Systems Analysis quantifies urban stormwater resources and market mechanisms for pricing stormwater and environmental management

Prof Peter Coombes[1]

[1]*Urban Water Cycle Solutions, Carrington, Australia*

Overview

This research project builds on previous publications by Coombes et al (2018 ; 2016) that utilised a Systems Framework of historical big data from government agencies and utilities to identify the water and stormwater benefits of property scale water conservation measures for Australian cities, including Adelaide, Brisbane, Melbourne, Perth and Sydney. This project combines additional spatial and temporal detail from the Australian Bureau of Statistics (ABS), Bureau of Meteorology (BOM), utilities, government agencies and latest research in the Systems Framework to quantify the stormwater resource and associated impacts throughout each city.

The Systems Framework for each city was enhanced by the addition of higher resolution spatial detail of demographic, socioeconomic, land use, local observations and economic information. The results for the enhanced systems analysis of each city is combined with the latest research into non-market or externality values of associated with stormwater management decisions that include amenity, waterway and ecological health and recreation benefits. This process is used to estimate the water resources, economic and ecological footprint of urban stormwater runoff, and develop a new market mechanism for pricing stormwater and environmental management services via impervious area charges.

Objectives

This research project employs systems analysis of big data to quantify the historical magnitude and impact of urban stormwater runoff in Australian cities over time and to enhance the estimates of the contribution of the local scale to stormwater management in cities. The project evaluates water demands, wastewater discharges, sediment and nutrient loads, change in runoff days, and associated economic and ecological values from the perspective of urban stormwater runoff. This information on costs and benefits of urban stormwater runoff is used to derive a new pricing mechanism for stormwater and environmental management in Australia cities.

Results

This research project combines two decades of systems analysis and forensic examination of historical data into enhanced analysis to identify the quantum, costs and benefits of stormwater runoff from Australian cities. Average annual stormwater runoff from urban services ranged from 440 GL (Melbourne) to 560 GL (Sydney). The wastewater networks in each city convey an additional 10% to 25% of stormwater runoff to waterways at net present costs of up to $34 billion to 2050. Actions at the local scale and a pricing mechanism based on impervious area tariffs will make significant contributions to mitigating impacts of stormwater runoff.

Conclusions

This investigation has revealed the strong spatial and temporal variance of stormwater runoff throughout Australian cities and the associated water resources, economic and ecological foot print. A pricing mechanism for stormwater and environmental management based on effective impervious surfaces was developed and investigated. This market mechanism was found to generate significant incentives for improved stormwater management and revenue for stormwater managers. However, there is also a requirement for a policy framework that binds revenue from the pricing approach to stormwater and environment outcomes.