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Introducing total water cycle management in Sydney: a Kogarah Council initiative

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Abstract

Away from traditional supply option of building dams, we need to adopt new supply options that can be incorporated into urban development and at household-level technology, including rainwater harvesting and wastewater reclamation. While technological advancements have made them possible, economic arguments and to larger extent a lack of political leadership have been keeping these options at pilot stage. The Kogarah Council is amongst a few NSW municipalities who have embarked on a comprehensive review of its water management practices. This journey has resulted in changing the Council's focus from traditional drainage pits and pipes to a much broader approach to water cycle management. In 2003 the Kogarah Council became the first one in Sydney to adopt TWCM principles into its Sustainability Management Plan. "Reduction in per capita water demand in Kogarah" was identified as a key sustainability indicator in the plan. At the same time, the Council recognised that while it had a statutory responsibility for managing stormwater, a successful partnership with the Sydney Water Corporation (responsible for water and wastewater) was vital to bringing together data, resources, and knowledge to develop and implement TWCM projects. The project developed a TWCM strategy for the Beverley Park catchment to identify priority projects in the catchment that produce the most cost-effective water savings. The Council has since endorsed the strategy and is committed to three priority projects identified for implementation in 2004/05: participation in Sydney Waters "Every Drop Counts" Business Program, the Beverley Park Water Reclamation Project, and the Rainwater Tanks in Schools Project. The first project will enhance the on-going water efficiency roll-outs from the Sydney Water Corporation, and the other two projects focus on creating new water sources. By 2005/06, the implementation of these projects will save up to 150 ML of drinking water every year in Kogarah. This paper presents an insight into this innovative project and provides the current status of the three priority projects.

Keywords: Total water cycle management; Sewer mining; Rainwater harvesting; Demand management

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1. Background

History is evidence of the ways in which humankind has manipulated water resources to meet increasing demand. As towns expanded, water had to be brought from increasingly remote sources, leading to sophisticated engineering efforts such as large dams and aqueducts. Reliance on engineering solutions to augment water supplies continued well into the 20th century, which brought a massive change in the global aquatic environment. The consequences of this anthropogenic manipulation on the hydrologic cycle are gradually becoming evident. Rivers, lakes, and wetlands worldwide are undergoing serious decline in health. Important life-sustaining ecological functions that these natural ecosystems provide, such as water purification, flood protection, and provision of habitats for wildlife including fish and waterfowl, are being lost [2].

At the dawn of the 21st century, when considering the future of its water resources, the world is finding itself in a peculiar position. This has been summarised into three major challenges facing water supply planning [3]. The first of these concerns is continued growth in population, which is seeing the demand for water beginning to exceed the potential for local supply in many places. The second challenge focuses on the increase in pollution, which has made many streams and rivers unsuitable for water supply. Finally, the growth of environmental controls such as environmental-flow requirements provides the third challenge, with many water supply alternatives having been rendered unfeasible.

The future of sustainable water resource management will have to rely on a combination of demand- and supply-side management approaches, an approach that is now being labelled as total water cycle management (TWCM) [1]. This holistic approach alone can provide a balanced means for water resource management. Such an approach recognises that on one hand, demand management is essential to conserving every possible drop of water, while on the other an increase in population will inevitably result in the need for additional supply. Consequently, further limited augmentation may still be needed to meet the overall increased demand [1].

The option of building new dams is certainly off the agenda, as recently re-affirmed by the NSW Premier Bob Carr (Media Release, 18/10/04). We, therefore, must adopt new supply options that can be incorporated into urban development and at the household level, including realising the resource value of rainwater and wastewater. While technological advancements have made them possible, bureaucratic red tape and, to a lesser extent economic arguments, are keeping these options at the pilot stage.

2. Kogarah and water cycle management

The Kogarah Council has a long history of incorporating sustainable design and planning into projects to ensure water is used more efficiently. Kogarah Town Square Redevelopment, for example, achieved a 42% reduction in water consumption from Sydney Water storages in 200 residential apartments through a combination of water efficiency measures and rainwater harvesting.

The Kogarah Council is amongst a few NSW municipalities who have embarked on a comprehensive review of its water management practices. This journey has resulted in changing the Council's focus from traditional drainage pits and pipes to a much broader approach to water cycle management. In 2003 the Kogarah Council became the first one in Sydney to adopt TWCM principles into its Sustainability Management Plan. "Reduction in per capita water demand in Kogarah" was identified as a key sustainability indicator in the plan.

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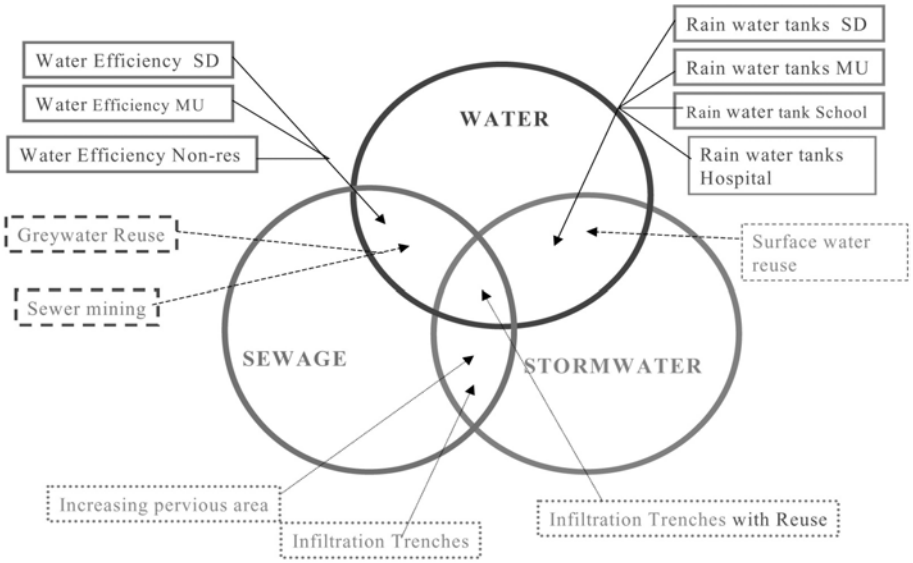

Fig. 1. Total water cycle management — concept diagram for the Beverley Park catchment [4].

the prevalent institutional arrangements within Sydney Metropolitan do not allow for much dialogue between local government and those responsible for managing water supply and sewerage. A successful partnership with Sydney Water Corporation (responsible for water and wastewater) was therefore vital to bring together data, resources, and knowledge to develop and implement TWCM projects.

This partnership was formalised in a joint project between the Kogarah Council, Sydney Water Corporation and the Institute of Sustainable Futures, UTS, to develop a TWCM strategy for the 224-ha catchment of Beverley Park. The project has taken a holistic approach to managing water, wastewater and stormwater in the Beverley Park catchment. The TWCM strategy for the Beverley Park catchment identifies priority projects in the catchment that produce the most cost-effective water savings.

Beverley Park offers an ideal pilot area for TWCM in metropolitan Sydney. It is a typical older-style suburb comprising a range of land uses including commercial, industrial, medium- and low-density residential, recreational parks and schools. Beverley Park also provides a complete hydrological catchment where the impact of the various components of the water cycle can be studied and understood effectively.

3. Methodology

The development of a TWCM strategy involved the following steps:

- Situation analysis — Data and information for the Beverley Park catchment were collected and analysed with a specific view to understanding the water budget of the catchment.
- Stakeholder consultation process — Stakeholders (involving community members, local businesses and organizations, State agencies, experts and council staff) were consulted on the kind of TWCM measures that should be considered for inclusion in the strategy. A range of measures were identified.
- Modelling process — The TWCM options and scenarios identified in stakeholder consultations (stage 1) were modelled to evaluate the TWCM measures against agreed evaluation criteria. The criteria included a reduction in

scheme water, dry weather discharge to sewers, and in run-off volume.
- Evaluation process — Using the results from the modelling, TWCM options were evaluated. In line with the principles of balanced outcome planning, the evaluation criteria considered the present value costs and present value avoided costs of the options. Evaluated options were then ranked accordingly within the TWCM strategy.

4. Kogarah Council projects

The Kogarah Council endorsed the TWCM strategy, and three priority projects were identified for implementation in 2004/05.

4.1. Beverley Park water reclamation

The project aims to reclaim up to 0.4 mega L of sewage every day for treatment and reuse for irrigation at the Beverley Park Golf Club (BPGC) and five other parks in the Kogarah LGA. It is expected that this project will reduce potable water use in Kogarah by as much as 140 mega L/y.

The Kogarah Council plans to intercept sewerage at Beverley Park before it flows to the local sewerage treatment plant. This process of water reclamation will see sewage pumped to a small custom-designed treatment station that uses membrane technology to provide effluent that can be used for irrigation directly at the BPGC and nearby Jubilee Oval, as well as piped or trucked to various KMC parks in the Kogarah LGA.

The project scope includes the upgrading of irrigation equipment and practices so that this new recycled source is used efficiently. By 2005/06 the project will:
- ensure all of the Kogarah Council's irrigation needs are met by efficient use of recycled water,
- reduce loads on the sewerage treatment plant by as much as 750 kL/d in the summer,
- reduce sewage overflows entering the Georges River,
- increase community awareness and knowledge of water efficiency and water reuse,
- reduce water consumption and increase use of recycled water by two of the catchment's most significant water users: the BPGC and Jubilee Oval.

An options study and a feasibility study have been completed, which outline the technical and cost dimensions of the project. The Kogarah Council has invited the relevant state agencies to form a steering committee to oversee the detailed designs and consultation phase during 2004/05. It is expected that the project will be constructed and on-line by the summer of 2005.

4.2. Rainwater tanks in Kogarah schools

The project is currently assisting all 22 primary and secondary schools in the Kogarah LGA to increase the efficiency of water use and install rainwater tanks to reduce potable water use in toilet flushing and irrigating school gardens. As a planning component for this project, a study into the potential for rainwater tanks in Kogarah's schools by the UTS showed that these schools can meet up to 70% of all their water needs for irrigation and toilet flushing by installing rainwater tanks. Depending on the size of the school,

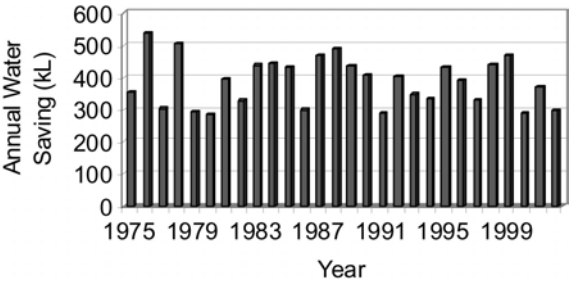

Fig. 2. Annual savings at Carlton Public School with 20 kL tank (source: [5]). Annual water conservation (kL) = reduction in annual run-off volume (kL).

the size of the tanks will vary between 2000 to 10,000 L. This equates to reducing potable water usage by 7 ML/y in the Kogarah LGA (Fig. 2).

In 2005 the project will:

- reduce potable water use in schools by 3 L/d/student,
- educate students and teachers to ensure long-term behaviour change, including measurable outcomes through local interschool competition initiatives,
- reduce stormwater run-off and improve water quality in Georges Bay.

The Kogarah Council is currently auditing schools' water use and providing advice on reduction strategies, as well as liaising with the Sydney Water Corporation regarding education programs for each of the schools. It is anticipated that the installation of rainwater tanks was completed by early 2005.

4.3. Sydney Water's "Every Drop Counts" business program

The project aims to ensure that the Council established formal water management systems and is undertaking water efficient practices. By participating the program, the Council aims to gain a better understanding of water usage and identify opportunities for reducing at least 10% of water consumption through greater efficiencies and best-practice management.

With assistance from the Sydney Water Corporation, the Kogarah Council conducted a water management diagnostic workshop in early 2004 and developed a Water Management Implementation Plan. This plan establishes a framework by which the Council can improve the management of water resources in the LGA.

Benefits of the project include:

- demonstrated corporate commitment by the Council and staff,
- efficient operating procedures within the Council, as well as investigation and integration of new and innovative technology.
- reporting, feedback and control systems in place within Council,
- improved metering and monitoring.

The Water Management Implementation Plan was prepared and completed by Sydney Water and Council staff. The Council implemented the actions identified in the plan and did strive to finish it by the end of 2004. The Implementation Plan is an adaptive plan and actions are updated every 6 months.

5. Conclusions

The TWCM approach contributes to sustainable management of water resources through the core principles of improving water use efficiency, recognising stormwater and wastewater as a resource, and lastly, matching the demand with appropriate quality from appropriate source (such as stormwater, rainwater, greywater, wastewater).

The TWCM strategy can be applied at many different scales from single lots to whole service systems. However, the opportunities to realise sustainable water management objectives through the TWCM concept are better at a catchment level because stormwater infrastructure planning is generally undertaken at these levels.

The models, and especially the decision-making framework developed by the UTS as part of this project, can be modified for any other council to develop a similar catchment-based strategy for their area.

As previously stated, the costs, avoided costs and levelised cost for the each of the TWCM options were individually estimated by the Institute for Sustainable Futures using the least-cost planning model built within the Scenario Manager. The scenarios were evaluated for their cumulative impact on reduction in scheme water, reduction in dry weather discharge to sewers, reduction in run-off volume and the present value costs and present value avoided costs. A number

of mixed scenarios were modeled as part of this project including:

- retrofitting showerheads and taps in existing dwellings,
- retrofitting toilets in existing dwellings,
- water-efficient devices in all new dwellings,
- rainwater tanks (5 kL) for toilet flushing and irrigation in existing dwellings,
- rainwater tanks (20 kL) for toilet flushing and irrigation in new multi-residential units,
- rainwater tanks (20 kL) at St George Hospital and Carlton Primary School for irrigation,
- rainwater tanks (5×20 kL) at St George Hospital for cooling tower,
- reclaimed sewage for irrigation (BPGC) and
- stormwater run-off and collection and reuse for irrigation.

This rigorous modeling exercise that formed part of the project planning ensured that the options identified for TWCM strategy were effective and would deliver on the objective of sustainable water resource management. It was always the intention of the TWCM project to steer the Council towards a sustainable water cycle management program.

A fundamental objective behind embarking on a TWCM strategy was to metamorphose the Council's traditional preoccupation with drainage engineering into a much broader approach to water cycle management. The project team was successful in achieving this goal at Kogarah, which now sees water management as one of the key priorities along with the three traditional priorities of rates, roads and rubbish.

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