



CRC for
Water Sensitive Cities



Revitalising Canning City Centre: A Water Sensitive Perspective

Design charrette summary with supporting design concepts from the
2015 UWA / Monash Urban Design Studio and
2015/16 UWA Environmental Engineering Design Project

November 2016

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Date of publication: November 2016

An appropriate citation for this document is: CRC for Water Sensitive Cities and City of Canning, 2016. Revitalising Canning City Centre: A Water Sensitive Perspective. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

The CRC for Water Sensitive Cities and City of Canning gratefully acknowledge the contributions of The University of Western Australia and other Design Charrette participants.

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Introduction

Revitalising Canning City Centre – A Water Sensitive Perspective

The revitalisation of Canning City Centre was explored from a water sensitive perspective in a two-day design charrette in August 2015. The design charrette was hosted by City of Canning and facilitated by the Cooperative Research Centre for Water Sensitive Cities (CRCWSC). Individuals from the following organisations contributed their knowledge and ideas through the design charrette:

- City of Canning
- CRC for Water Sensitive Cities
- The University of Western Australia (UWA)
- Monash University
- Department of Housing (now Housing Authority)
- Department of Parks and Wildlife
- Department of Water
- Water Corporation
- Essential Environmental
- SERCUL

The purpose of the design charrette was to:

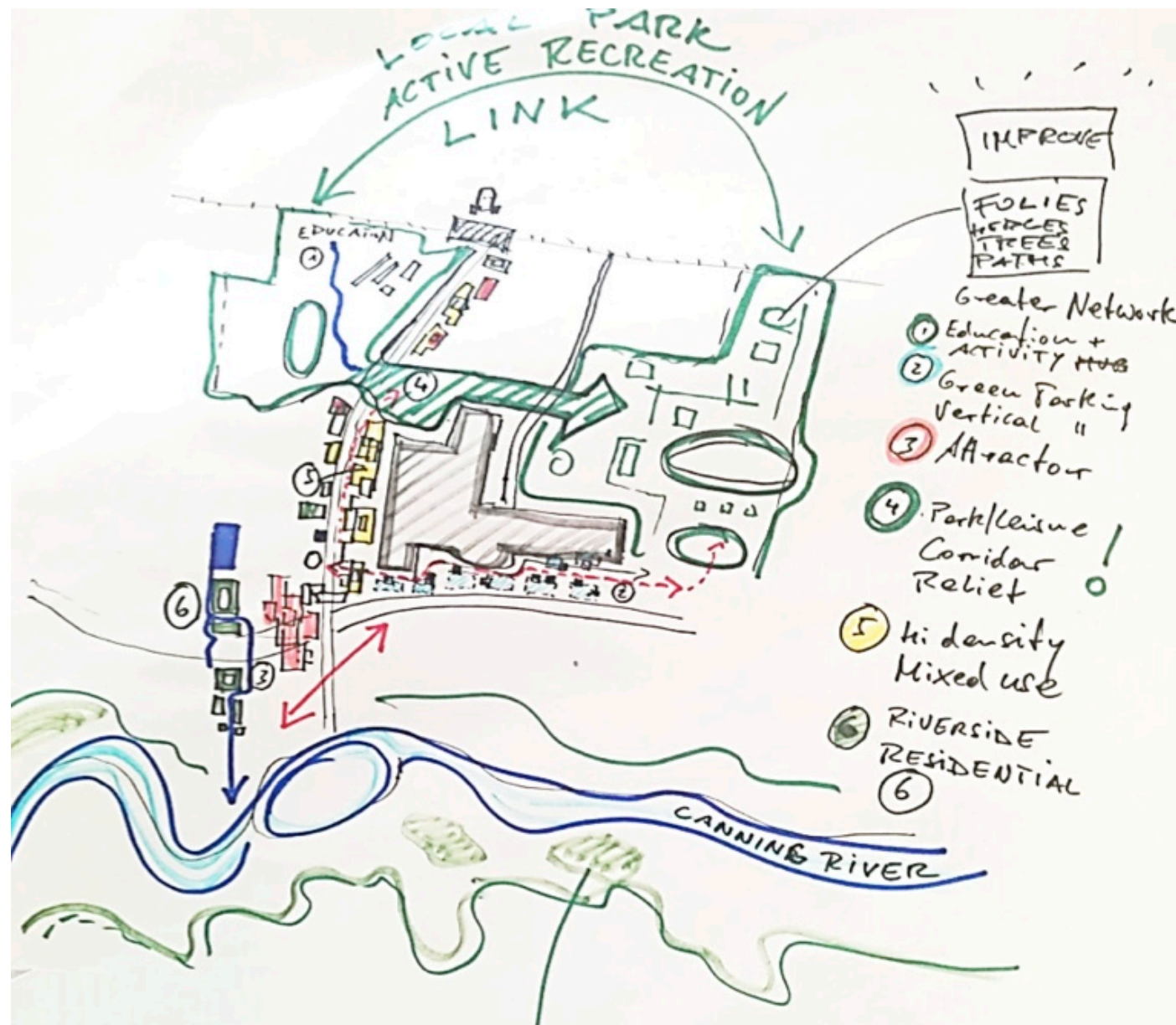
- Explore the interface between the built form and the public realm (with a focus on urban streams and constructed waterbodies) to help guide desirable forms of development.
- Inform design parameters for future urban streams and constructed waterbodies within the revitalisation precinct.

The design charrette also provided an introduction and foundation for two UWA and Monash University initiatives:

- A semester-long urban design studio for 4th year students from the University of Western Australia (UWA) School of Architecture and Design to explore imaginative urban design proposals that incorporate the creative use of water (Semester 2, 2015). The design studio included a one-week mini-studio for Monash University students from the School of Architecture, Design and Arts.
- A two-semester-long engineering design project for 3rd/4th year students from the UWA School of Civil, Environmental and Mining Engineering (Semester 2, 2015 and Semester 1, 2016). The outcomes of the design project are documented in the report: *Water Sensitive Urban Design Considerations in the City of Canning* (UWA and City of Canning, 2016).

This document provides a compilation of key outputs from the design charrette and includes a selection of design concepts developed as part of the urban design studio and engineering design project.

The engineering design project included the development of an environmental management plan for Cannington Swamp.



Identifying aspirations and key locations within Canning City Centre (design charrette sketch)

Context

The Revitalisation of Canning City Centre

Canning City Centre (Cannington Strategic Metropolitan Centre) is identified as a Major Growth Area in Perth's strategic planning document: Directions 2031 and Beyond (Department of Planning 2010).

Through its Structure Plan, Canning has a unique opportunity to evolve the City Centre into being a place that welcomes new investment, celebrates quality urban design, public amenity and, most importantly, puts people first. Looking to the future, Canning City Centre has the potential to accommodate approximately 24,400 residents in 10,000 new dwellings and 10,400 workers in 140,000sqm of new commercial and retail space. (City of Canning, 2013)

The vision for Canning City Centre, developed in response to community and Council expectations and based on the socio-economic and commercial profile of the City Centre, is:

A re-energised city centre with a community heart that is connected, accessible, vital and resilient.

Place values underpinning this vision (City of Canning, 2013) are:

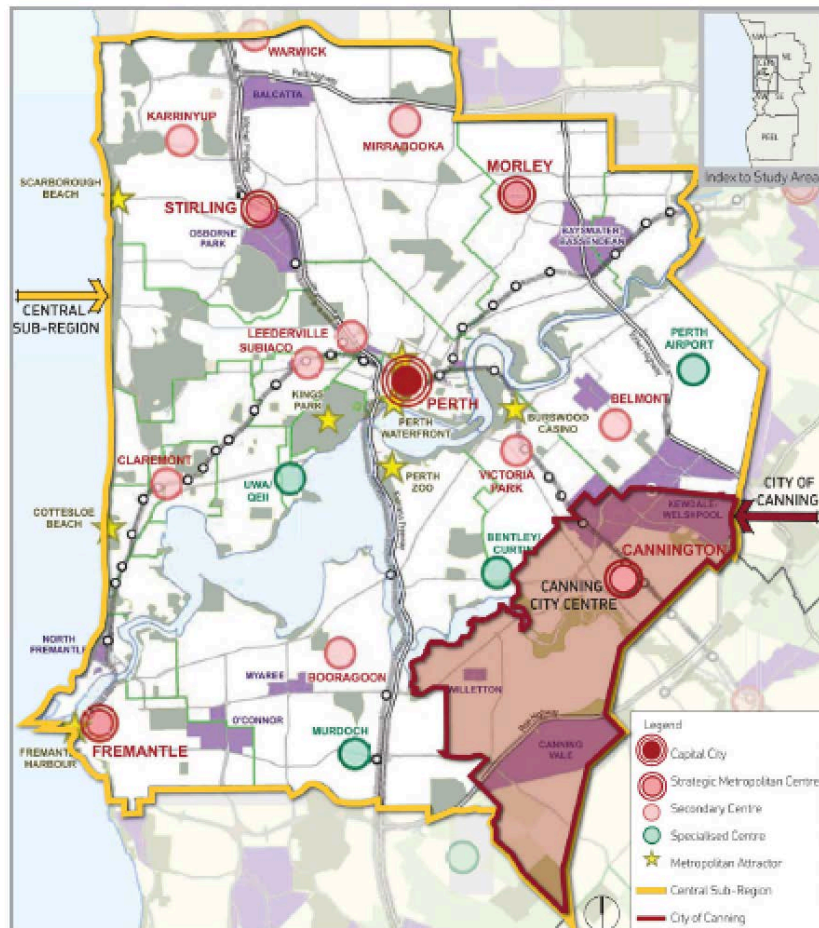
CONNECTED - *Canning City Centre will be a connected place that celebrates its heritage as a commercial hub focused on trade, movement, the river and people. It will be a place that puts people first, including residents, businesses and visitors.*

ACCESSIBLE - *We will create a welcoming place, easy to get to and move through, with fresh, green and open meeting places and spaces, a revitalised train station and pedestrian and cycle ways that connect to the river.*

RESILIENT - *We will create a place that inspires people to take another look by delivering resilient and innovative design. We will focus on our buildings, their landscape setting, and visibly improve our public spaces and underutilised areas.*

VITAL - *Actively demonstrating Canning City Centre's vital position as the south east's primary retail, business and investment destination, we will build a positive investment climate through a strong vision, commercial leadership and credible partnerships that create a shared platform for growth.*

RE-ENERGISED - *We will be a place that is safe, fun and leisure orientated – day and night, from the Greyhounds to the Cinemas; the river to cafés; from Carousel to Coker Park, through to our people and places.*



Left: Location of Canning City Centre / Cannington Strategic Metropolitan Centre (WA Department of Planning, 2010)
 Right: Canning City Centre regional context (City of Canning 2013)

Identifying Water Sensitive Opportunities

Water Sensitive Aspirations

Through the design charrette process, participants identified five strategic aspirations for the revitalisation of Canning City Centre:

- Utilising water and water-links as a key design driver.
- Leveraging open water bodies to provide multi-functional community assets.
- Leveraging Cecil Avenue to enhance connectivity and opportunities to linger.
- Utilising local vegetation communities to enhance biodiversity, identity and belonging.
- Implementing good governance and an effective design review process in order to realise aspirations for the revitalisation of Canning City Centre.

Key Locations

The interface of the public realm and built environment is an important design consideration. The expression of water elements (including urban streams and water bodies) within the public realm can provide a basis for physical and visual connectivity. This concept underpins the identification of key locations within the precinct for exploring public-private interface and connectivity.

Key locations identified:

1. Cannington Railway Station Precinct
2. Cecil Avenue (Sevenoaks Street to Albany Highway)
3. Cecil Square
4. Albany Highway to the Canning River
5. Compensating Basins
6. Lake Street Urban Stream

Water sensitive planning and design considerations and associated urban design concepts for each of these locations are presented in this document.

Cannington Swamp, an ephemeral wetland identified as a Threatened Ecological Community (TEC) under the Commonwealth EPBC Act, was also identified as an important part of the water story of the precinct but was not explored as part of the Design Charrette. A proposed wetland management plan prepared for this location as part of the UWA engineering design project is documented in *Water Sensitive Urban Design Considerations in the City of Canning* (UWA and City of Canning, 2016).



Water-links as a Key Design Driver

The first water sensitive aspiration identified by design charrette participants (water-links as a key design driver) was explored in more detail and is documented in this section.

Aspiration

Utilise water and water-links to connect people and place. Create a healthy environment (for people) by bringing water to surface in living streams.

Planning and Design Considerations

Planning and design considerations were identified through an exploration of water sensitive opportunities at the precinct-level and at specific locations. These included:

- Understanding the needs of the local community / users, and designing for people (as part of the system).
- Planning the interface between future buildings and green/blue links.
- Establishing governance arrangements that: (i) facilitate and encourage the provision multiple benefits associated with water bodies and drainage paths, and (ii) address organisational risks and responsibilities associated with multifunctional assets.
- Implementing mechanisms such as development incentives (e.g. height limits, plot ratios) to achieve built form outcomes that go beyond minimum requirements, particularly in relation to the private – public interface.
- Providing water connection through the staged delivery of a linear system.
- Maintaining / improving surface water management and associated groundwater quality.
- Ensuring there is sufficient (fit-for-purpose) water to sustain trees and vibrant open spaces.
- Providing shade and natural cooling in public areas through green walls, trees and soil moisture.
- Balancing economic, environmental and social considerations.

Water Sensitive Opportunities

Identified water sensitive opportunities associated with using water'-links to connect people and place include:

- Leverage the existing water bodies (Canning River, urban streams and compensating basins) to provide a regionally unique identity and provide a water-based narrative for the precinct.
- Create a high quality linear park network based around existing water elements to provide active and passive recreational opportunities for current and new residents. Create better connections (for residents, commuters, wildlife) to the Threatened Ecological Community, Coker Park and Canning River.
- Incorporate contextual understanding of the area including indigenous culture, heritage/multiculturalism, ecological and hydraulic systems, a blue/green corridor and other networks.
- Convey the 'local water story' through the public realm, by enhancing opportunities for people to engage with water and the natural environment. Incorporate 'artwork that moves', reference the Canning River and the water cycle, and provide opportunities for nature based education and play.
- Establish an agreement between the City of Canning and Water Corporation (e.g. memorandum of understanding) to address design, implementation and management of the reconceptualised compensating basins and urban streams.
- Utilise native / endemic plant species.
- Consider how multifunctional assets are represented in the structure plan and town plan.

Contribution to Canning City Centre Place Values

The contribution of these water sensitive opportunities to the place values are summarised below.

Connected

- Water links (blue and green corridors), together with quality open space, support physical and social connection.
- The expression of water in the landscape supports people's connection to nature and place, and provides opportunities for celebration.

Accessible

- Water-links support the provision of 'fresh, green and open meeting places' through creation of green and blue corridors and nodes.
- Connected green and blue corridors support ease of movement throughout the precinct.

Resilient

- Fit-for-purpose use of water is used to maintain a healthy high-quality urban landscape in a drying climate.
- Blue and green corridors incorporating multi-functional compensating basins and living streams contribute to improved urban landscapes.

Vital

- A vibrant, engaging and attractive public realm and associated positive investment climate is created through innovative use of water in the landscape.

Re-energised

- Blue and green corridors and nodes provide opportunities for people to engage, to linger and to enjoy.

Location 1. Cannington Railway Station Precinct

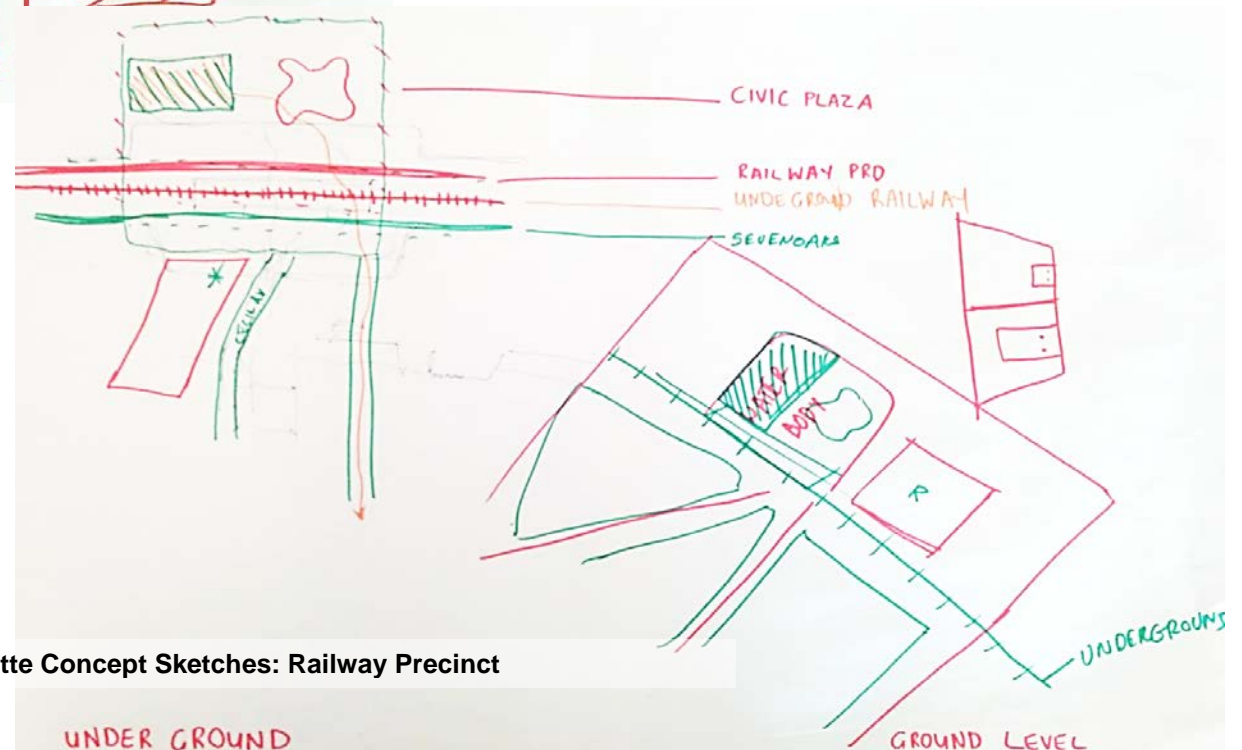
Station Precinct Aspirations

The redeveloped railway station is tangibly linked and associated with Canning City Centre with improved connectivity between East Cannington and the city centre.

The precinct incorporates a high-quality linear park celebrating the presence of water while creating active and passive recreational opportunities for existing and new residents. Design approaches draw on the natural environment and natural processes, and the use of local flora and fauna is encouraged.

Planning and Design Considerations

- The upgraded / redeveloped railway station needs to engage and connect with the new city centre and Carousel shopping centre.
- The distinct identities of the areas north and south of the railway line need to be recognised and referenced in the railway station upgrade / redevelopment.
- The connection between the areas north and south of the railway line needs to be improved, as does the safety and accessibility of the station for local community.
- Investigate the potential for on-site water treatment, and temporary flood storage / conveyance at the adjacent Railway Parade compensating basin.



Design Charrette Concept Sketches: Railway Precinct

Cannington Railway Station Precinct

Water Sensitive Opportunities

- Modify (extend) the compensating basin located to the north of the railway station to make it more visible / accessible, and redesign it to provide multiple community and environmental benefits.
- Improve the link between the railway station, Lake Street, the Threatened Ecological Community and Canning River through the use of trees (shade, wayfinding, etc.).
- Provide environmental education (e.g. awareness and functionality of water bodies).
- Investigate water treatment and fit-for-purpose reuse within the railway precinct.
- Incorporate private and public open space areas for residents and workers to linger / have lunch.

Other Opportunities

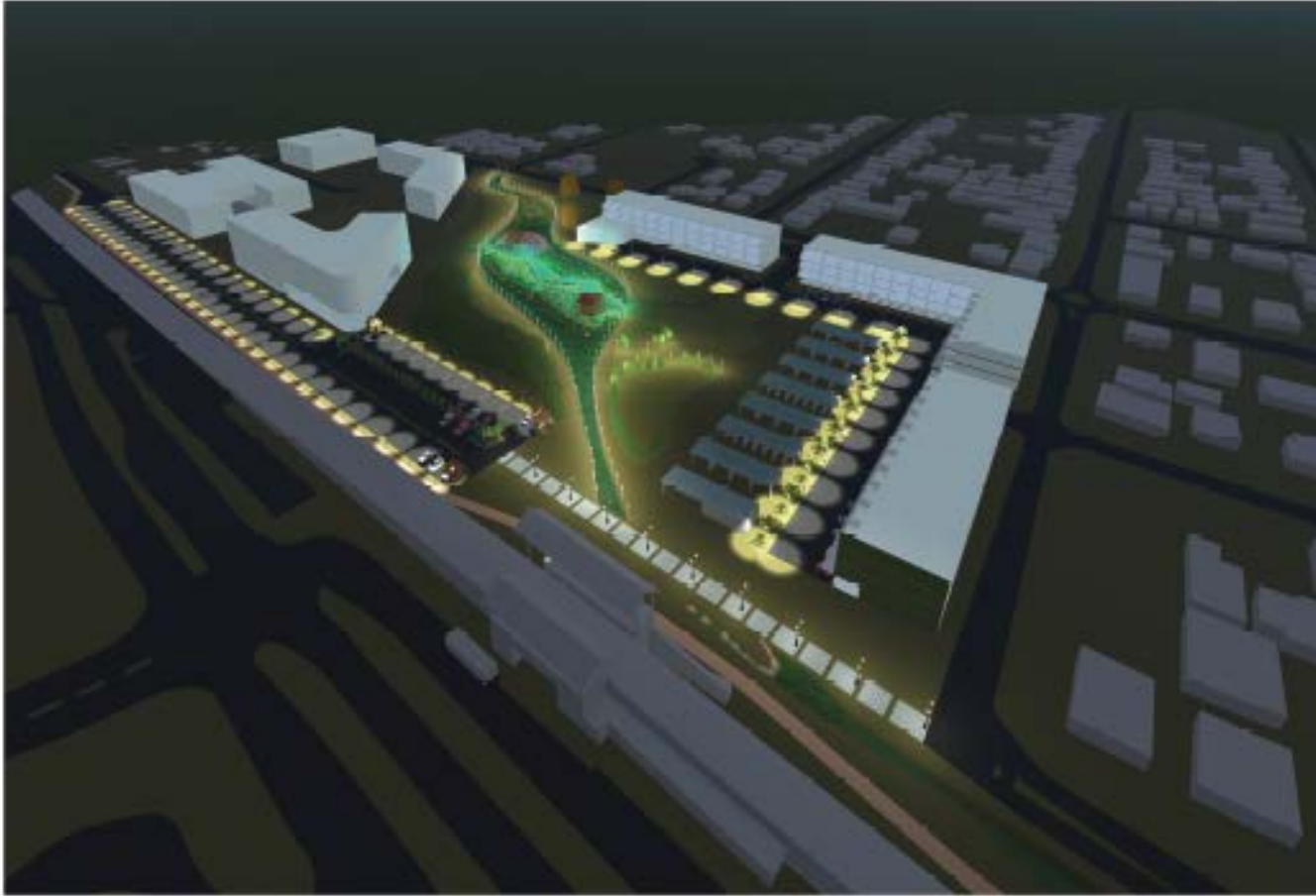
- Explore opportunities (and delivery pathways) for the upgraded railway station to become a gateway / landmark building for Cannington.
- Utilise the redevelopment of the railway station to catalyse redevelopment of the area to the immediate north of the railway.
- Incorporate a laneway bazar / promenade in the upgrade of the railway station.
- Incorporate bike storage and/or a public bike rental node in the railway station upgrade.

A selection of railway precinct urban design concepts developed as part of the UWA urban design studio are included on the following pages. This location was not investigated as part of the UWA engineering design project.

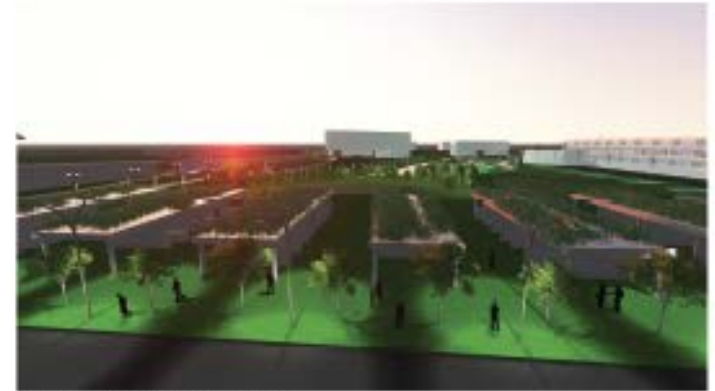


Railway Precinct Urban Design Concepts: Alwin Jhuboo, Master of Architecture, UWA (2015)

This urban design concept explores the relocation of a compensating basin and its integration into a new park adjacent to Cannington Railway Station. The park also incorporates productive landscapes and opportunities for commerce, and creates a stronger link between the areas north and south of the railway line.



NIGHT BIRD EYE VIEW INTO PROPOSED SPACE



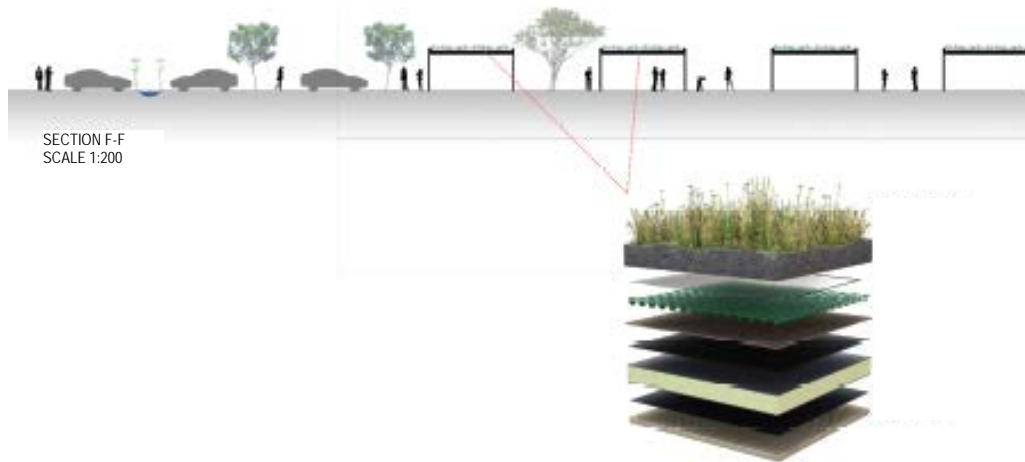
MARKET WITH ROOF TOP VEGETATION



VIEW INTO PATHWAY ON MAIN ISLAND



SECTION E-E
SCALE 1:200



SECTION F-F
SCALE 1:200



VIEW INTO FUTURE MARKET

Location 2. Cecil Avenue (Sevenoaks Street to Albany Highway)

Aspiration

Cecil Avenue is designed at a human scale, connecting people with nature and water. It links the railway station and the Canning River and provides places for people to linger and engage.

Planning and design considerations

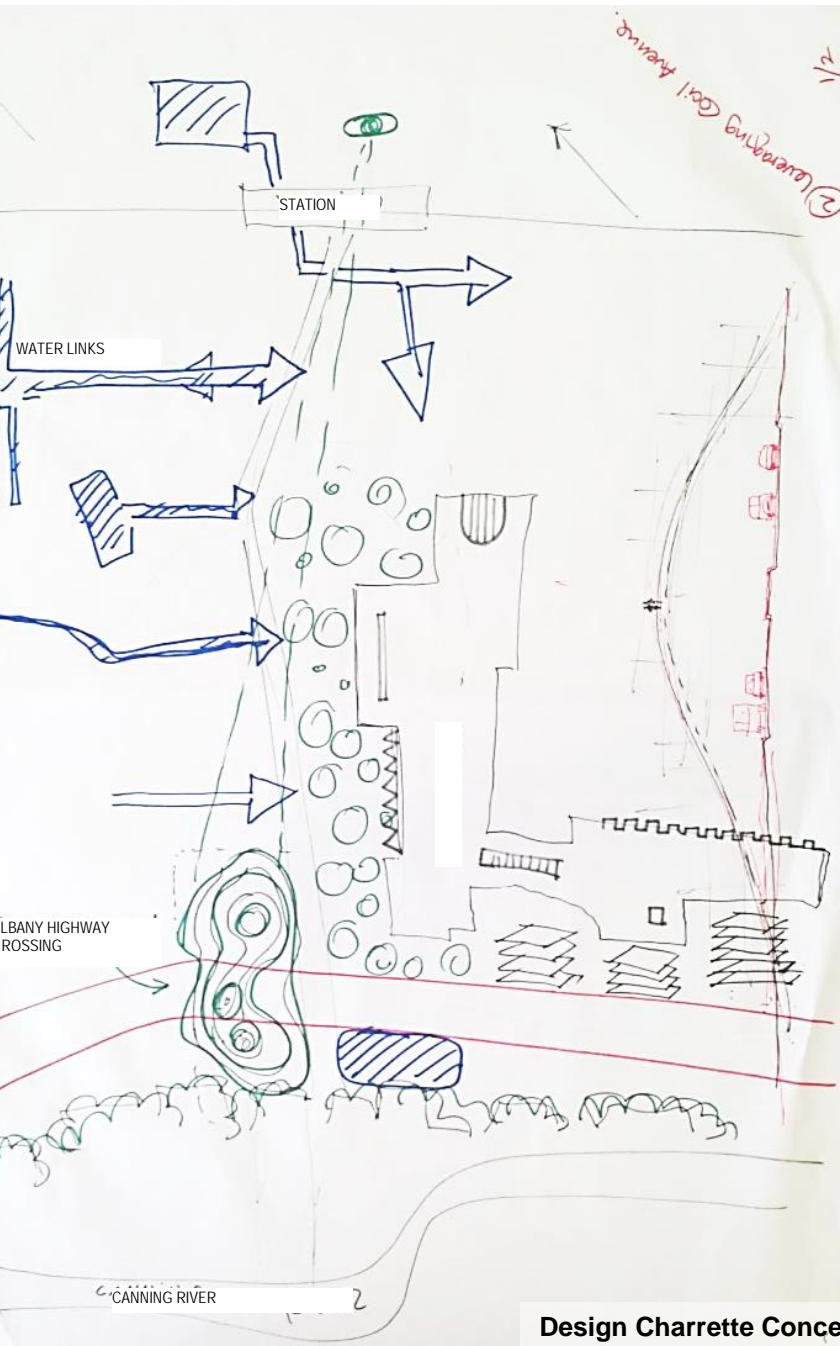
- Incorporating the 'local water story' along the avenue (and in public squares), incorporating Aboriginal and post-colonisation history.
- Managing road runoff from small rainfall events to improve water quality while also providing passive watering of vegetation.
- Providing space mid-block for vegetation.
- Leveraging latest research to inform the location and orientation of green walls and street trees for urban heat mitigation.
- Providing equitable and safe passage for all modes of transport along the full length of Cecil Avenue.
- Managing building overshadowing, particularly on the south-west side of Cecil Avenue (all seasons, all times).
- Incorporating flexible / multi-purpose spaces, and places to linger.
- Incentivising permeable built form that creates multifaceted interactions between internal and external spaces.

Water Sensitive Opportunities

- Create a green/blue corridor from Leisureplex to Cecil Square via Lake Street stream.
- Incorporate central median swales / biofilters and biofilter pockets along Cecil Avenue.
- Targeted tree planting / improved ecology along Cecil Avenue.
- Incorporate of permeable paving.
- Provide an alternate (slow) route from the railway station to Carousel via the enhanced Lake Street urban stream.

Other Opportunities

- Screening / place making.
- Provide cyclist / pedestrian priority.
- Transit (bus/train/light rail).
- Divert traffic from Cecil Ave to Wharf St.



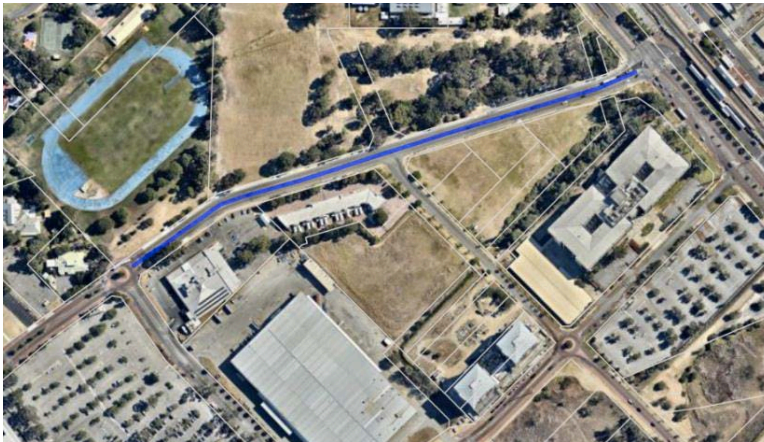
Design Charrette Concept Sketches: Cecil Avenue

Cecil Avenue (Sevenoaks Street to Albany Highway)

The UWA engineering design project explored a number of the water sensitive opportunities identified in the design charrette (refer page 18) with a focus on reducing nutrient loads entering the Canning River via runoff from Cecil Avenue and adjacent land. Other considerations included flow conveyance requirements, the influence of local soil conditions on infiltration, and the incorporation of native vegetation to improve local micro-climate and encourage active transport (walking and cycling).

Concept designs were developed for a central median vegetated swale along the northern section of Cecil Avenue (Sevenoaks Street to Carousel Road) and streetscape biofiltration systems (stormwater planter boxes) along its length.

Further information on these initiatives for Cecil Avenue is available in the UWA and City of Canning report *Water Sensitive Urban Design Considerations in the City of Canning* (2016).



Proposed Cecil Avenue swale location, NearMap 2016 (UWA and City of Canning, 2016)



Stormwater planter boxes, SW 12th Avenue, Portland Oregon (UWA and City of Canning, 2016)



Cecil Avenue swale and stormwater planter box concept (UWA and City of Canning, 2016)

The following three pages illustrate a selection of urban design concepts for Cecil Avenue and the adjacent Coker Park developed as part of the UWA urban design studio.



Urban Design Concepts: Anna Mustard, Master of Architecture, UWA (2015)

The design concept focuses on Cecil Avenue and Coker Park with an exploration of green-blue corridors and the interface between public and private spaces.



Cecil Avenue Urban Design Concepts: Anna Mustard, Master of Architecture, UWA (2015)

WESTERN ELEVATION CORNER



Location 3. Cecil Square

Aspiration

Cecil Square is designed at a human scale, connecting with nature and water. It is a key node along Cecil Avenue (linking the railway station and the Canning River) and provides a place for people to linger and engage.

Planning and Design Considerations

- Minimising impervious surfaces to mimic the natural water cycle.
- Incorporating flexible / multi-purpose spaces, and places to linger.
- Providing facilities and services (e.g. power, water) for pop-up markets / events.

Water Sensitive Opportunities

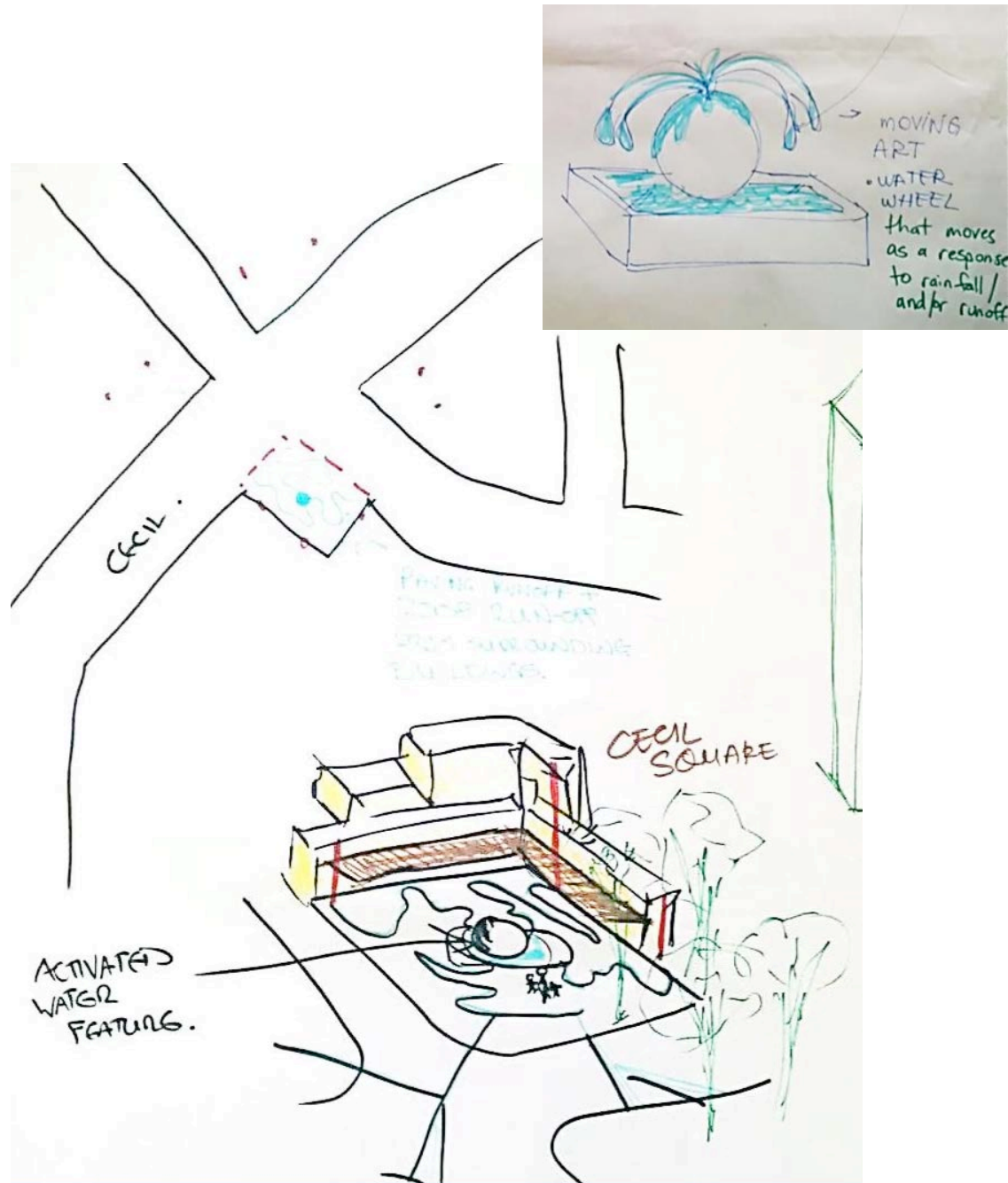
- Use pervious paving.
- Capture roof runoff from surrounding buildings (stored below the square) to activate a multifunctional ephemeral water feature.
- Integrated, passive solar shading (not permanent shade).

Other Opportunities

- Plan for and incentivise diverse food and drink outlets (rather than retail) that reflect the cultural and socio-economic diversity of local communities.
- Include fixing points on adjacent buildings for temporary decorations.

The UWA engineering design project reflected on Cecil Square from a water sensitive perspective. Opportunities for including permeable paving, native vegetation and passive water treatment systems (e.g. swales) were considered, as was the potential for Cecil Square to reflect the environmental values and initiatives of the City of Canning. The project identified that the benefits of a water feature in the square (amenity and microclimate) would need to be weighed-up against energy and water use (UWA and City of Canning, 2016).

Sketches from the design charrette are shown on the following page, with Cecil Square urban design concepts developed as part of the UWA urban design studio included on subsequent pages.



Design Charrette Concept Sketches: Cecil Square



Meet.

A civic square in the heart of the Canning city centre provides the perfect place for those lunch dates or catch ups with old friends. The flowing water theme conveys tranquillity, and reminds the public of our necessary reliance on water as a resource. The water jets are a place for children to play, while their parents sit and chat at a café or explore the gallery nearby.

Connect.

The hybrid concept incorporates civic functions and commercial activities, a hub for interaction between people of all social groups and income levels. The square will be a hive of activity both day and night, with cafes, restaurants and pop-up shops offering something for everyone. The large auditorium is a place for events which will draw crowds from all around the region. A gallery showcases the best work from the community, building connections and interactions within Canning residents, and providing a place for residents to connect with art and culture from across the country and the world. The square is flexible and inviting, and the possibilities for community building events and cultural celebration are endless.

Learn.

The square will feature a multicultural centre to cater to the cultural diversity of the Canning residents, bringing together young and old to celebrate the traditions within these cultures. This will be a place for teaching and learning, a place for the wider community to embrace the invaluable diversity of the Canning.

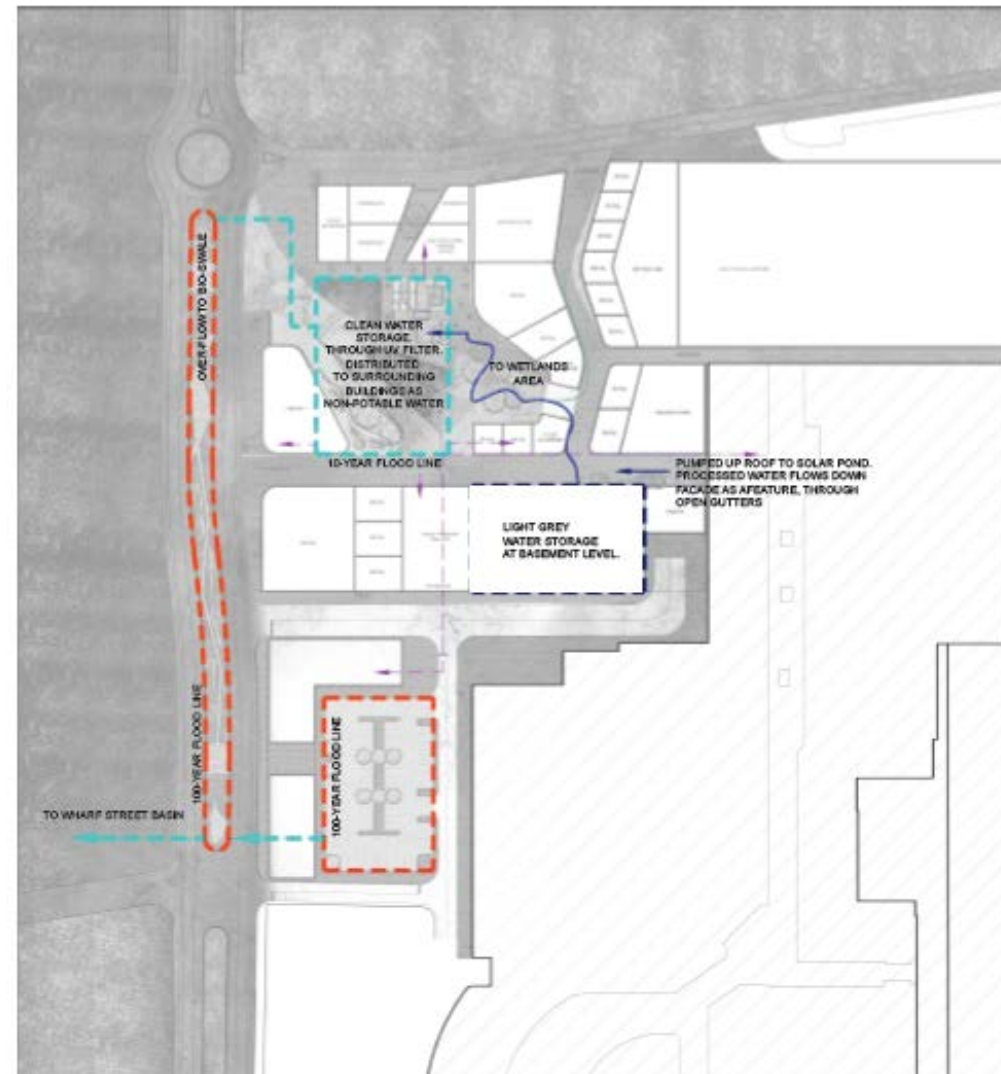
The library meets another anticipated need in the community. Libraries are traditionally places of quiet relaxation, historical appreciation, and now, in the twenty-first century, a public hub of connection and technology. A good library gives the public an invaluable gift; the opportunity to connect to their community and its history, and the wider world.

Cecil Square Urban Design Concepts: Kevin Cheung Ho Yan, Master of Architecture, UWA (2015)

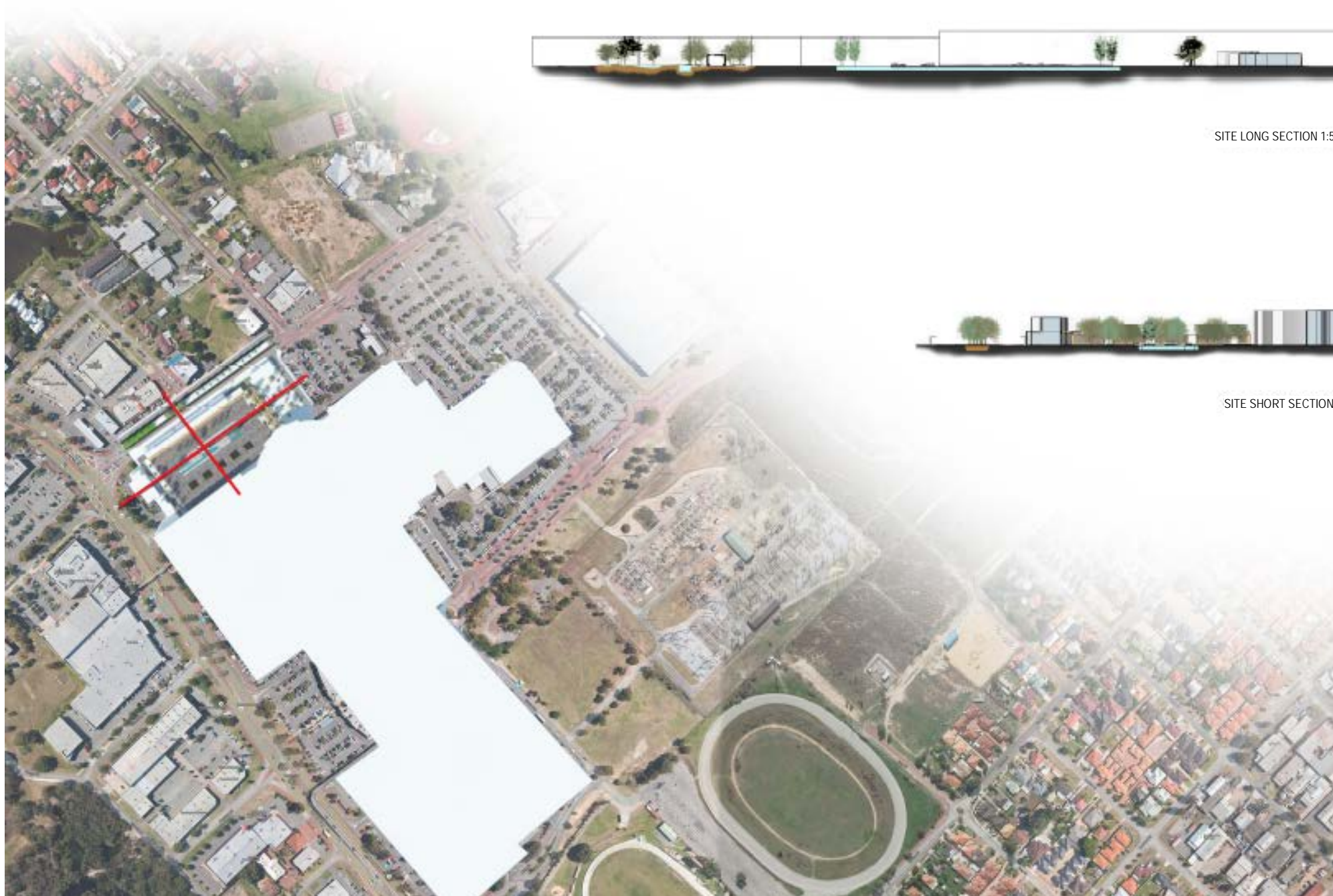
This urban design concept explores how water and vegetation could be used in Cecil Square to create a place to meet, connect and learn.



» Perspective



SITE PLAN 1:2000

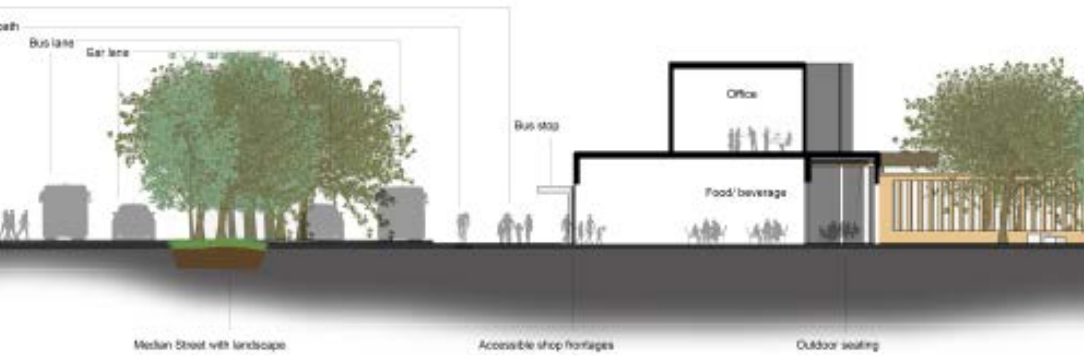


SITE LONG SECTION 1:5

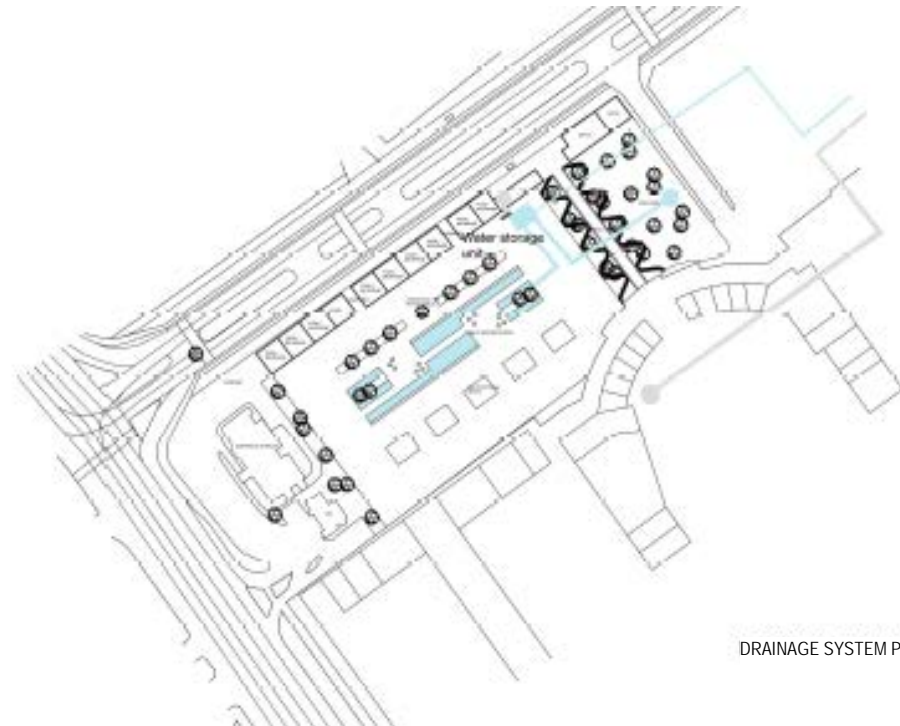
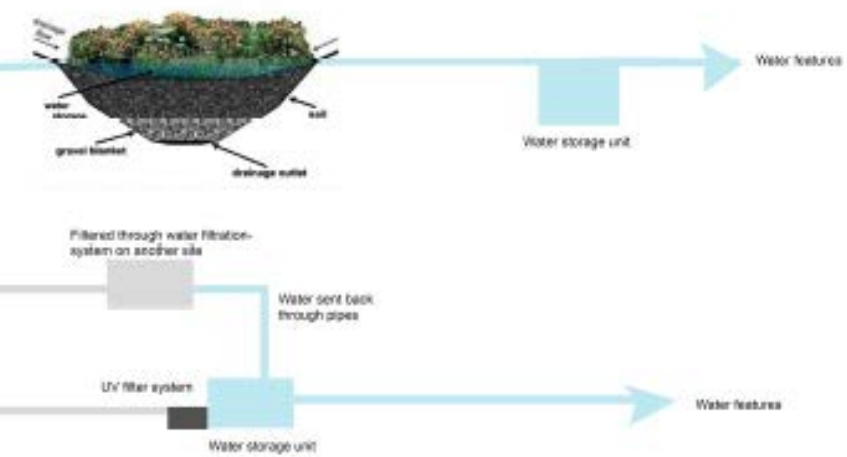
SITE SHORT SECTION

Cecil Square Urban Design Concepts: Ming Chen Kan, Master of Architecture, UWA (2015)

This urban design concept explores an alternate location for Cecil Square that connects public and private open space through the use of vegetation and linear water features.



WATER SENSITIVE URBAN DESIGN SYSTEMS



DRAINAGE SYSTEM PLAN

Location 4. Albany Highway to the Canning River

Aspirations

Connect Cecil Avenue to the Canning River along Richmond Street and Carden Drive.

A key focus for this location was Albany Highway as a major barrier to connectivity between Cecil Avenue and the Canning River.

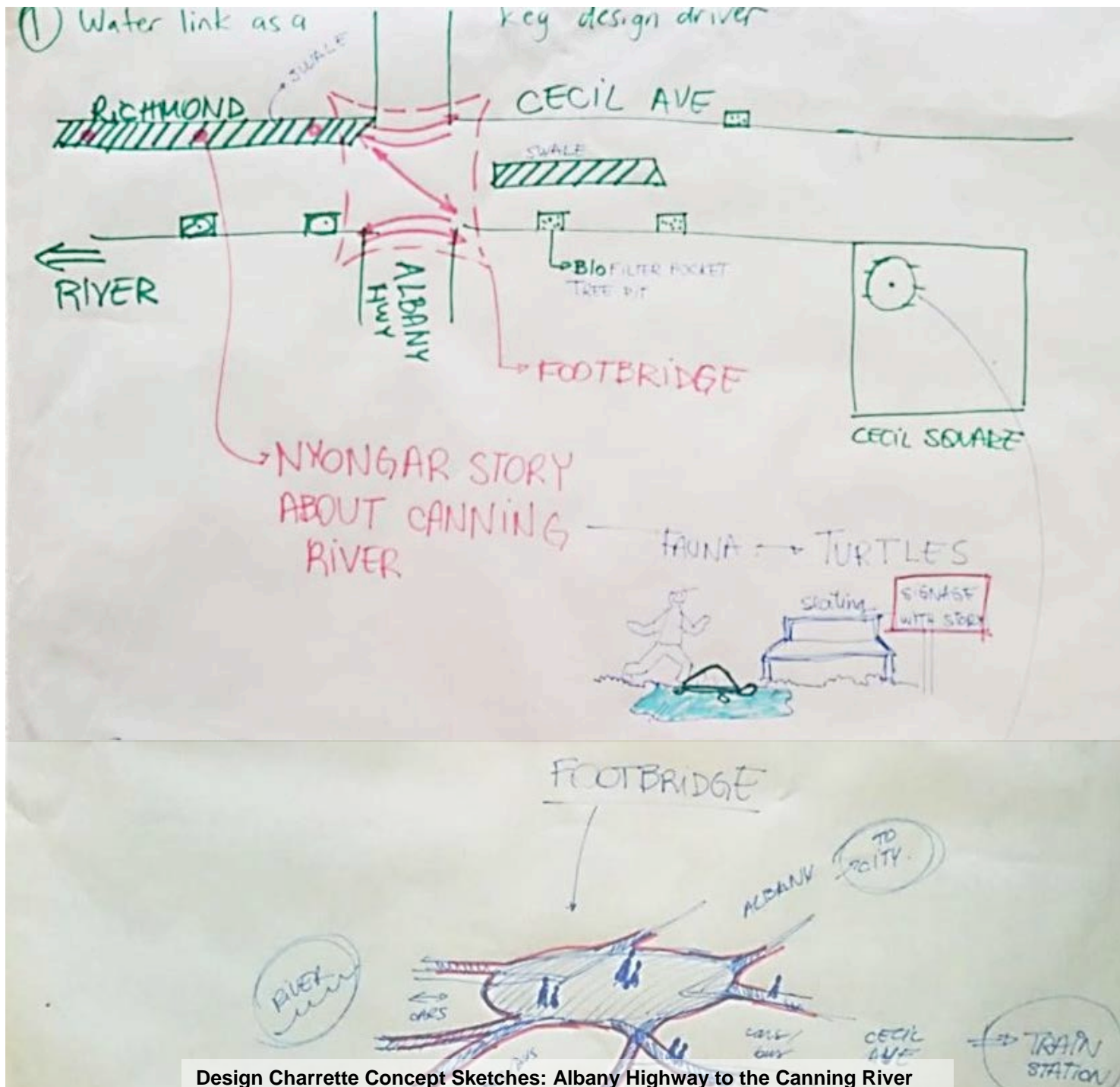
Planning and Design Considerations

- Understanding the needs of the local community / users.
- Express water as a valued element in the landscape.
- Shade public areas.
- Create safe spaces through activation and lighting.
- The sewerage treatment station (on Richmond Street) has a 150 metre environmental buffer.

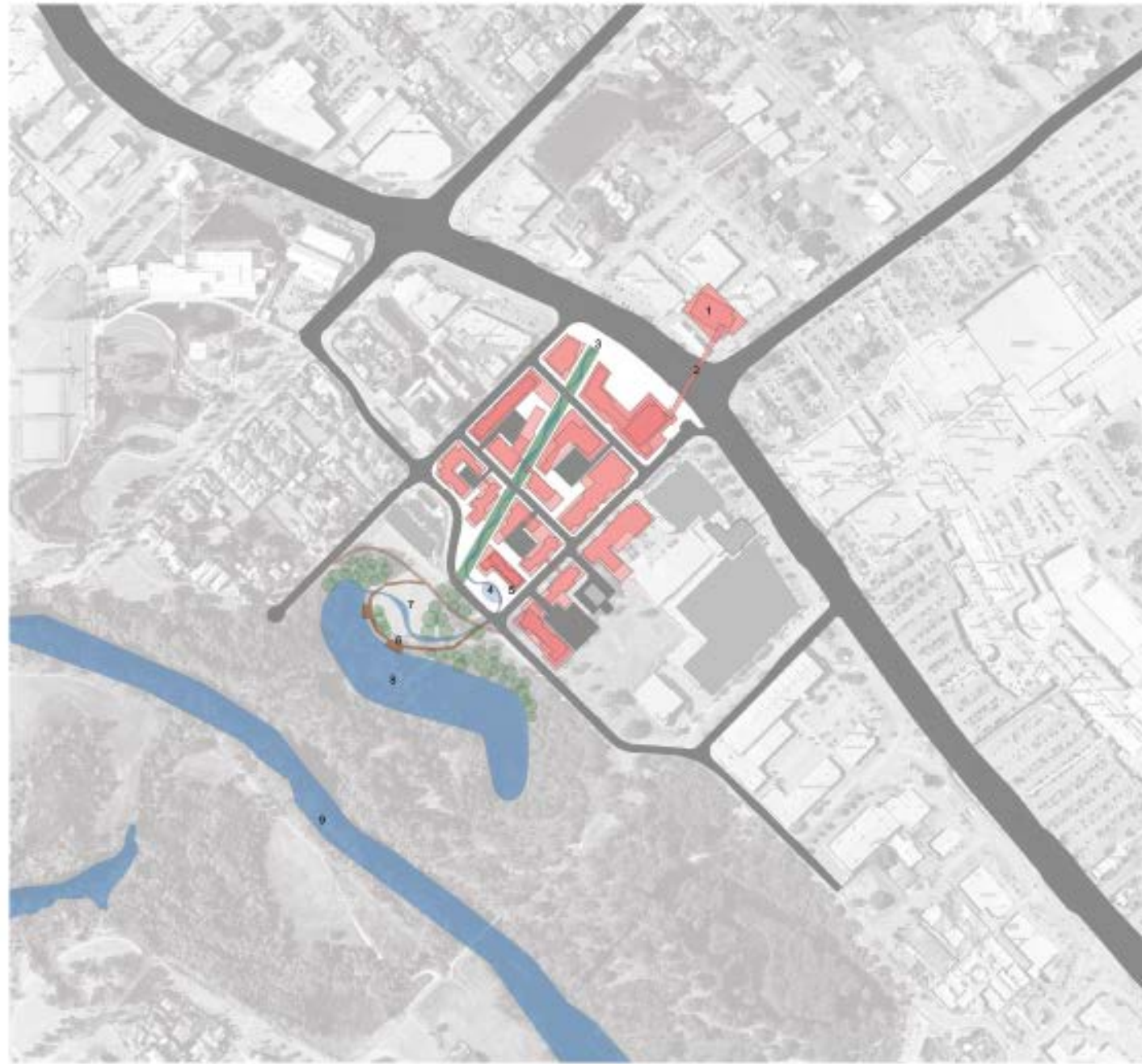
Water Sensitive Opportunities

- Create a green (living) walkway across Albany Highway to link Cecil Avenue to the Canning River, incorporating shade and multiple access modes (e.g. stairs and ramp).
- Create a story while celebrating water along the way and specially in public squares.

Sketched from the design charrette are included on the following page, with concept designs developed by the UWA urban design studio on the subsequent two pages. This location was not investigated as part of the UWA engineering design project.



Design Charrette Concept Sketches: Albany Highway to the Canning River

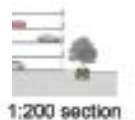


1. landmark building
2. pedestrian bridge
3. urban stream / linear park
4. water playground / amphitheatre
5. dining precinct
6. boardwalk & wetlands viewing gallery
7. water course
8. wetland
9. canning river

Albany Hwy to Canning River Urban Design Concepts:
Anthony Pratama, Master of Architecture, UWA (2015)



ALBANY HIGHWAY CROSSING



Location 5. Compensating Basins

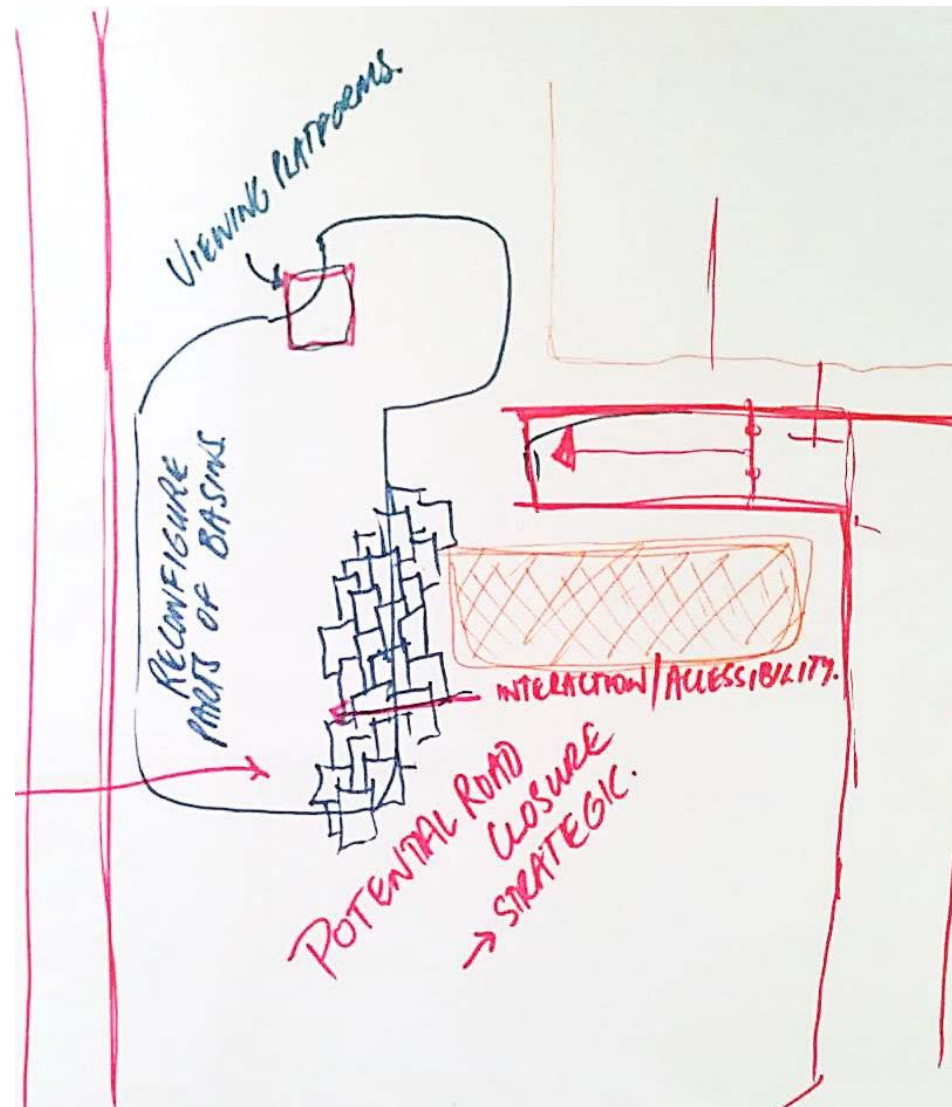
Aspirations

To reconceptualise and redesign compensating basins to be accessible, and to provide multiple benefits in addition to performing their primary flood risk management function.

The Wharf Street compensating basin was used as a basis for discussing considerations and opportunities for compensating basins within the Canning City Centre precinct more generally.

Design Considerations

- Provide function AND form.
- Primary function: flood conveyance and temporary storage (currently the singular function, but typically only required a few days a year).
- Secondary functions:
 - amenity (safe and accessible; maintain visible water)
 - recreation/leisure/interaction with nature
 - wildlife habitat
 - education opportunities (community connection)
 - local summertime heat mitigation (via irrigated vegetation).
- Reflect the ephemerality / seasonality of rainfall and associated water detention through the design of basins.



Design Charrette Concept Sketches: Wharf Street Compensating Basin

Compensating Basins

Water Sensitive Opportunities

- Retrofit compensating basins to provide multiple services / benefits (rather than singular purpose).
- Reconceptualise (redesign) compensating basins to encourage a more positive community association.
- Develop a climate responsive (seasonal / long term) design, and specify plants/materials appropriate for the climate.
- Provide connections between (retrofitted) compensating basins for local community, commuters, wildlife.
- Utilise Coker Park for water retention, thereby reducing pressure on the Wharf Street compensating basin.
- Reflect the concept of green/blue corridors through surrounding buildings and systems.
- Recreation space for community: picnic, lingering, education/information, interaction with water.

The UWA engineering design project explored two compensating basins with a high potential for redevelopment to improved water treatment and public amenity while maintaining or improving the current flood risk mitigation levels. Concept designs for Renou Street and Wharf Street basins considered water quality and flood management, public health and safety, and maintenance. An indicative estimate of capital and maintenance costs associated with the redevelopment of both basins was also undertaken.

Design concepts included removal of accumulated sediment, re-profiling the basins and banks where feasible, incorporating aquatic and terrestrial vegetation, and providing public access where safety considerations could be adequately addressed. Proposed redevelopment plans for both basins are included on the following page. More detailed information on the proposed designs is included in *Water Sensitive Urban Design Considerations in the City of Canning* (UWA and City of Canning, 2016).

Design concepts developed as part of the UWA urban design studio are included on subsequent pages.



Wharf Street basin (top) and proposed redevelopment plan (bottom) (UWA and City of Canning, 2016)

Renou Street basin (top) and proposed redevelopment (bottom) (UWA and City of Canning, 2016)



Location Plan 1:20000

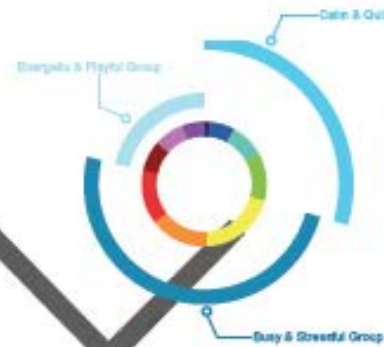
Canning City Centre, as a Strategic Metropolitan Centre, is not a vibrant, attractive or user-friendly place. It is a car-dominated environment with most activities located in the Westfield Carousel Shopping Centre and bulky goods retail premises along Albany Highway. High quality urban development is lacking and large parcels of undeveloped land, mostly near the train station contribute to its lack of intensity, diversity and place identity.

The broad scope of the Canning City Centre strategy is to regenerate the Canning City Centre and realise its potential as a Strategic Metropolitan Centre in Perth. The focus is to create a city centre that is vibrant and offers a range of activities and options to its users, who may come from areas beyond the Canning Local Government Area.



Concept Diagram

Urban living stream - ecological link that connects human, flora and fauna. It can be experienced through senses: see, hear, smell, touch, taste and feel.



City of Canning Community Profile:

- Babies & pre-schoolers (0-4)
- Primary schoolers (5-11)
- Secondary schoolers (12-17)
- Tertiary education & independence (18-24)
- Young workforce (25-34)
- Parents & homebuilders (35-49)
- Older workers & pre-retirees (50-59)
- Empty nesters & retirees (60-69)
- Seniors (70-84)
- Elderly aged (85 & over)



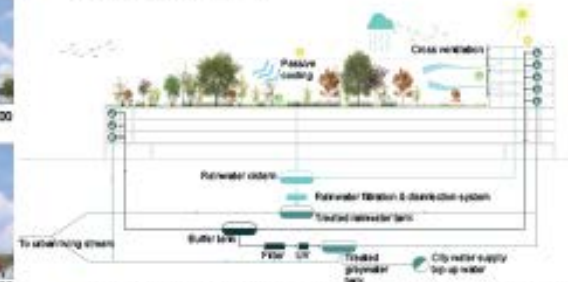
Rainforest pavilion by GUN Architects



The Great Street Games by KMA



Water Harvesting System Diagram



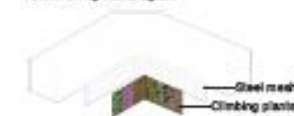
- 1 Solar thermal panels heat 24% of hot water used in the building, offsetting natural gas use.
- 2 Water-efficient plumbing fixtures help reduce water use by more than 44%. Rainwater re-use in toilet flushing on the apartment floors, reduces use of city water.
- 3 Roof gardens clean, detain and filter rainwater and significantly reduce roof temperature in warmer months.

Recommended Rooftop Species:

Food production:	Potatoes
Carrots	Capelouns
Tomatoes	Beans
Onions	Asian Vegetables
Cabbage	English Spinach
Cucumbers	Spring Onion
Sweet Potato	Beetroot
Leek	

Succulents (require little soil and little moisture):	Dragon Tree
	Udora Plant
	Pig Face
	Semio Serpens
	Sedums
	Kangaroo Paw
	Little Pal
	Chalk Sticks
	Birthday Candles

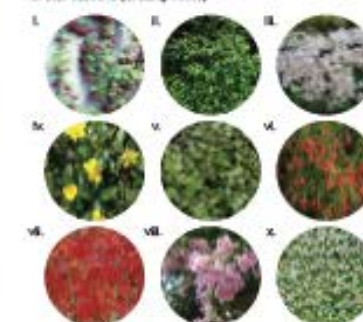
Green Living Wall Diagram



The green living wall provides shade to the building in summer. In winter, the wall drops its leaves, allowing sunlight into the building interior. Climbing plants of various colours stimulate a lively look and feel as well as create a city's distinctive identity for the City of Canning.

Recommended Climbing Species for Green Living Wall:

- Chocolate Vine (Purple)
- Kangaroo Vine (Green)
- Evergreen Clematis (White)
- Golden Guinea Vine (Yellow)
- Maidenhair Vine (Green)
- Dusty Coral Paw Vine (Red)
- Virginia Creeper (Green, Yellow, Purple)
- Pin Trumpet Vine (Pink)
- Star Jasmine (Creamy White)



Location 6. Lake Street Urban Stream

Aspiration

Create a living stream that mimics nature, provides drainage and habitat, and engages and inspires the community.

Planning and design considerations

Primary considerations:

- Mimic natural processes.
- Provide flood mitigation and drainage functions.
- Prioritise community engagement.

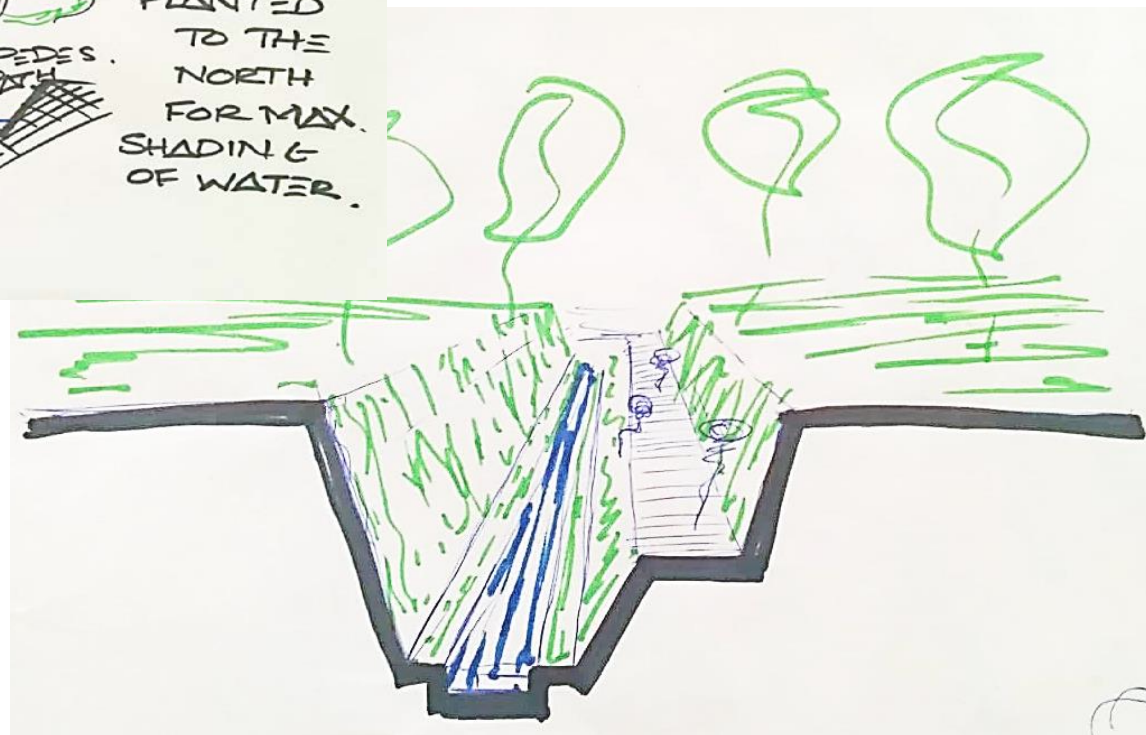
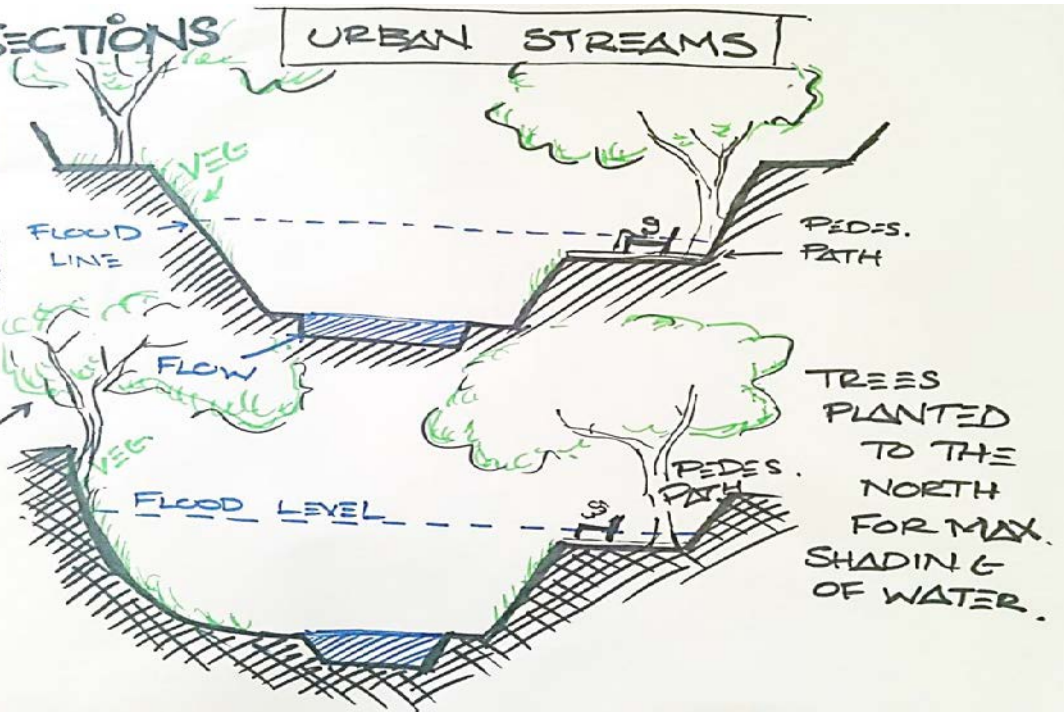
Other considerations:

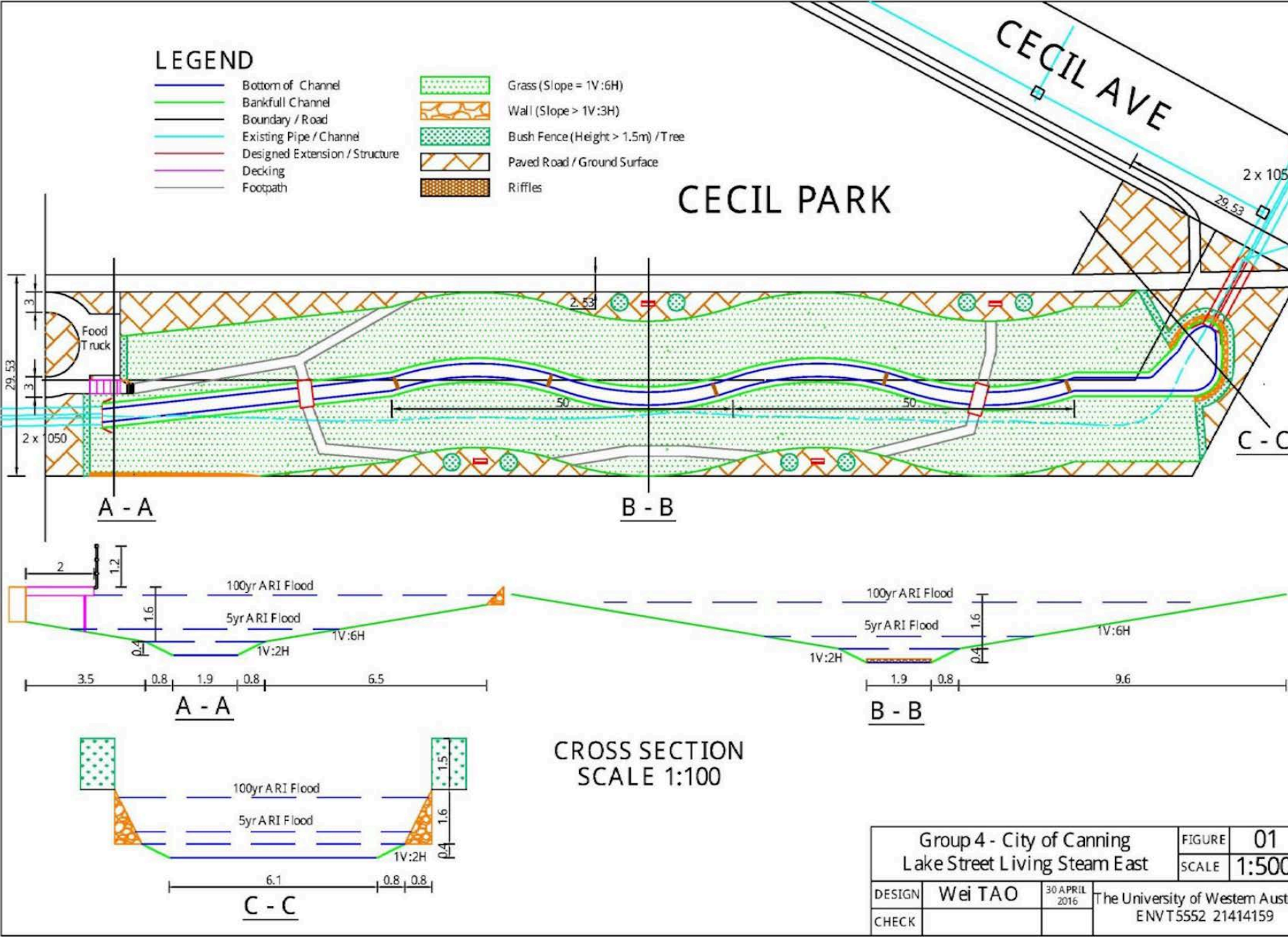
- Designing for minimal maintenance.
- Providing flow control (longitudinal gradient) and 10 year ARI flood mitigation capacity.
- Addressing public safety considerations (including side slopes and vegetation).
- Incorporating Indigenous plant species.
- Providing education and interpretation opportunities.
- Consideration of options for full or partial flow conveyance through the piped section.
- Identify and address water quality indicators.
- Providing a (more) tangible link to the Canning River.
- Providing Accessible walkways.

Water Sensitive Opportunities

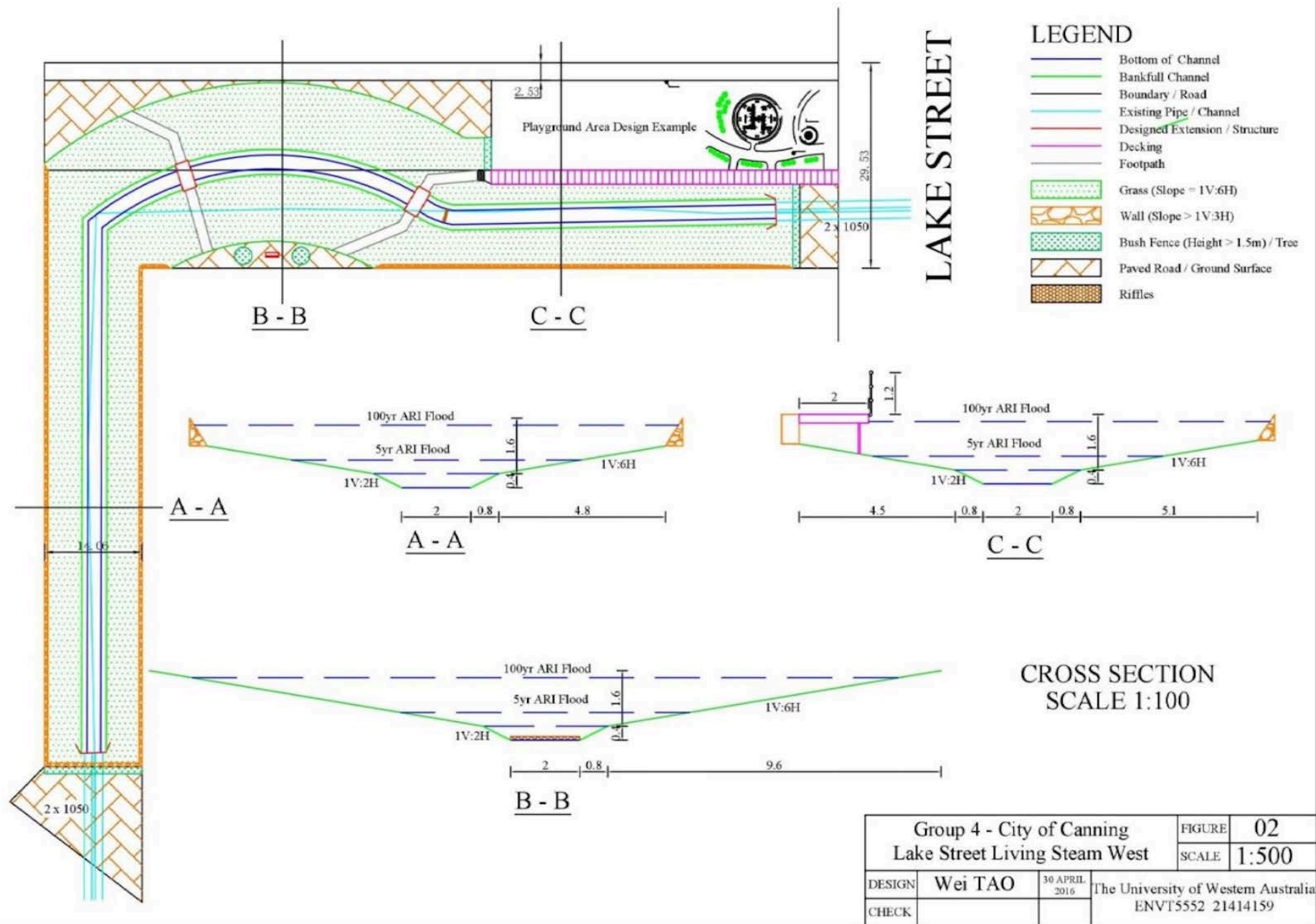
- Maximise water treatment through slow, continuous flow.
- Inspire people to interact with water (e.g. riffles encourage children to play while also oxygenating water).
- Utilise the urban stream to facilitate strong community engagement and education.

A conceptual design for Lake Street Urban Stream was developed as part of the UWA engineering design project (UWA and City of Canning, 2016). The design considered flow conveyance, water quality management, vegetation (including weed management), mosquito control and public access and amenity. Engineering details are available in *Water Sensitive Urban Design Considerations in the City of Canning* (UWA and City of Canning, 2016), with engineering plans and sections included in this report after the design charrette sketches on the following page.





Lake Street Urban Stream – Cecil Avenue to Lake St (UWA and City of Canning, 2016)



Lake Street Urban Stream – Lake St to Grose Avenue (UWA and City of Canning, 2016)

Lake Street Urban Stream

Lake Street Urban Stream could directly contribute to the place values identified in the Canning City Centre vision document (City of Canning, 2013) as summarised below.

Connected

- Support physical and social connection (current and future communities).
- Secondary link between the railway station and Cecil Square.
- Provide connection between local residents and businesses.

Accessible

- Incorporate walking / cycling paths and ambulant access to / direct contact with water (via accessible bank slopes).
- Focus on safety considerations.

Resilient

- Riffles in flow for oxygenation.
- Shade for cooling.
- Use of natural materials (e.g. logs on the banks).
- Use of native plants.

Vital

- Support activation and activity (e.g. walking, sitting, play) and opportunities for engaging community, schools, government.
- Opportunities for active and passive education.
- Connection to other key locations within the precinct (e.g. railway station, Cecil Square).

Re-energised

- A new template for (multifunctional) urban drainage.

Concept designs for Lake Street Urban Stream developed as part of the UWA urban design studio are shown on the following pages.



Urban Stream Design Concepts: Sami Joer, Master of Architecture, UWA (2015)



Wet Condition - 8:22am, 18th July 12°C



Dry Condition - 1:09pm, 7th January 40°C



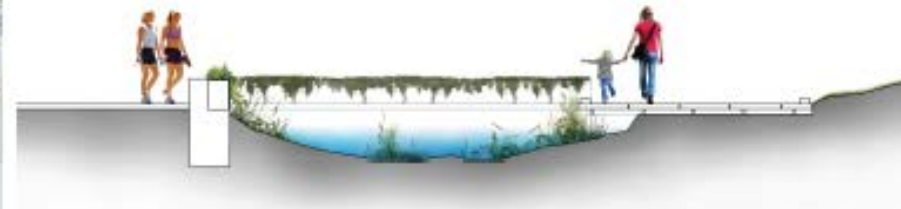
Normal Condition - 3:37pm, 30th October 28°C



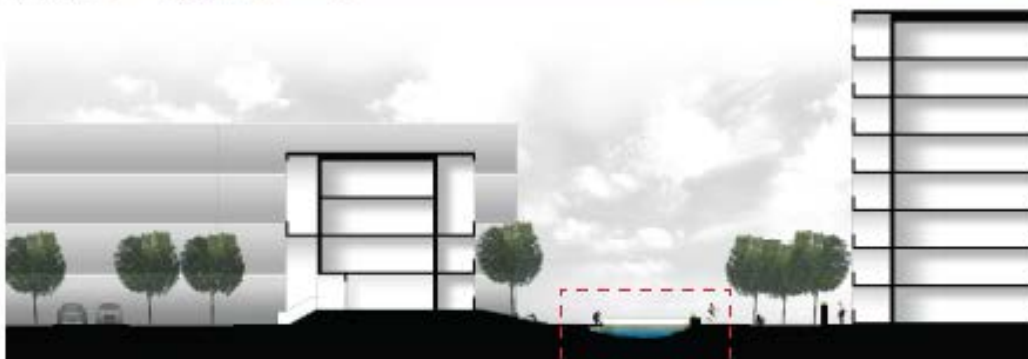
Section E 1:1000



Section F 1:1000



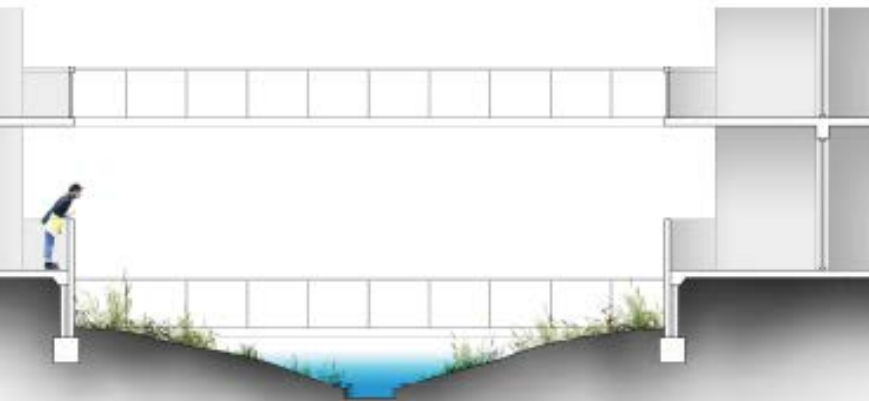
Lake Street Drain Detail 1:50



SECTION G 1:300



SECTION H 1:300



1:50



Located between two 4 storey apartment blocks, this grey and stormwater drain filters the water through natural processes before releasing into the Lake Street drain and onto the Canning River. This provides a natural break for the residents from the urban environment.



Shadow Diagram

Noon, June 21st



Foliage Diagram

Total GFA of the site 70 370m²
Total Green Space on ground level 18 067m²
23%
Total Green Space (including green roof and podium level gardens) 23 617m²
34%



Water Diagram

64L of reusable greywater per person per day
20L go back into apartment for toilet flushing = 64 L/person/day
Greywater is used for 'daylighting' the drainage in urban streams and reconnection of green space.

The urban streams create a series of place and an appealing visual point of interest as well as a filtration/cleaning system. The water comes from the Lake Street drain, greywater from surrounding buildings and stormwater. After it passes through this site it will drain into the Canning River.

TYPE	SOURCE	L/person/day
Blackwater	Toilet	20
Greywater	Shower	63
	Hand Basin	6
	Washing Machine	13
	Laundry Tap	2
Other	Kitchen Tap	12
	Dishwasher	5
TOTAL WASTEWATER		121
TOTAL REUSABLE WATER		64



Internal Trees

Local species preferred
Not too intrusive, invasive roots can damage paving and roads
Small to medium sized trees
5 - 20m



Gungah
4 - 6m



Cotton Tree
3 - 6m



Plum pine
8 - 10m



WA Peppermint
5 - 15m



Common Olive Tree
5 - 10m



Street Trees

Local species preferred
Requires clear trunk to maintain sight lines through the road
Sufficient canopy coverage
10 - 12m



WA Peppermint
5 - 15m



Plum Pine
8 - 10m



Spotted Gum
15 - 25m



Park Trees

Local species preferred
Focus on shade
Deciduous trees can negatively affect water quality
Variation in colour is preferred
Small to large trees
5 - 40m



Jacaranda
10 - 20m



Gungah
4 - 6m



Turrit
15 - 40m



Port Jackson Fig
15 - 20m



Flame Tree
15 - 20m

Tree Selection



Precedence

Conclusions

Supporting Research Knowledge

Research knowledge developed by the CRC for Water Sensitive Cities has informed aspirations and opportunities identified through the design charrette and design studio, and can support the further development of this work. Relevant publications are listed below.

Water sensitive context for Perth

Shaping Perth as a Water Sensitive City: Outcomes and perspectives from a participatory process to develop a vision and strategic transition framework (Rogers *et al.* 2015).

Identifying priority areas for action to support water sensitivity

Moving toward Water Sensitive Cities: A guidance manual for strategists and policy makers (Brown *et al.* 2016).

Analysis of local heat vulnerability

A spatial vulnerability analysis of urban populations to extreme heat events in Melbourne Australia. Victorian Department of Health, Melbourne (Loughnan *et al.* 2009).

Green infrastructure prioritisation

Planning for cooler cities: A framework to prioritise green infrastructure to mitigate high temperatures in urban landscapes (Norton *et al.* 2015).

The value of living streams

The value of restoring urban drains to living streams (Polyakov *et al.* 2016).

Living Stream Performance

Performance assessment the of Anvil Way Compensation Basin living stream: 2004-2013 (Ruibal-Conti *et al.* 2015).

Water-sensitive project prioritisation

Ranking projects for water-sensitive cities: a practical guide (Pannell 2016).

Summary of CRCWSC research to date

Summary of Research Outputs Tranche 1, 2012/13 – 2016/17 (Farrelly *et al.* 2015).

Recommendations

An exploration of the revitalisation of Canning City Centre from a water sensitive perspective has identified a number of opportunities to use water and vegetation to re-energise the city centre with a community heart that is connected, accessible, vital and resilient.

Water and water-links could provide a key design driver for the city-centre revitalisation and contribute substantially to the identified place values.

Ownership and management responsibilities for water-related infrastructure involve a number of government stakeholders. Implementing good governance arrangements and an effective design review processes is therefore necessary to realise the water sensitive aspirations.

Place-based opportunities for incorporating the outcomes of the design charrette and associated design studio into the city-centre revitalisation are summarised below.

1. Cannington Railway Station Precinct

Create a high-quality public open space area to the immediate north of the railway station and improve pedestrian and ecological connectivity between North Cannington, Carousel shopping centre and Canning River. Incorporate a relocated and re-imagined compensating basin within the railway station precinct while also providing opportunities for business and community activities. These initiatives would require multi-organisational collaboration as part of the proposed future station redevelopment.

2. Cecil Avenue (Sevenoaks Street to Albany Highway)

Provide multi-functional connection and continuity between the railway station precinct, Cecil Square / Carousel shopping centre and the Canning River. Incorporate vegetation, water conveyance and treatment along the Cecil Avenue central median to create a green-blue corridor.

3. Cecil Square

Design Cecil Square at a human scale, providing places for people to linger and engage. Incorporate permeable paving and an ephemeral water feature supplied with water from adjacent building roofs and stored below the square.

4. Albany Highway to the Canning River

Improve way-finding and continuity for pedestrians / cyclists between Cecil Avenue and the Canning River along Richmond Street and Carden Drive. Create a green (living) active transport bridge across Albany Highway and provide visual links to the Canning River Regional Park through vegetation along the roads and on adjacent commercial buildings.

5. Compensating Basins

Reconceptualise and redesign compensating basins to be publically accessible and provide multiple benefits in addition to performing their primary flood risk management function.

6. Lake Street Urban Stream

Create a living stream that mimics nature, provides drainage and habitat, and engages and inspires the community. Provide a secondary nature-based link between the railway station and Cecil Square / Carousel shopping centre.

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SERCUL

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About the CRC for Water Sensitive Cities

The CRCWSC is a national research program that brings together inter-disciplinary research and practice expertise spanning physical and social sciences to revolutionise water management in Australia and overseas.

The CRCWSC was established in 2012 to facilitate research and industry partnerships to respond to three critical drivers affecting Australian cities:

- population growth,
- climate change and variability, and
- changing economic conditions.

In collaboration with over 80 research, industry and government partners, the CRCWSC delivers the socio-technical urban water management solutions, capacity-building programs, and industry engagement required to make cities and towns more water sensitive.

About the City of Canning

The City of Canning is located in Perth's south-eastern corridor, approximately 10 kilometres from central Perth and covers a total area of 65 square kilometres. Canning's population was estimated to be over 96,000 people in 2013, and is predicted to increase to approximately 100,000 by 2031.

The original inhabitants and custodians of the Canning area were the Wadjuk Nyungar people. European settlement started in 1829, changing the landscape through farming, market gardening and timber milling. Canning River and its wetlands ('Dyarlgard' in the Nyungar language) are a defining feature of the City of Canning.