

# CITIES AS WATER SUPPLY CATCHMENTS

**A 5-year research program which aims to harness the potential of stormwater and build greener more liveable cities with a resilience to the challenges of housing a growing population in an era of climate change.**

## AUSTRALIAN CITIES – THE CHALLENGE

Across Australia, cities are facing a range of critical pressures related to climate change and urban expansion. We are experiencing critical water shortages along with increasing weather extremes and the degradation of our urban streams and waterways. As the population increases, bushland and regional areas are replaced with housing and paved areas. This loss of vegetation results in increased local temperatures, flooding, and stream degradation. These problems are compounded by the droughts and extreme weather that climate change brings.



Current centralised solutions to urban water management, whilst fundamental to Australian cities must become resilient to the climate and social pressures confronting them. This National Research Program investigates the role that stormwater can play in building this resilience.

Current solutions to urban water management, whilst fundamental to the development of our cities, cannot solely provide the multiple benefits required for the future needs of our cities. We must find new, more integrated solutions to address climate change, urban growth and other related problems such as the degradation of our waterways.

## WATER SENSITIVE CITIES - THE SOLUTION

The vision of Water Sensitive Cities is becoming increasingly accepted as the way forward. The philosophy is to use a mix of water management solutions to make our cities resilient to population growth, water scarcity and climate change while delivering multiple benefits to people and the environment.

Of the range of solutions available, the harvesting of stormwater after rainfall offers the greatest potential.

However, the difficulty is finding solutions to combining our existing water infrastructure with new systems that utilise stormwater harvesting at the individual household, whole streets or entire neighbourhood.

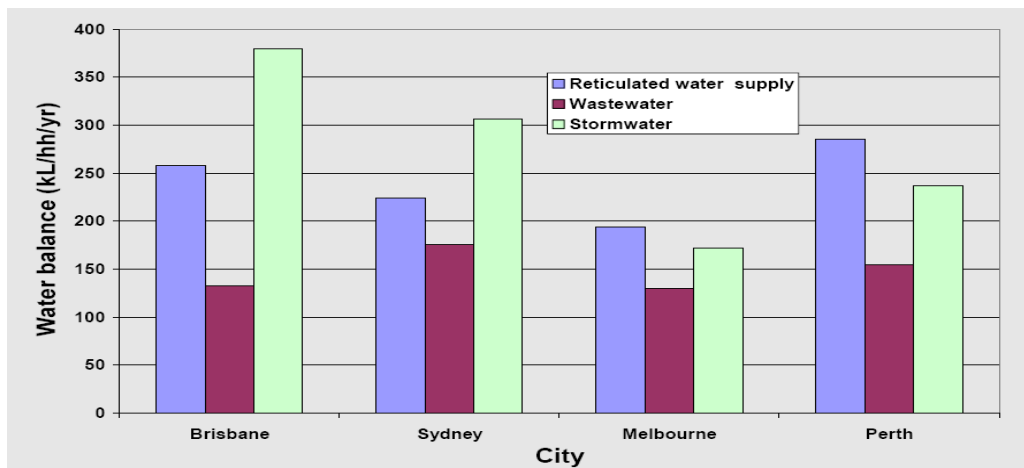
Stormwater harvesting systems can be fully integrated into the urban landscape to deliver a wide range of benefits. The figures below illustrate several types of systems that are proven technologies and which could be employed elsewhere.



**Figure 1.:** Street trees that collect and treat runoff from Bourke St, Melbourne (left), the rain-garden in Victoria Park, Sydney (middle) and Lynbrook Estate stormwater wetland, Melbourne (right).

Stormwater harvesting is essential to the realisation of Water Sensitive Cities, because:

- Urban stormwater is a large source of water, generated close to where it is needed. In most instances the amount of stormwater discharged is approximately the same or greater than the cities’ demand as seen in the graph below.



**Figure 2.:** Urban water use and discharges, PMSEIC, 2007.

- Uncontrolled stormwater runoff from our cities degrade creeks and waterways. Stormwater harvesting can protect and enhance the health of urban streams by restoring flows and water quality close to what they were prior to urban development.
- Harvested stormwater used to maintain natural vegetated systems such as wetlands and raingardens has an important role in reconnecting the built and natural forms; reducing temperatures in our cities and therefore the need for

artificial cooling which produces greenhouse gases and contributes to Climate Change.

- Communities find the recycling and reuse of stormwater easier to accept than wastewater reuse
- Stormwater harvesting and recycling systems, if designed appropriately, can function with very low energy use compared with other water management solutions.

## SO WHY HARVEST STORMWATER?

Unlike the traditional centralised water supply systems, which have benefited from over two centuries of dedicated research and development, urban stormwater harvesting systems are relatively recent inventions.

There are a number of important knowledge gaps impeding the widespread adoption of stormwater harvesting, from affordable technologies to guidance on the appropriate levels of harvesting with respect to maintaining and improving stream health in both established and new urban developments.

There needs to be a better understanding of the benefits of stormwater harvesting before it will be adopted nationwide. Furthermore, investigations must involve industry and all levels of Government.

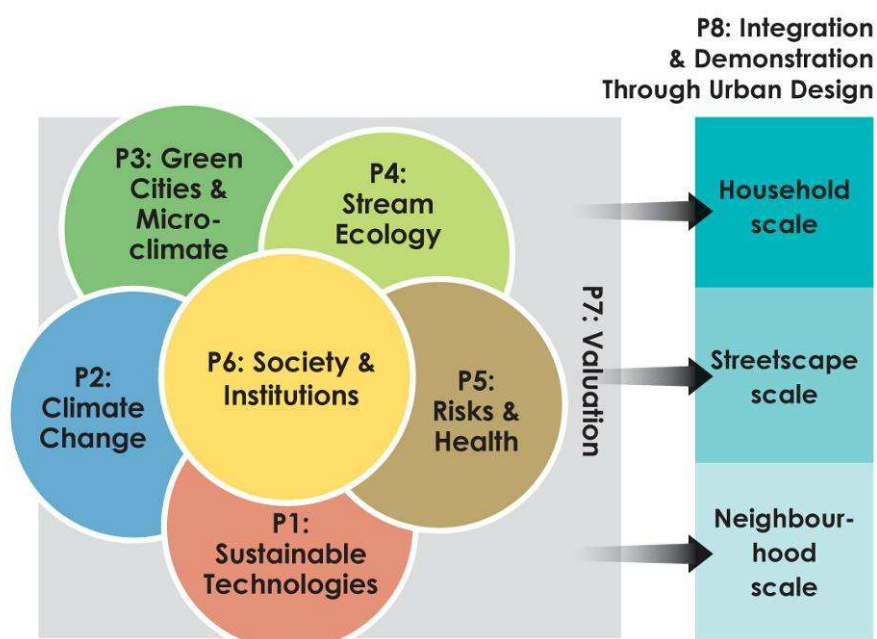


Figure 3.: The main attributes of stormwater harvesting solutions

## A 5-YEAR RESEARCH PROGRAM

Our research program aims to harness the potential of stormwater to overcome water shortages, reduce urban temperatures, and improve the landscape and liveability of Australian cities. We propose to develop integrated stormwater harvesting solutions as part of realising Water Sensitive Cities.

The 5-year research program will take an integrated approach, where findings from each of the eight projects will inform one another while delivering practical solutions for integration into partner organisation's operations.



**Figure 5:** The main project of the research program

**Project 1 - Sustainable Technologies** – This project will identify and improve stormwater harvesting solutions that can be adopted using proven Water Sensitive Urban Design technologies; such as raingardens, street tree pits, wetlands, porous pavements, etc. Stormwater would be treated and reused at different scales and levels by individual houses, a whole street and entire neighbourhoods and would also provide a level of flooding protection.

**Project 2 – Urban Rainfall in a Changing Climate** – Climate Change is understood to lead to more variable, less predictable weather patterns, which makes it difficult to plan the design, construction and maintenance of stormwater management systems into the future. This project will develop methods to assess the impact of climate change on variable rainfall patterns that can be integrated into the design and performance of stormwater management systems in the face of Climate Change.

**Project 3 – Green Cities and Micro-Climates** – The Urban Heat Island Effect identifies urban climates as generally warmer and drier than natural climates before development. Comparisons will be drawn between different environments (urban, rural and natural) in order to define how stormwater harvesting can be used to assist returning urban climate temperatures to more natural levels without having to use artificial cooling.

**Project 4 - Stream Ecology** – Since European settlement, our cities have caused the degradation of our streams, rivers and oceans because of both the quantity of water that erodes our streams and the toxins and impurities carried within stormwater that pollutes our waterways. The aim of this project is to investigate the role stormwater harvesting can have on reducing the impacts of urbanisation on our waterways and to assess methods for improving them.

**Project 5 - Risks and Health** - In order to ensure urban stormwater can be used safely and more widely than it is currently used; this project will study the issues and solutions related to harvesting and reusing stormwater for drinking and other uses within our cities.

**Project 6 - Society and Institutions** – In the last few decades, water management and use in our cities has undergone the greatest change since settlement and particularly in the face of water scarcity, growing populations, climate change and a better understanding of the human impacts on our waterways. To reflect these changes, the institutions responsible for managing our urban water also need to change. For example, community education, resourcing, responsibility, knowledge, vision, commitment and coordination. The aim of this project is to assist institutions in making this change by identifying and demonstrating the advantages to proactively progress the adoption of harvested stormwater at different scales and levels by individual houses, a whole street or entire neighbourhoods.

**Project 7 – Economic Valuation** - Unlike stormwater harvesting, traditional stormwater management systems do not build resilience in our cities to modern day issues such as water scarcity, population growth, urban sprawl, environmental protection and climate change. One of the key challenges for widespread application of stormwater harvesting systems is in the economics of these solutions compared with traditional options of capture, remove and discharge to our waterways. The economics of building resilience in future cities is a fundamental aim of this project. This project compares technologies and encourages the adoption of systems with the greatest potential for resilience and social gain, rather than continuing to rely solely on traditional solutions.

**Project 8 – Integration & Demonstration Through Urban Design** - This project provides a practical, whole-system analysis and demonstration of the potential of urban stormwater as a viable water resource by integrating the findings from the 7 other projects. The findings will be translated into design and via at least one urban development demonstration site established in key Australian urban centres. The sites would set the benchmark for industry and government partnerships in re-developing existing infrastructure, and for planning new urban designs to realise Cities as Water Supply Catchments.

## THE RESEARCH TEAM

The research consortium is led nationally by Monash University, in partnership with Melbourne and Queensland Universities and AECOM. The key researchers leading each of the projects are listed below under the Program direction of Professor Tony Wong:

**Project 1: Sustainable Technologies** – Professor Ana Deletic (Civil Engineering, Monash University);

**Project 2: Urban Rainfall in a Changing Climate** – Professor Christian Jakob (School of Mathematical Sciences, Monash University);

**Project 3: Green Cities and Micro-Climate** – A/Professor Jason Beringer and Prof Nigel Tapper (School of Geography and Environmental Sciences, Monash University);

**Project 4: Stream Ecology** – Associate. Proffesor Tim Fletcher (Civil Engineering, Monash University), and Assoc. Prof Chris Walsh (The University of Melbourne);

**Project 5: Risks and Health** – Doctor Christoph Ort (Advanced Water Management Centre (AWMC), University of Queensland);

**Project 6: Society and Institutions** – Associate Professor Rebekah Brown (School of Geography and Environmental Sciences, Monash University);

**Project 7: Economic Valuation** – Associate Professor Vivek Chaudhri (School of Business and Economics, Monash University);

**Project 8: Demonstration & Integration through Urban Design** – Ross Allen and Leane Hodyl (AECOM).

### **BECOMING AN INDUSTRY PARTNER**

Those Government and Industry organisations who would like to become an Industry Partner of the Research, please contact Stacey Sawchuk, Business Manager, Cities as Water Supply Catchments on (03) 9905 9709 or via [stacey.sawchuk@msi.monash.edu.au](mailto:stacey.sawchuk@msi.monash.edu.au).