboard that can be set up to report at

selected intervals.

Figure 2: Example of the dashboard display of water data captured by new digital water meters

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8. **Identification of water meters.** A student task team identified and mapped the City and UCT water meters and sub-meters on all campuses. The location of each meter has been captured on a GIS map (which now includes the UCT and the City reticulation and drainage systems). The students also produced a Google map showing the location, photographs and a description of the condition of each meter, including serial numbers, site and situation.

Figure 3: Verification of UCT's water reticulation system

Figure 4: A student team that assisted in verifying UCT's reticulation system and in identifying information about the condition of water meters at all campuses and residences

9. **Stormwater water harvesting - Kopano Residence:** A consulting engineering company installed a set of small tanks and a reticulation system to capture stormwater from the channel that passes alongside the Welgelegen residence. This water is fed into the underground dam next to the Kapano Residence and astro-soccer pitch, and will be used to supplement the irrigation of the cricket pitches (Figure 4).

Figure 4: Stormwater harvesting, Lower Campus

5. RESULTS

The Department of Water and Sanitation required the CoCT to reduce its overall water use by 45%. The CoCT had to impose Level 6b restrictions to meet this target. Similarly, UCT was requested to reduce its water use by 45% with reference to water use in 2015, but agreed to reduce by a further 5% because the use of potable water for outdoor purposes was minimal. The following list highlights some progress that UCT has made from the water-saving campaign based on our municipal records for January to July 2018, and comparing these results against 2015 water use for the same period. In summary:

- UCT residences achieved a 55% reduction resulting from the sustained efforts by students, residence house committees, water champions, wardens, management and staff who work in the residences. Properties and Services played a significant part in undertaking various interventions to control the demand, including the conversion of baths into showers, and in retrofitting toilet cisterns and installing aerators in basin taps.

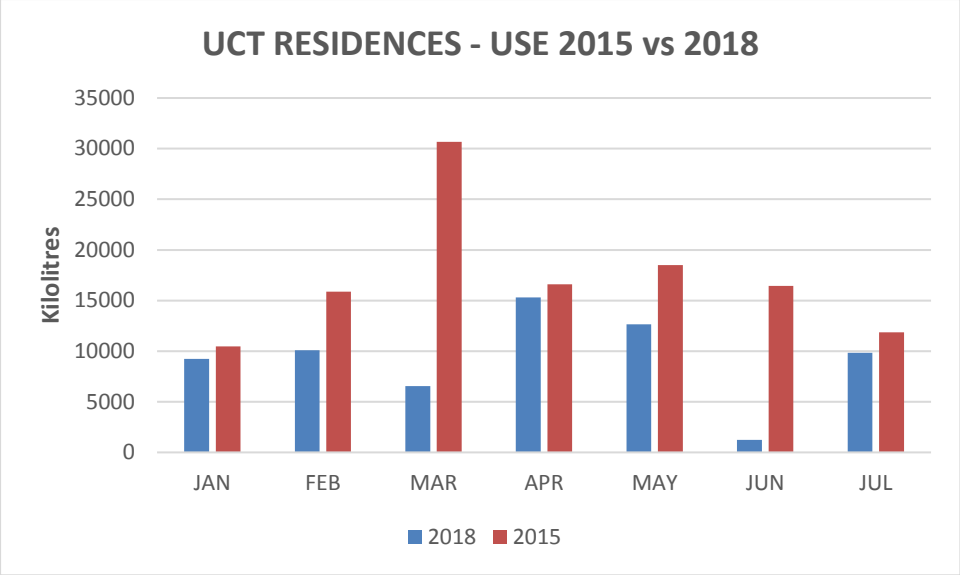

Figure 5: Comparison of water use in 2015 and 2018 for the period January to July

- The GSB campus achieved a 47% reduction with strong support from site managers, support from water champions, and a sustained awareness campaign.
- Results for other campuses, excluding GSB, are difficult to determine due to the increase in the number of new water meters that have been added to the system compared to 2015 records, or are now provided greater efficiency in accounting for water use. Despite the undercount in 2015, all campuses showed a total reduction of 11% in water usage.
- The cost of water has risen substantially as a result of restrictions under drought conditions. These costs will impact on UCT's operating budget. From January to July this year, UCT residences faced an increase of 43% (R3.4 million) compared to the same period in 2015, and an increase of 70% (R7 million) on all other campuses excluding the GSB with a slightly lower increase of 28% (R128 000).

It has been difficult to demonstrate the results because data supplied by the CoCT is often inconsistently reported and UCT has no verification system in place. It is hoped that this will change once P&S is more comfortable with the new digital monitoring system. However, the results suggest that real gains have been made in the students' residences, among others, in maintaining and strengthening the communications programme, and in providing regular feedback and information to managers and student leaders.

6. FINANCIALS

In August 2017, the WTT received an award of R350 000 from the Executive Management to achieve a selection of short-term aims and objectives.

Table of expenses August 2017 to September 2018

IMMEDIATE PRIORITIES		Cost
1	*Awareness raising*: Production costs of stickers and banners	R20 000
2	*Improving inflow channels to UCT Dam*: P&S arranged for clearing of stormwater channel entering UCT property (north western corner) and leading to the UCT dam. Student volunteers assisted in filling in gullies and levelling the broken channel, that is severely damaged, and covered the channel with plastic sheets in a makeshift arrangement in order to direct water into the dam. Cost of materials only.	R5 000
3	*Stormwater harvesting – lower campus*: Capture and store stormwater from Welgelegen channel and discharge into underground dam along the astro-turf soccer field	R87 000
4	*UCT Water Desk:* To manage all water communications and information sharing during the water crisis, and liaise between CMD, management and students.	R120 000
7	*Verifying water meters:* Identify and verify the location and number of City of Cape Town (CoCT) water meters on campuses. City officials have offered their support in carrying out this exercise. Geo-locate all bulk meters, verify and digitise UCT's water reticulation system. Employ skilled students to assist.	R16 000
8	*Action:* Conduct a survey of groundwater potential and identify possible sites for drilling boreholes on upper campus.	R47 000
	TOTAL SPENT	R290 000

Table of anticipated expenses

ANTICIPATED EXPENSES	
Permanent solution to catchpit and inlet to stormwater harvesting system alongside astro-turf soccer field	R35 000
Consultant's report on design and management plan for stormwater inflows into UCT dam: channel reconstruction and clearance of alien vegetation	R25 000
TOTAL PROJECTED COSTS	R60 000

7. CONCLUSIONS

The City of Cape Town learnt many lessons through the water crisis. The event has sharpened our collective attention on improving water management and communicating knowledge about the current water situation. UCT news and media has been at the forefront of carrying regular news about the water crisis in the region, and has done well in asserting itself as a leader in understanding the science and social behaviour of one world's largest cities that came close to running out of water. The CoCT's own efforts in averting Day Zero has been acknowledged by experts worldwide, including a

recent certificate from the International Water Association which recognises that Cape Town was able to control water demand and avoid undue investment in unnecessary new water schemes.
The WTT has made some inroads into contributing to UCT water management. We recognise that this is a long-term exercise, but are pleased that the water crisis has initiated the establishment of a Directorate of Environmental Sustainability that may prove to be a critical interface between P&S and the VC and Executive Management. The WTT will continue its role as an advisory team and to use it's expertise in helping UCT to transition to a more water-sensitive and secure institution.

Report compiled by Kevin Winters on behalf of the Water Task team
October 2018