CRC for
Water Sensitive Cities

Program B: Water Sensitive Urbanism | Project B2.1 | Project duration: July 2012-December 2014

Cities as water supply catchments – Stream ecology

Overview

Urban streams are commonly degraded by stormwater that runs off hard surfaces such as roofs and roads. Built-up, impervious urban areas result in large, intense flows of stormwater through pipes and drains resulting in less water infiltrating into the ground, and decreased evapotranspiration and baseflow which all lead to deteriorating water quality and higher frequency flow regimes. The results are drastically altered geomorphology and ecology of urban streams. However, integrated stormwater management and harvesting offers the potential to protect urban streams from this degradation, or to return ecological function to already degraded streams.

A common concern of stormwater harvesting is the perception that it will lead to a starving of urban streams of their natural flow. However, the opposite is almost always the case. In existing urban areas stormwater harvesting helps reduce the frequency and flow volume of excess runoff, potentially restoring it to near pre-development levels if enough water can be harvested.

The project aims to determine the impact of integrated stormwater management strategies, including stormwater harvesting, on the hydrology and water quality of streams, and to assess the subsequent ecological and geomorphic responses.

Key outcomes

The project will produce a conceptual model and indicators that will underpin operating guidelines for stormwater harvesting. This will provide a more informed basis a more informed basis for managing stormwater by quantifying explicit relationships between stormwater and ecological and geomorphic condition. This includes targets for stormwater harvesting and retention and identification of treatment and infiltration-based technologies that can improve and protect the aquatic ecosystem health of existing urban areas and greenfield developments.

In addition to the stormwater focus the program identifies opportunities for improving urban stream health through managing sediment loads and riparian zones (for example, by providing more space for natural stream movement). Results could be incorporated into state and national guidelines for improving waterway health and stormwater harvesting by determining the optimal volume and pattern of water extraction from the catchment.

Early insights into stormwater harvesting – Little Stringybark Creek

The Little Stringybark Creek project is a rare catchment-scale restoration experiment. It aims to restore the health of Little Stringybark Creek in Mt Evelyn, east of Melbourne, by tackling the main cause of the creek's poor health: excess urban stormwater runoff. Working with the catchment community and Yarra Ranges Council, the project team installed more than 280 stormwater control measures across the catchment. Combinations of harvesting and infiltration (raingarden) systems that harvested and treated runoff from impervious areas ranging from 100 square metres to more than one hectare resulted in reduction and treatment of stormwater runoff from most of the roofs and roads in the catchment.

The project has already been influential in driving new approaches to stormwater management in Melbourne, nationally and internationally.

Importantly, it is underpinned by a long-term ecological monitoring program of the creek, its three tributaries as well as sets of equally degraded urban control streams and forested streams against which variation in ecological condition can be assessed over time. In 2014, less than a year after completion of most of the works, no biological changes biological changes associated with the construction works have been detected, but the tributary with the most complete retention of urban stormwater runoff shows trends suggestive of increased baseflow and reduced nutrient concentrations. With different degrees of catchment intervention or management action among tributaries, this study will allow important inferences regarding the necessary extent and intensity of interventions to improve in-stream ecological condition.

An Australian Government Initiative

CRC AUSTRALIA

Project design

The first part of the project involved the development of indicators, such as runoff frequency or rainfall retention capacity, that were used to assess the impact of stormwater harvesting on the hydrology and water quality of streams. This was followed by the development of predictive models of likely ecological responses. The second part used, among other strategies, two case study catchments to measure the effect of stormwater harvesting, applying the indicators and conceptual models previously developed. The primary empirical testing has been undertaken through the Little Stringybark Creek case study.

Geomorphic monitoring and investigations have been undertaken on 17 streams around Melbourne, each representing a different level of urbanisation as measured by directly connected stormwater systems. The results demonstrate that the extent of channel erosion, channel size and the amount of physical habitat can all be related to stormwater design. In addition, opportunities have been identified to better manage stormwater control infrastructure to reduce ongoing sediment maintenance and improve appropriate levels of sediment supply to streams. All studies will be combined to inform the development of algorithms relating hydrology and water quality to stream ecology.

Outlook

This project will conclude at the end of 2014 providing final design, operating rules and analysis tools for stormwater harvesting to deliver optimal stream health outcomes. Lessons learned from the Little Stringybark Creek project will also be published by the end of this project.

The outputs that this project delivers include:

- conceptual models and indicators to underpin stormwater harvesting operating guidelines
- case studies of hydrologic restoration using stormwater harvesting and other stormwater retention strategies.

About the Cooperative Research Centre for Water Sensitive Cities

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) brings together interdisciplinary research expertise and thought-leadership from Australia and the world to address current urban water management challenges facing our cities and regions. In collaboration with over 80 research, government and industry partners, it develops and synthesises knowledge into powerful tools and influences key players aiming to achieve sustainable, resilient and liveable water sensitive cities.

Further information

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