CRC for
Water Sensitive Cities

Kings Square Raingardens

Location:
Perth, WA

Case Study — Prepared by Cooperative Research Centre for Water Sensitive Cities, September 2018

Australian Government
Department of Industry, Innovation and Science
Business Cooperative Research Centres Programme

Insight

Application of water sensitive urban design strategies to provide retention, filtration, litter management and bio-retention outcomes, as well as improvements to local amenity

Project description

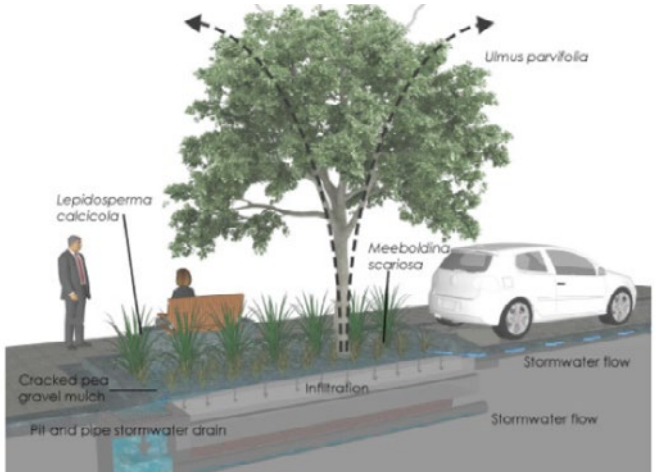
The Kings Square development in Perth's central business district is part of Perth City Link – an urban renewal project including offices, retail space, community open space and residential development. The project extends the commercial core of Perth and reconnects the city with Northbridge.

As part of the development's approach to sustainability and total water cycle management, a network of raingardens were incorporated into the streetscape design to provide stormwater treatment, protect sensitive groundwater systems that flow into the nearby Swan River, improve the long term health of street trees, enhance amenity, and integrate with the surrounding built form and elements of the streetscape.

The drivers

Use street trees, groundcovers and bioretention media within raingardens to help capture contaminants brought in from the road during frequent, first-flush rain events

- **Perth City Link Vision** – The project is driven by Perth City Link's core vision to reconnect Perth's city centre with Northbridge. As such, it aims to deliver environmentally sensitive design including integrated streetscape design, stormwater management, on-street street parking, alfresco dining, landscape amenity and shade.



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Bioretention system included in street tree planting

What does this case study demonstrate?

Each case study has been selected to demonstrate specific solutions, benefits or enabling structures that support the creation of water sensitive cities. This case study focuses on:

Stormwater treatment

Water sensitive streets and carparks

The innovations

Achievement of a 1:2 ratio of infiltration area to parking area; an accomplishment not attempted before in the 'hard urban landscape' of Perth

- **Raingarden sizing and layout** – The raingardens are designed to fit the local streetscape context and dimensions, being sized for hydraulic efficiency and to fit into the cross-sectional parking dimension between road crossing points. They are also located to accommodate surrounding alfresco dining and retail opportunities with shade, rest points and amenity provided by the vegetation and trees.

- **Raingarden location to capture first flush** – Each raingarden is positioned upstream of a traditional 'pit and pipe' stormwater gully drain to catch the first flush events which account for approximately 95% of rainfall. Larger events flow past the raingardens and into the overflow system.

- **Dense understorey planting** – Dense planting of eight plants per square metre assisted in providing a critical mass of initial vegetation. The vegetation plays a role in removing nutrients and binding pollutants (hydrocarbons, heavy metals, nutrients, dust and leaf litter) into the soil.

- **Passive irrigation** – Street and pedestrian pavements are graded to sheet stormwater into raingardens around trees and planting beds to promote passive irrigation of the vegetation.

- **Use of sedge plantings** – *Meeboldina scariosa* and *Lepidosperma calcicola* (both locally native) are used in the raingardens to treat the stormwater. Both species were common on the site prior to development.

- **Deciduous trees with relatively small leaf size** – Two deciduous trees (*Ulmus parvifolia* and *Jacaranda mimosifolia*) were selected. *Ulmus parvifolia* provides summer shade and winter solar access. The relatively small leaf size of these trees also reduces the likelihood of drainage system blockages.

The lessons

- **Public safety can be integrated into the urban streetscape** – Public safety features are included in the design of the raingardens. A Safety in Design process was followed. Integrated trafficable ramps along the road edge allow for stormwater ingress (sheetflow into the raingardens), while the selection of stone with a high luminance contrast for the edge material visually deters cars from entering. The sizing of the edge units and their footings acts as a physical deterrent. The integrated stone edge units to the back and sides act as a wheel stop to the parking bays and prevent pedestrians (including vision-impaired) from falling into the raingardens. Bed levels are set to minimise injury if a car or pedestrian does accidentally fall in. Seating integrates and adds amenity.

→ Raingarden with integrated seating

The outcomes

Cities providing ecosystem services	Cities as water supply catchments	Cities comprising water sensitive communities
• **Native vegetation** – The use of locally occurring species in the raingardens promotes local biodiversity. • **Bioretention** – The soil media binds contaminants and stops these entering the groundwater (a sensitive receptor) or being carried into the nearby Swan River.	• **Passive irrigation** – Passive irrigation design minimises imported water demands. • **Local aquifer recharge** – Treated stormwater is delivered to local aquifer to recharge.	• **Improved local amenity** – Improvements to local amenity and aesthetics is achieved through the planting of vegetation and provision of seating. • **Public awareness** – the raingardens visually demonstrate to the public that a water sensitive approach provides multiple benefits to the community.

Business case

Costs	Benefits
• Overall project cost $1.2 million. • Typical raingarden cost is $15,000 each. • Raingardens range in length from 4m to 9m and have a typical width of 2.5m. • Raingarden maintenance costs $750 per year.	• Urban design innovations capitalise on local ecology, lighting, plants and place making for a functional and high amenity outcome. • Street sweeping cost savings are $1,200 per year.

Raingarden tree pit with raised edges

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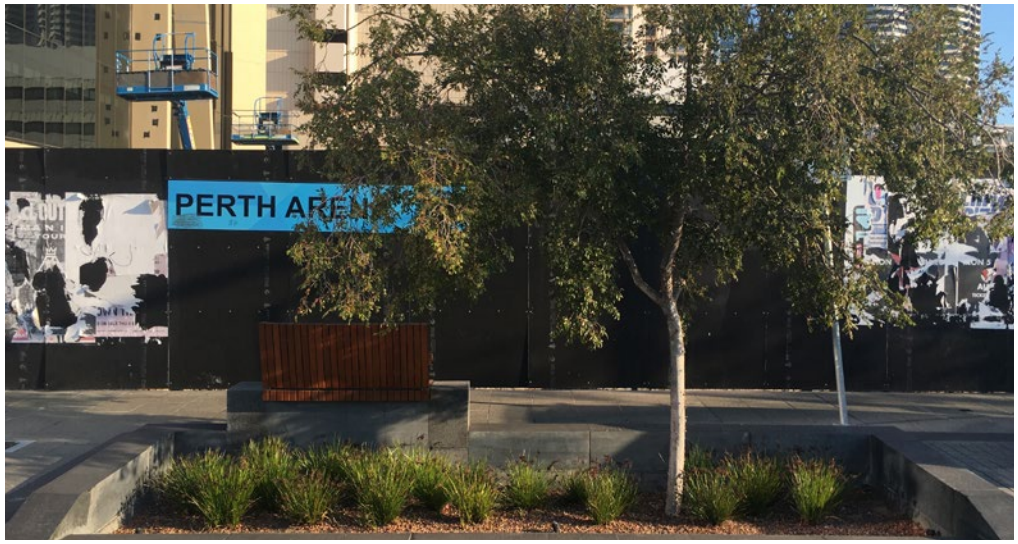


Transferability

The neat integration of competing elements (car parking, raingardens, service alignments, pedestrian movement and safety, alfresco dining and retail opportunities) demonstrated at the Kings Square streetscape will not always be achievable on other projects, particularly on retrofit projects. However, for greenfield development, Kings Square is a useful precedent for water sensitive street design that can be adopted in other parts of Perth, Australia and globally.

The raingardens are appropriate in locations where there is adequate room in the street layout, gradients are suitable and the catchment area is appropriate for this approach (e.g. sheetflow across a road into kerb and gutters).

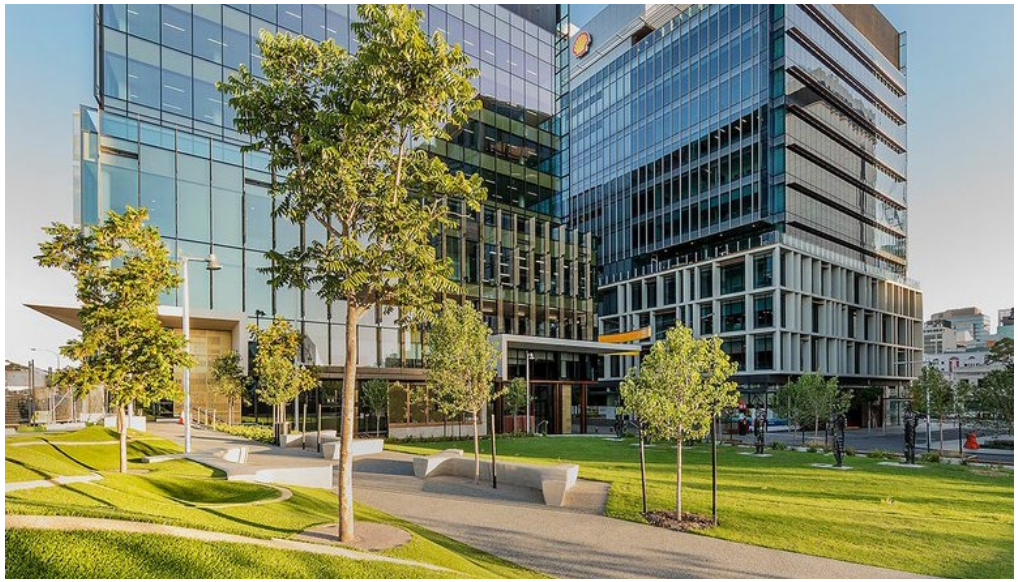
Project collaborators

- Leighton Properties (Part of CPB Group)
- The Metropolitan Redevelopment Authority
- City of Perth
- AECOM (Landscape Architect)
- BGE (Civil Engineer)
- State Government of Western Australia
- WALGA
- UDIA
- New WAter Ways
- Water Corporation

Additional information

More information on the Kings Square raingardens project can be found at:

- New WAter Ways
- Kings Square raingardens case study



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Kings Square Wellington Gardens looking east

Cooperative Research Centre for Water Sensitive Cities

Level 1, 8 Scenic Boulevard
Monash University
Clayton VIC 3800

info@crcwsc.org.au

www.watersensitivecities.org.au

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