

Ideas for the Liverpool Collaboration Area

River Sensitive Liverpool: Cool, Comfortable, Connected

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1. Introduction

Ideas for the Liverpool Collaboration Area

About this document

Water is a key enabler of a more liveable and resilient Liverpool. This project focuses on these water cycle opportunities. It builds upon the Liverpool Place Strategy and the existing collaborative networks of stakeholders who comprise the Liverpool Collaboration Area (LCA).

This project approaches Liverpool from the perspective of creating a water sensitive city. This approach intentionally prioritises water management as a key building block for urban renewal, and differs from conventional approaches which first create the city plan, followed then by consideration of water assets, infrastructure and services.

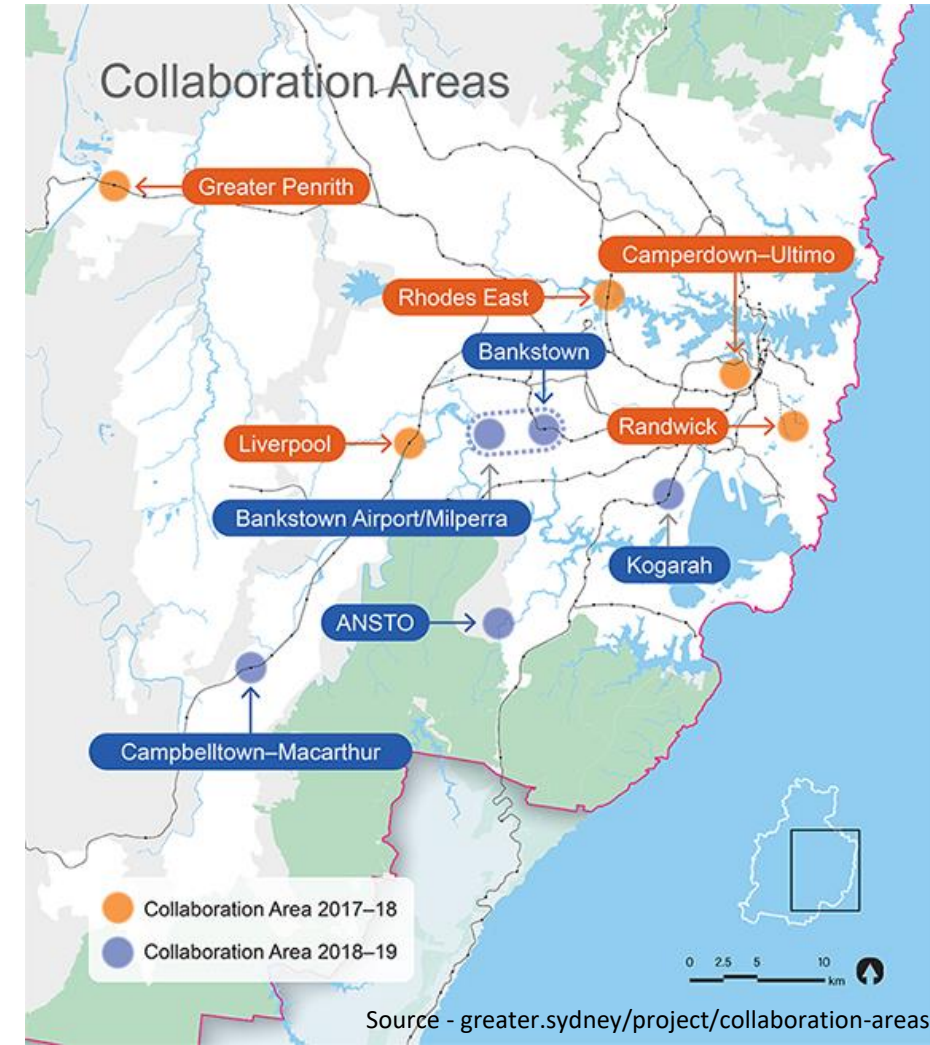
A major premise is that the greatest benefits will be achieved if water (systems, assets, infrastructure, management) is planned as a one of the foundational layers in the renewal of the city. In this way, water can be used to activate urban spaces, keep the temperature down and underpin a growing economy and innovative new industries.

Building on Existing Strategies

New ideas and actions for water are already documented in Liverpool City Council's Water Management Policy (2016) and the Liverpool Place Strategy (GSC, 2018). This project builds upon these initial ideas by:

- Providing an overarching framework for water management that ties individual actions into a cohesive strategy
- Clarifying links and dependencies between water and urban planning
- Demonstrating how the actions can be applied
- Employing designs that capture the multiple benefits that simultaneously support sustainability, resilience and liveability outcomes.

The result is a transformation of urban and water planning: to position water as the starting point for urban planning, in recognition of its critical role in forming the landscape. As such, we can image the LCA renewal being framed by blue and green lines rather than road networks; locally sourced water being viewed as a vital resource for economic growth; and the Georges River being an integral part of local community identity.



Collaboration in action

Workshop process

This project was based around a two-day collaborative workshop held in Liverpool on 12-13 February 2019.

The ideas were created through a co-design process. A range of stakeholders participated and the workshop was co-hosted by Sydney Water and the City of Liverpool.

The process included:

- Identifying water opportunities, using the Place Strategy as a lens
- Providing a framework for translating the observations into insights and then ideas
- Collaboratively developing these new ideas into tangible proposals and action plans.

This workshop and discussion paper represent an ongoing process of collaboration. It does not represent a commitment nor endorsement of these ideas by the organisations that participated in the workshops.

Workshop focus

Workshop participants were set a grand challenge: How can water management deliver Council's Water Management Policy and implement the priorities and actions of the Liverpool Place Strategy and how can these ideas achieve Council and the community's vision for Liverpool?

The workshop participants decided to frame these questions more specifically by exploring the following opportunities:

- Respecting water in the landscape
- Connecting the community to water and the Georges River and Brickmakers Creek
- Improving water quality of the Georges River and Brickmakers Creek
- Implementing the NSW Government Architect's Green Grid
- Keeping the LCA cool during heat waves
- Enabling the LCA to be net zero/positive for water and energy
- Funding and delivering this – setting expectations among partners and agreeing on responsibilities.



Hosted by	By the numbers
Liverpool City Council Sydney Water	35 participants 11 organisations 4 big ideas 2 days 1 Collaboration Area

Key stakeholders

The LCA process facilitates ongoing collaboration between key agencies and private sector partners. Key partners in the workshop included the following organisations:

Liverpool City Council provides a range of services and resources to the local community including planning of services, facilities and developments to meet future community needs, and providing quality local environments for the community today.

Sydney Water supplies water, wastewater, recycled water and some stormwater services to more than five million people in Sydney, Illawarra and the Blue Mountains. It also supports the liveability of Sydney by protecting the harbour, beaches, rivers, and waterways.

Greater Sydney Commission leads metropolitan planning for Greater Sydney by facilitating a collaborative "one government" approach to development, transport and housing planning.

Other stakeholders included property developers, NSW Office of Environment and Heritage, NSW Health Infrastructure and NSW Department of Planning and Environment.



2. Understanding context

About Liverpool

Liverpool is a key node in the proposed Western Parklands City which will accommodate over 1.5 million people by 2056.

Liverpool itself is located approximately 25 km from the Sydney GPO in Sydney's south western suburbs. It is one of the fastest growing regions in Sydney and its current population is expected to almost double over the next 20 years.

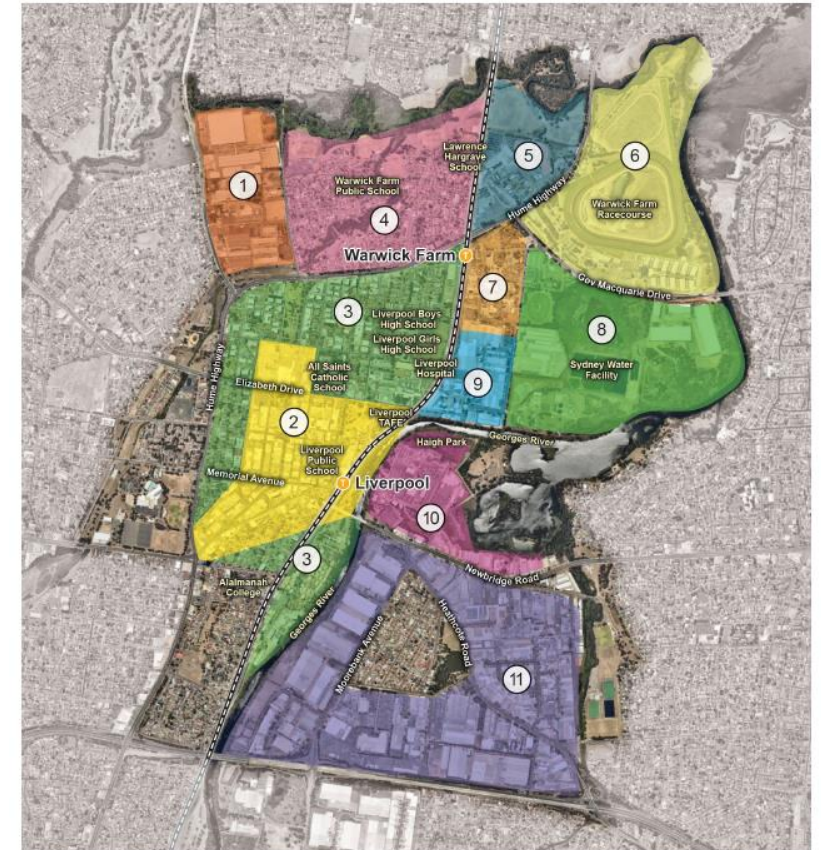
The city is a strategic commercial centre of south west Sydney, and its transport links to other areas of Sydney place it in prime position to attract a range of industries.

Liverpool is culturally diverse, including a significant Aboriginal community. Its significant heritage buildings and cultural and arts focus contribute to its character.

Approximately a third of Liverpool is covered in vegetation, including more than 500 open space reserves. The Georges River and numerous creeks flow through Liverpool.

Within the Western Parklands City, Liverpool has been identified as a Collaboration Area, to facilitate coordinated planning and to bring stakeholders together to “find practical solutions” to complex planning issues. These stakeholders have since worked together to create the Liverpool Place Strategy.

The LCA includes the CBD, the health and education precinct, the Warwick Farm precinct, and nearby residential and industrial lands. As part of south west Sydney's major growth area, Liverpool will also be site of Sydney's second airport at Badgerys Creek.



① Orange Grove Road	⑤ Sapho Road	⑨ Scrivener Street
② Liverpool City Centre - Core	⑥ Equine Precinct	⑩ Georges River North
③ Liverpool City Centre - Frame	⑦ Munday Street	⑪ Georges River South
④ Hangrave Park	⑧ Eco/Utility	

Source – Liverpool Collaboration Area Place Strategy (GSC 2018)

Hargrave Park

Liverpool enjoys large areas of blue and green. Its creek system is extensive, existing private lots are typically large with modest building footprints, creek riparian areas are largely intact and road reservations are often wide. Hargrave Park is an example of this.

Hargrave Park is an older part of Liverpool. The area is somewhat isolated from the rest of the LCA due to physical barriers such as the Hume Highway and its sound wall, freight rail, and the large industrial precinct. It has hidden creek lines and ageing housing stock. Its street network is wide, but these areas lack tree canopy and are harsh environments on hot days.

Hargrave Park is well serviced with “green” space and “blue” assets such as the Cabramatta and Brickmakers Creeks. Because there has been past flooding, development has been kept back from these creeks – creating a de-facto open space network.

Because the housing is older, the area is low density. Private open space is generous, with building footprints generally modest with respect to overall block size. But, the current urban form has turned its back on creeks and open spaces.

These attributes mean Hargrave Park is already a cooler and greener area. But there is a risk that redevelopment will shift the area towards higher density and erase many of these benefits.



Liverpool Recycled Water Plant

The Liverpool Recycled Water Plant sits adjacent to the Georges River.

It forms part of the Malabar Wastewater System, along with other wet weather (storm) plants at Fairfield and Glenfield.

Treated effluent is discharged to the sea via the Malabar plant. Occasionally, during wet weather, effluent is discharged to the Georges River.

Recycled water produced at the plant is used at Liverpool Golf Course, Warwick Farm racecourse and the Rosehill Recycled Water Scheme.

The site supports biodiversity via several decommissioned sludge lagoons and Horseshoe Swamp.

Within the LCA, the Recycled Water Plant, the equine precinct and the medical precinct are in close proximity. These sites produce a range of “wastes”, on a large scale, that could be transformed into resources and reused locally to meet the daily operational needs of these and other local businesses.

By the numbers (2009/10)

Vol. of effluent treated: 1501 ML
Vol. discharged to the Georges River: 1361 ML
Vol. of recycled water produced: 140 ML
Vol. of recycled water used on-site: 1215 ML

Opportunities

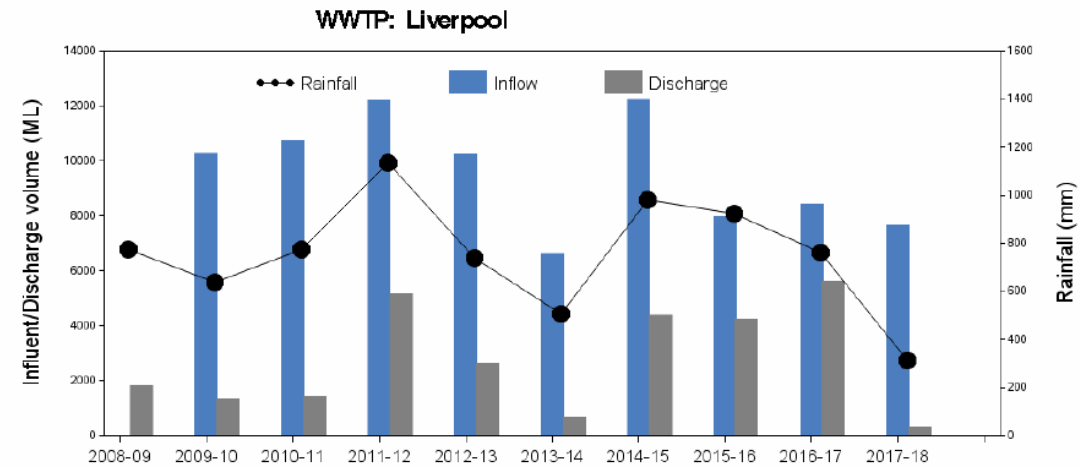
- Co-digestion for waste disposal
- Energy generation from biogas
- Increased recycled water production to meet local or regional demands
- Habitat restoration at Horseshoe Swamp
- Community access to the Georges River
- Augmentation of the Malabar Wastewater System to provide additional capacity to cater for population growth.

References

Dept. Environment and Climate Change, 2008, Management Plan for the Green and Golden Bell Frog Key Population of the Georges River.

www.sydneywater.com.au

<http://www.bom.gov.au/water/nwa/2010/sydney/urban-water-sydney-water-corporation2.html>





Liverpool CBD

Liverpool's CBD is a vibrant place, but it is disconnected from the Georges River– if you are in the main street there is no indication you are in a “river city”. There is no expression of water in the landscape. This influences Liverpool's culture.

The urban heat island is particularly pronounced in the CBD. There is a noticeable temperature difference between the CBD and the waterway on a hot day.

Parts of the CBD have a low density of street trees, and extensive hard surfaces that absorb heat and restrict rainfall recharge to landscapes. Other locations have a higher density of street trees, although these are generally in poor health. (Council has previously identified this issue and is implementing its Urban Forest Strategy to fast track tree planting in the CBD).

Liverpool's community is culturally diverse. Despite its space in the landscape, cultural aspects (Aboriginal or colonial) of water in Liverpool are not evident. Lower socio-economic community segments are particularly vulnerable to heat effects.

While Liverpool is a city, we can also think of it as a series of villages and use localised approaches to provide a new understanding of place. There is already a drive for place making within the CBD, making this a prime location for pilot projects that express greening and water in the landscape.

Turn Down the Heat

The urban heat island is a significant issue in the Western Parklands City.

Analysis of the past 40 years of temperature records shows temperature rises in Western Sydney have been greater than those in coastal parts of the city, and the number of very hot days has increased in the west.

These higher temperatures are due in part to geography and local urban heat effects. But, they can also relate to larger climate trends, such as global climate change and regional trends such as the large urban heat island over the Sydney CBD, which can delay and even block the inflow of the sea breeze into western Sydney.

Urban heat is also created by the built form within western Sydney. For example, heat mapping undertaken for the Parramatta CBD demonstrates the higher temperatures experienced by developed areas, and the influence water bodies and areas of landscaping and planting have on reducing the temperature.

Source – Turn Down the Heat, WSROC, 2018

Moore Point

Moore Point is located on the Georges River and is the site of a planned major urban development.

The site itself is flood prone and currently contains a number of natural features and vistas across the river.

The development is symbolic of the planned scale of investment for the airport, hospital and education precinct, all of which represent significant potential for co-investment if the opportunities can be identified. Specific opportunities exist in Moore point for using recycled water, as well as flood resilient design.

Unlike other cities, there is no water deficit in Liverpool. With the recycled water plant, and predicted urban renewal, a large volume of water is either imported or created locally, which can be made available as a resource. Moore Point sits on the opposite river bank to the Liverpool Recycled Water Plant.

While many cities consider the road network as the primary organisation framework, this could be shifted to a blue and green grid during the development of Moore Point to enable flood resilience. The development could pilot new typologies for built form and open space that reveal the river and enable community accessibility of its edges.



Georges River and local waterways

The George River is the major natural asset of the region and the city. It is accompanied by a network of smaller creeks (Brickmakers, Cabramatta etc.) and other semi-natural water bodies (Horseshoe Swamp) that form a widespread blue network and corresponding habitats.

But the Georges remains largely hidden. Its edges are largely inaccessible, and there are few visual or cultural connections between the CBD and Georges River environs.

Natural flow paths of the tributary creeks have been replaced by buried pipes, disconnecting water from the urban landscape. There is no other expression of water in the landscape.

Potential linear parks along creek corridors are difficult to access because the existing urban design has turned its back on these spaces. Litter and weeds within local creeks affect biodiversity and visual amenity.

Stormwater runoff affects both the Georges River and Lake Moore.

The levee around the Liverpool Recycled Water Plant indicates the magnitude of Georges River flooding and is a reminder to protect key assets.

The Georges River and remnant ecological habitats (Horseshoe Swamp) are underutilised by the public for recreation and education.

Liverpool's waterways could become a new open space opportunity as the city redevelops. While there are plans for this (such as re-engaging the old railway overpass), there has been limited reactivation of the waterways themselves. To reconnect the river to the city, it needs to find a new expression in place.



Opportunities and priorities

Urban heat

- Liverpool has more green space than many other cities. But, it does lack green infrastructure in its streets, which are hot and harsh environments.
- The CBD is an example of these contrasts – it contains areas that are green and benefit from a full canopy, while other areas have a harder landscape which is noticeably hotter during heat waves.
- People vote with their feet, and were seen lingering in the greener areas, and avoiding the hardscape areas of the CBD.
- The total area of green space in Liverpool will change as the LCA is redeveloped. This will increase the urban heat island effect unless provision is made for greening that considers the area, location, and design of green spaces and green infrastructure.

Resources

- Sydney Water wants to work with others to determine how the large volumes of water that enter the LCA (albeit of varying qualities) can be used to meet growing future water demands.

- By strengthening and expanding connections to adjacent green spaces, such as the equine precinct, there is potential to establish a green oasis for the city.
- The equine and hospital precincts generate large and consistent waste streams that could be suitable for processing into resources at the Liverpool Recycled Water Plant.

Harnessing planned investment

- Liverpool will experience significant investment during its next phase. This includes redevelopment of the hospital and equine precinct, as well as new housing developments. Given that most of this investment is committed, there is an opportunity to harness this scale of change to incorporate iconic blue and green infrastructure into these designs.

Waterways

- Although there are numerous spots along the Georges River that are frequented by locals, there is generally no sense of the waterway existing in Liverpool.
- Creeks throughout Liverpool have generous setbacks and riparian zones, but houses and public spaces currently face away from these natural environments.



Ecology

- The Liverpool Recycled Water Plant site has numerous interfaces with natural water bodies and environments. It is surrounded by the Georges River, and has several large open water bodies as well as the semi-natural Horseshoe Swamp. In combination, these features could be regenerated into an iconic site providing habitat and ecosystem services.

3. A framework

River sensitive city

Water is integral to almost every feature of an urban landscape. Our cities and towns are complex, ever evolving places. In a water sensitive city, we interact with the urban water cycle in ways that:

- Provide the water security essential for economic prosperity through efficient use of diverse available resources
- Enhance and protect the health of waterways and wetlands, the river basins that surround them, and the coast and bays
- Mitigate flood risk and damage
- Create public spaces that collect, clean, and recycle water.

Liverpool provides a special case of a water sensitive city: a **river sensitive city**. A river sensitive city uses its proximity and the inherent value of a major river system to determine how the principles of a water sensitive city are defined and applied.

The river becomes a major reason for, and enabler of, the city's resilience, liveability, economic growth and sustainably.

In Liverpool, we can apply a river sensitive city approach by thinking about:

- Social and cultural aspects of the Georges River, and of water more generally
- Resources opportunities at the Liverpool Recycled Water Plant
- Greening and urban heat
- Flood resilience
- Urban design.

Water Sensitive City, and its principles

City as a water supply catchment

Cities harness a range of different water sources at a range of different scales, and for a range of different uses.

City providing ecosystem services

Water infrastructure delivers a range of ecosystem services and contributes to a healthy natural environment, thereby offering a range of social, ecological, and economic benefits.

Water Sensitive Citizens

Citizens have the knowledge and desire to make wise choices about water, are actively engaged in decision-making, and demonstrate sustainable behaviours.

River Sensitive City attributes

- A river city is abundant in water. But this water is managed carefully and sustainably.
- Just as flooding rivers redistribute nutrients through a catchment, the water system in a river sensitive city cycles resources to support local economies.
- Floods periodically connect the river to the land. These water flows/features are a part of the urban landscape adding amenity and driving built form design.
- Blue and green networks are the primary organising frame for the city's renewal.
- Water is visible in the urban landscape.
- Urban areas are cool, green places connected to waterways and creeks.
- The river is a part of Liverpool's history, culture and design.
- Citizens visit, enjoy and respect the river.
- The river is part of the major attraction/feature that "puts the city on the map".

watersensitivecities.org.au/what-is-a-water-sensitive-city/

Social and cultural

The water sensitive city visions established by different cities consistently highlight the importance of liveable places, collaboration, well designed places, healthy people, thriving environments, innovation and adaptive infrastructure, as well as engaged and empowered community.

The emphasis on empowered community highlights a feedback between water users and the overall water efficiency of the city. CRCWSC research finds higher water-related knowledge is associated with water sensitive attitudes and behaviours:

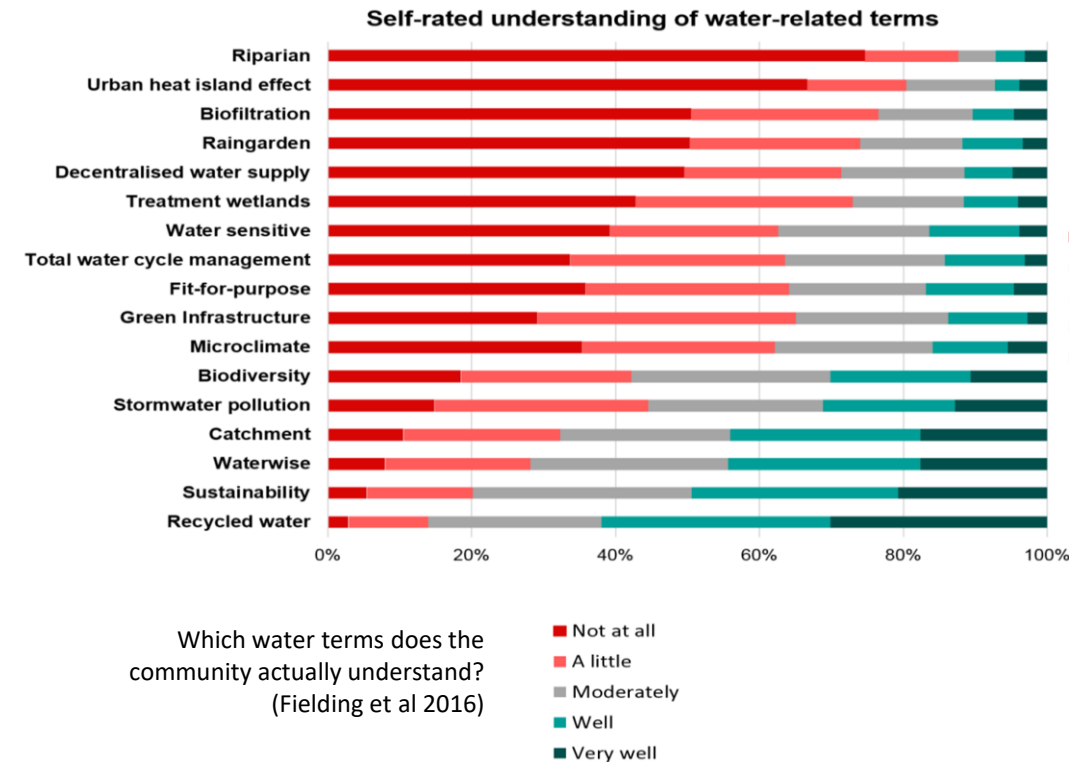
- Greater support for raingardens
- Greater use of everyday water saving strategies
- Higher uptake of water saving devices
- Greater support for alternative water sources.

However research also shows Australian citizens generally have limited water literacy – a poor understanding of the urban water cycle and waterways. So, they are not well connected to water in their community, which directly influences their behaviours.

One aim of creating a river sensitive city could be to create a community of active water stewards. This is achieved by connecting citizens to a shared water story. For Liverpool, this story could be based on the river, its history and its current value to the community.

The river story will recognise culture and place. The past 200 years has led to a progressive decline in the health of the Georges River. There is an opportunity to recognise and integrate Aboriginal water values (cultural, economic, social) into planning for the LCA. For instance, the junction between salt and fresh water (sweet water) at the weir below the train station has particular cultural significance for Traditional Owners.

The LCA could also recognise the important role of water in shaping Liverpool's physical landscape, and the city's post-1788 history, industries and economy. This emphasises the river's role in the city's continuing evolution.



Urban heat and greening

Urban heat islands are not well understood by the community. We can make this concept tangible by dealing with what the community does understand – trees and green spaces.

When doing this, we focus on action at the strategic level – a tree canopy target and an urban forest strategy. This approach further focuses on individual streets and parks and we ask where is it best to plant trees, and what sort of surfaces are best?

We understand that heat accumulates in different ways in the urban environment. We can quantify these relationships and incorporate this understanding into the way that we design the places in which we live.

Categorising the urban landscape to understand heat mitigation responses

Stubborn heat islands	Responsive heat islands	Borrowed cooling	Cool sinks
This refers to existing impervious areas, such as roads and pavements, that are difficult and costly to break up to convert to green areas without significant construction activity.	This refers to areas of the urban landscape that can be easily converted from heat islands to green, cool areas just by adding water, such as dry grass that can be irrigated.	Large green areas in the urban landscape, such as golf courses or blue areas like rivers, provide a cooling benefit to those living adjacent to these sites. This can be thought of as borrowed cooling.	This refers to opportunities at the intersection of responsive heat islands and borrowed cooling. By loading up parts of the landscape with water in the days before a heat wave, it may be possible to charge up the area for evaporation.

Mitigating urban heat

A number of planning and design decisions help us to design the LCA with the goal of mitigating urban heat in mind:

Mapping

- Quantifying the relationship between planning and design decisions, and how heat accumulates in the landscape provides evidence of which areas are currently, or will be, hotter, allowing us to manage these impacts.

Material choice

- Surface treatments matter. Choice of materials has a large bearing on urban heat.
- Shade matters. Planning opportunities to create shade is easily achievable and effective.

Open space provision

- The area and location of green and blue open spaces is important, as is the management of these spaces.
- Vegetated areas are cooler, and irrigated vegetated areas are cooler again (see below).

Urban canopy and forests

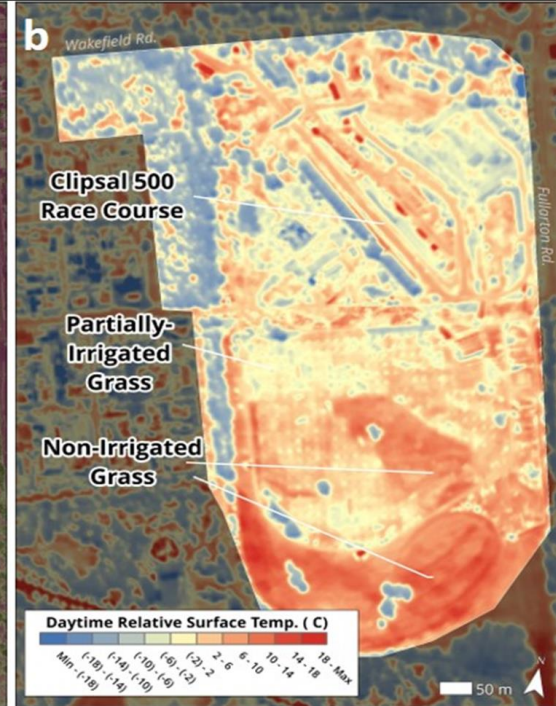
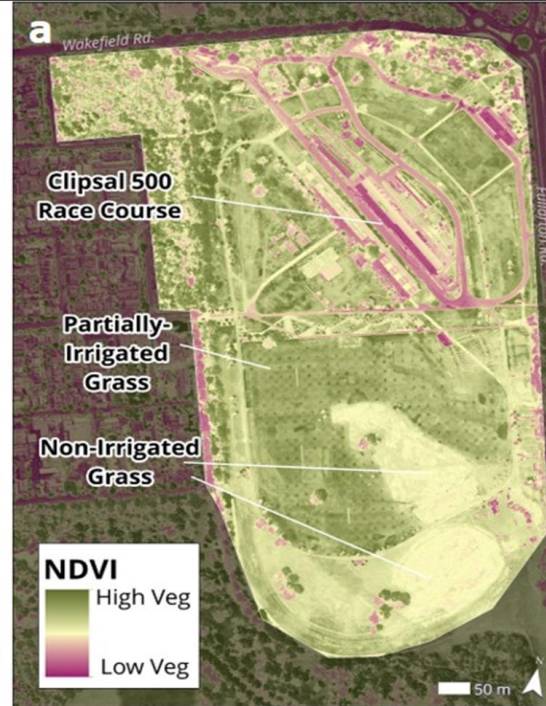
- Open spaces can incorporate shade trees for added cooling (and other) benefits.
- Tree lined streets are measurably cooler.

Water matters too

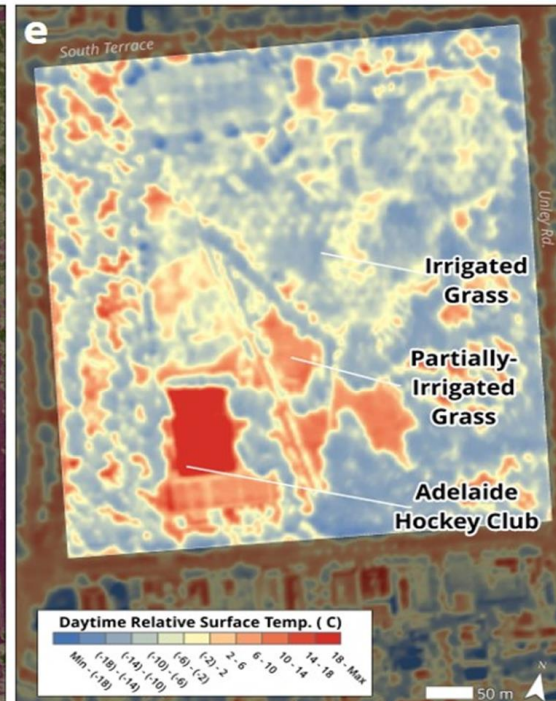
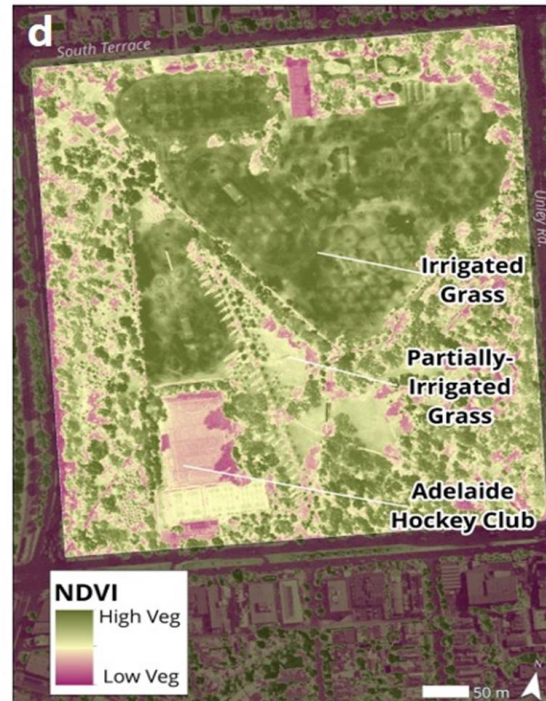
- Irrigated grass is cooler than non-irrigated grass. This shows that a cooling strategy is not just about providing open space, but about having green, irrigated open space.

Partially vegetated and treed areas are the coolest features in this landscape, averaging 4°C cooler than average.

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Case study: Passively water trees

CRCWSC partner City Green has experimented with street tree design in Forster Car Park in the City of Belmont (WA).

They compared two designs – with and without passive watering and deep soils – and showed quantifiable differences in tree health and canopy size.

Trees managed using passive watering were healthier and growing at unprecedented rates. By contrast, trees planted conventionally in a nearby site, and now 15 years old, showed clear signs of poor health.

This translates into differences in tree canopy and shade. The passively watered tree canopy covered 50 m² after four years. The canopy of trees planted conventionally were only 7.5 m² after 15 years.



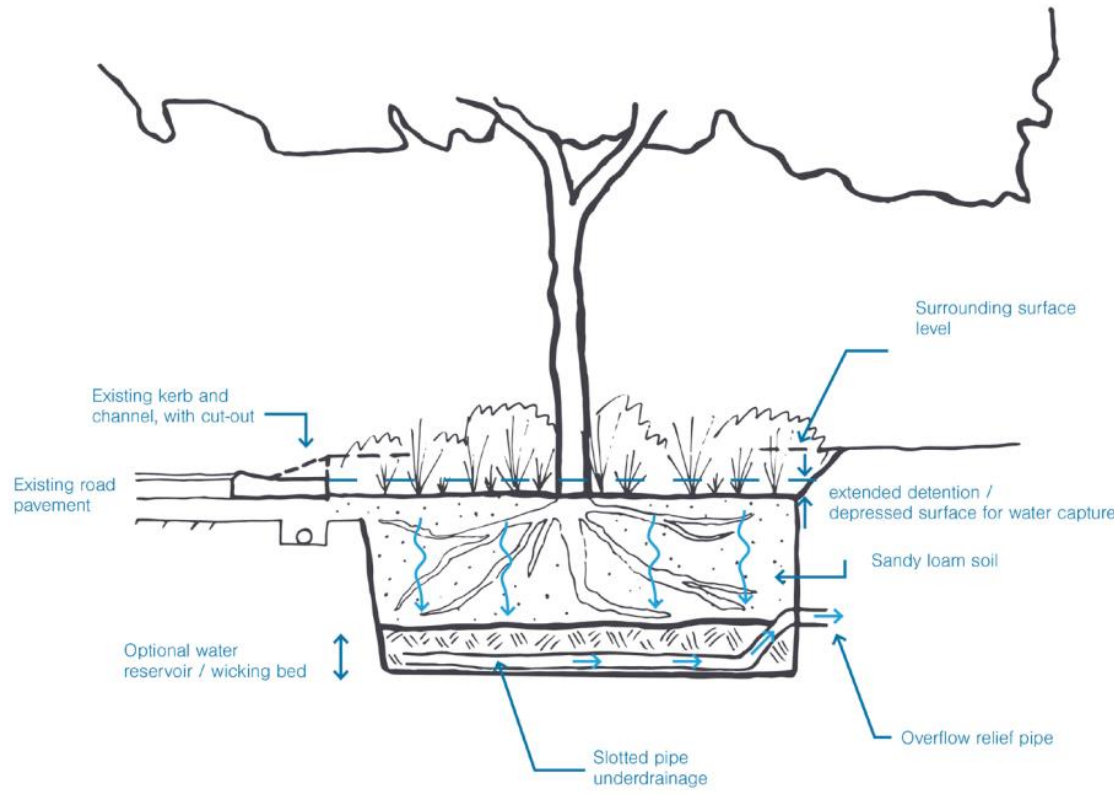
Source - citygreen.com

Growing evidence of the benefits of passively watered trees

- Double the growth rate (Grey, V. *et.al* 2018)
- Canopy 8–10 x larger (Hitchmough, J. 1994)
- Increased lifespan from 13 to 50 years (Skiera, B. and G. Moll. 1992)
- Economic benefit – leafy streets add a 3% premium to house prices (Lyndal Plant pers comm, Uni of Qld & Urban Forester)

- Achieve or exceed water quality objectives (E2Designlab & Healthy Land and Water, 2018)
- Microclimate – Urban Cooling (Coutts, A and Tapper, N. 2017, CRCWSC)
- Frequent flow & potential flooding benefits

Analysis by E2DesignLab
e2designlab.com.au/projects/industry-tools-support/i_178-passive-irrigation-modelling-in-queensland



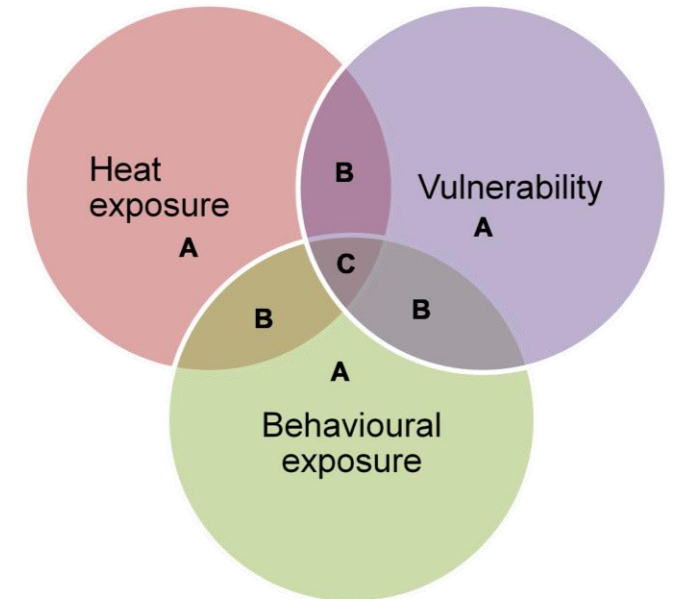
How to prioritise heat mitigation

Actions to mitigate urban heat should occur first in areas of:

- Temperatures hotspots where there is a large amount of impervious surface
- High population vulnerability (e.g. high proportion of older or very young community segments)
- High behavioural exposure, where people move and gather, such as public transport corridors, schools and public spaces.

This framework can be applied at the city, neighbourhood or street scale to guide where investment in heat mitigation should occur.

An example in Liverpool is local schools. These areas typically feature exposed streets with few trees, small children who are more vulnerable, and behavioural exposure when students are playing at lunch time or travelling home during hottest part of the day.



Norton et al., 2015

Resources and energy – urban metabolism

If we think of our cities like our bodies – taking in, using, storing, and emitting water – then this provides a framework for assessing the efficiency of cities.

Typically, cities import water as and when it is needed, and immediately dispose and discharge of the waste streams, all in a linear process. An alternative is to apply a metabolism approach to cities, to try to store more water in cities, to understand the role that water plays in broader processes such as managing urban heat, and to use water in more energy efficient ways.

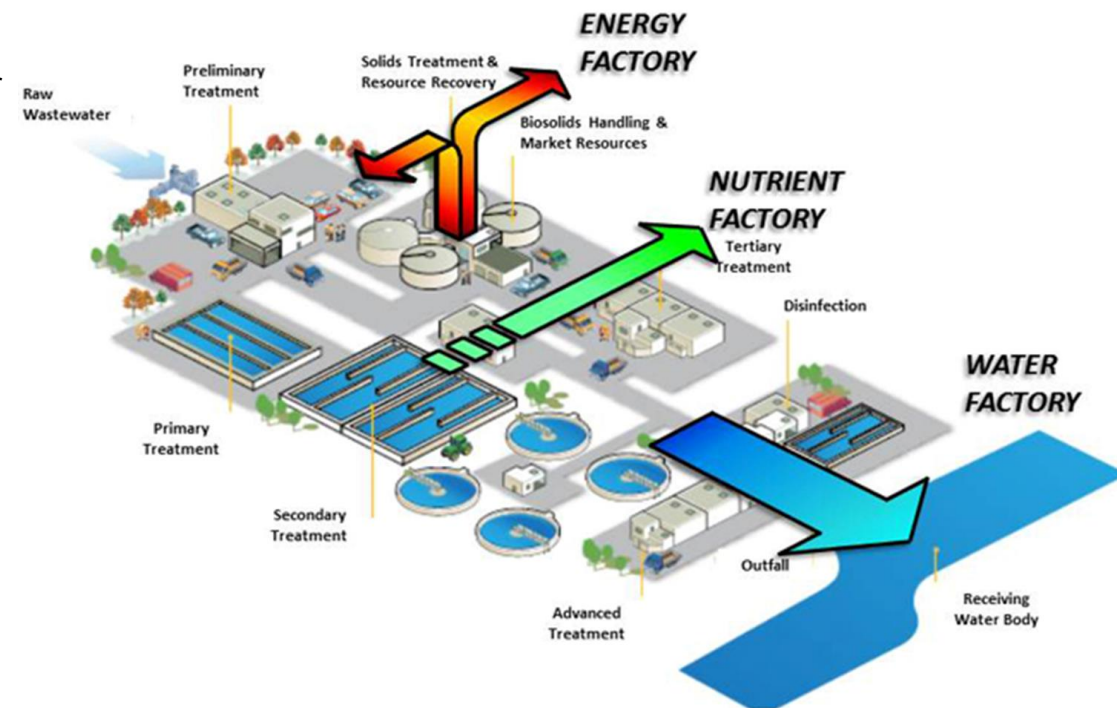
Water is therefore a good example of a circular economy. It can be recycled multiple times, has multiple resource applications, and is renewable and ubiquitous in cities. Input resources and output wastes are minimised by slowing, closing, and narrowing energy and material loops through urban design, reuse, recycling, and upcycling.

This approach can influence both urban planning principles as well as infrastructure principles, to ensure the city as a whole is designed to maximise reuse opportunities.

Metabolism extends beyond water. Water and energy are highly connected and flow through cities together. Yet, none of the performance boundaries or metrics for these is aligned, and this prevents us from measuring how efficient a city really is. So, when we redevelop our cities, we continue to manage water, energy and nutrients as separate materials, not as connected opportunities.

Water is beginning to emerge as the common boundary to drive broader changes in recycling practice. Opportunities exist at different scales. Both households and wastewater treatment plants can become water and nutrient energy factories. This is done by treating not only wastewater but also waste organics. Waste streams can include agricultural waste, municipal waste and food waste, which can be used to produce a range of new resources.

Markets for these resources are developed by identifying which resources/services are currently provided individually but could be provided in a centralised way in a new servicing model



New metrics to measure the metabolism of cities

- How natural are the water flows/water cycle?
- How internalised is a city's water supply (sourced from within or external to the city)?
- How much functionality is water providing (e.g. amenity, cooling)?
- What is the resource efficiency (energy footprint) of water used?
- Before and after evapotranspiration. (This is a good proxy for the urban heat island.)

Flood resilience

In NSW, the average annual damage from flooding to coastal and inland urban centres is around \$200 million (NSW SES, 2018).

The scale of these costs is similar in many cities, a number of which are now focused on building resilience to reduce these impacts. Resilience reduces costs through long-term adaptation, rather than by creating defences to floods.

As the climate changes, the costs of flood defence approaches will increase. The flood thresholds to which flood defences are built are also shifting, leaving communities more exposed to flood impacts, but largely unaware of this risk.

Retreat, adapt, defend

A number of flood prone cities are now incorporating a retreat, adapt, defend approach into their planning:

Retreat – In a planning sense, this means making room for the river to flood and avoiding development in flood prone areas. In a climate change scenario, it might mean strategically relocating land uses that will become progressively exposed to flooding over time. A strategy might also create blue and green corridors to carry flood waters, or relocating low value building stock that coincides with overland flow paths.

Adapt – This means allowing water to come into and flood an urban area, but ensuring there is an inbuilt resilience to cope with this, via the built form, emergency management, street scape design and social systems that need to respond. Areas can maintain their social and economic value between floods, while minimising the impacts of occasional flooding. In a planning sense, this might include green infrastructure, flood resilient building design and other architecture responses.

Defend – This traditional approach uses levees, raises building floor levels and creates other barriers to separate people and at-risk land uses from flood waters. This approach has its place, but can create undesirable street level design outcomes if poorly managed. This approach might also include engineering works to augment drainage capacity.

Social and infrastructure solutions

Moving from a defend to a resilience approach can be achieved by imagining ways to live with flooding rather than trying to avoid it.

Insights into this come from developing countries where flood defence infrastructure is often not available. Here, communities must adapt to flooding. Whilst not suggesting that we should plan our cities to represent developing world conditions, this does suggest that there are multiple pathways to flood management.

This approach relies on building community understanding of flood risks and preparedness to manage exposures to these risks. In this way, flood resilience is often described as a mix of social and engineering actions.

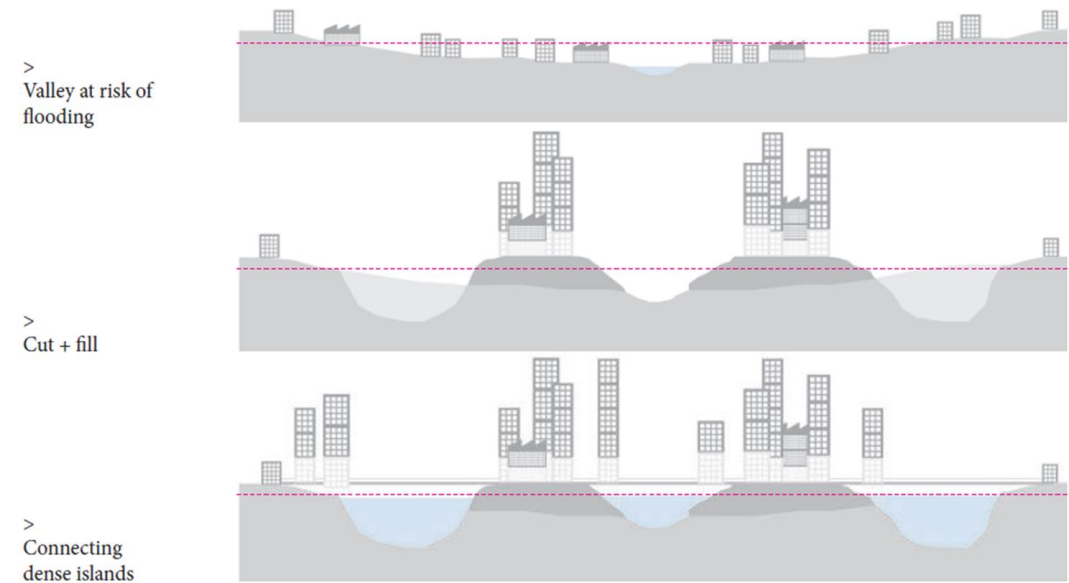
Adapt: Arden Macaulay

Arden Macaulay is a major urban infill project in land prone to flooding. The site sits at the confluence of the Moonee Ponds Creek and Port Philip Bay (Melb).

The CRCWSC has proposed an “Islands of Intensity” concept to facilitate urban renewal while also building flood resilience.

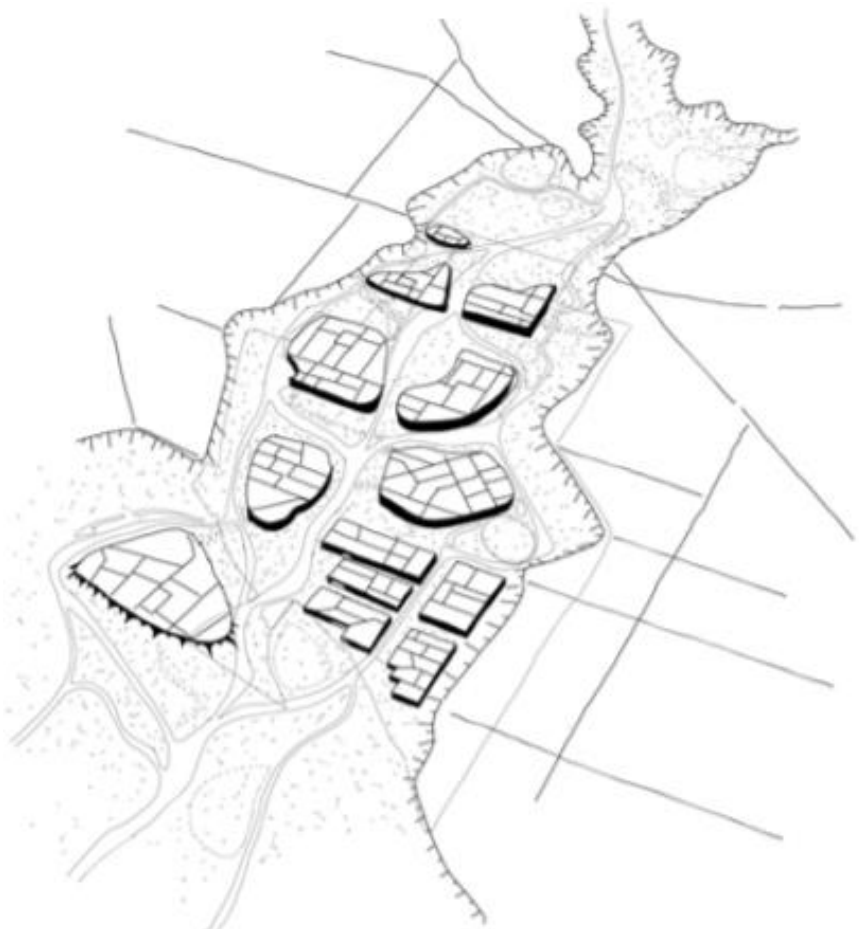
This concept creates “islands” through the floodplain using cut and fill techniques. This differentiates a lowered, wetland landscape from a higher, development landscape.

Old and new buildings are densely grouped on these islands, and the lower, wetland areas are activated for community use during dry periods.



Bertram et al, 2017

Case study:
Arden
Macaulay



Retreat – Room for the river

The “Room for the river” program is a catchment scale representation of a retreat strategy. It is being used in Europe to reclaim floodplains that had previously been disconnected from the river, developed and built upon.

With river floods along major rivers becoming larger and more frequent, multiple European governments have embarked upon catchment scale reclamation of the riparian zones and floodplains of major trans-boundary rivers.

This entails working with landholders to ensure the functionality of floodplains is restored and vulnerable lands uses are relocated. It has included tenure changes, new land uses and ecological restoration.

Brickmakers Creek ,
Liverpool



Room for the river in Europe
Photo – www.mottmac.com

Urban design

In Liverpool, the Georges River is currently hidden. There is no representation of water in the urban landscape and many citizens remain unaware of the river's true value.

Urban design can be used as a tool to help create a river identity and river culture for the city. Urban design can create places throughout the city that respond to water, express water, and draw people to the river.

The river itself is also key. In a river sensitive city, major activity and congregation areas are associated with the river help to reshape the way the city thinks about itself. The waterfront is used as a celebration place to allow people to get down to the river. This does not mean little picnic spots, but instead significant places of congregation and celebration that shape an identity for the city.

Urban design therefore has a role in shaping:

- the waterfront itself
- points of interaction between the city and the river
- how the LCA, as a whole, can express itself in water terms
- opportunities for community to interact with and play in water.



The Rill, London
Photo - twitter.com/fhayesmccoy/



Making water visible

“Hardscape waterways” provide an opportunity to create blue grids within the CBD landscape, helping to create streets that are walkable during inevitable heatwaves. These waterways can also showcase Liverpool’s river context, by creating visible links back to the river that respond to the weather and seasons.

Street trees and raingardens can be connected to these hardscape waterways to enable passive watering and stormwater treatment.

This new water “supply” can also be connected to public open spaces – ensuring these spaces remain green throughout the year.



Street trees, Liverpool

The Brook, Roombek, Enschede (NL); Ruwenbos (NL)
Photo - atelier GROENBLAUW, Amar Sjaauw En Wa



Hunters Point (New York)

Urban design can create ways for the landscape, waterfront and river's edge conditions to work together harmoniously.

Hunters Point South Waterways Park (NY) provides an example. This project transforms 4.5 Ha of abandoned industrial land opposite Manhattan into a welcoming public space.

The site is surrounded by water on three sides, and is designed with flooding in mind. This design uses infrastructure, landscape, and architecture to establish ecological corridors and different levels across the site. These corridors and levels are able to accommodate park uses at different water levels as the East River rises and floods.

There are opportunities at Moore Point to demonstrate this by thinking about how the development could promote a site-appropriate ecological response through its design.

River pool (Copenhagen)

Copenhagen (Denmark) provides an example of a city that has activated its major waterway.

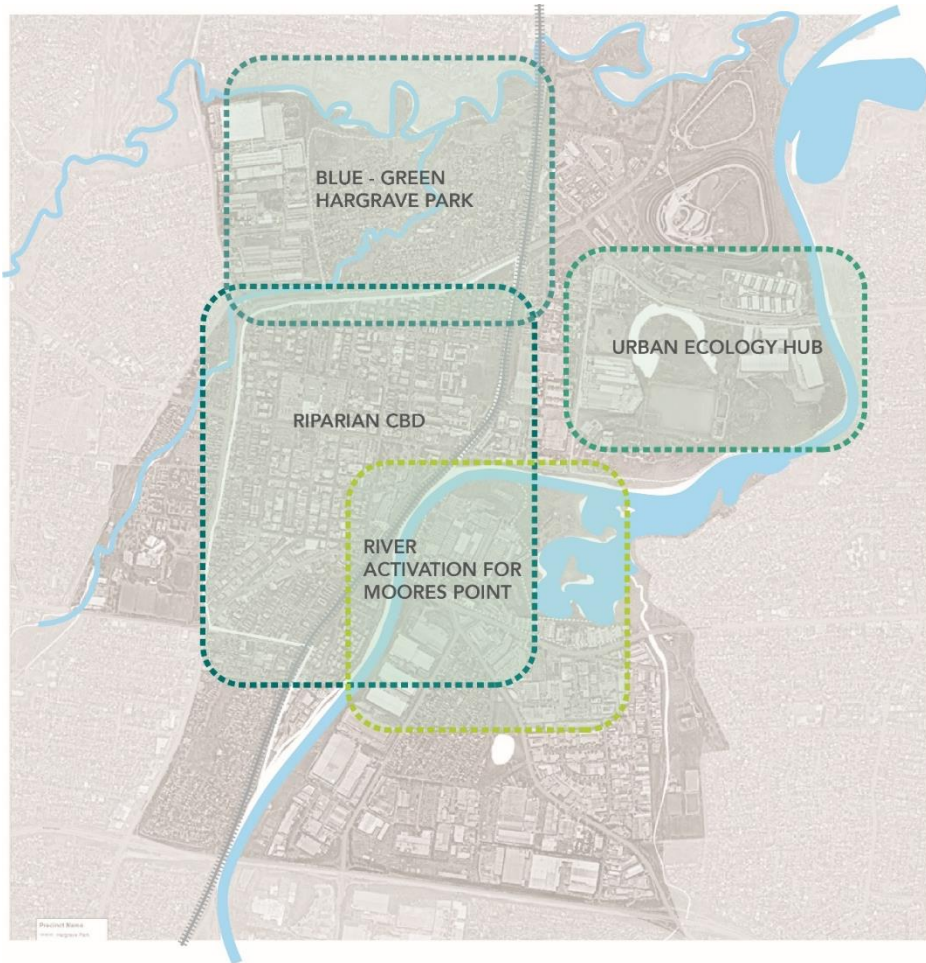
The city has successfully created a swimming pool that sits within the city's river. The pool sits on the river but the water in the pool is not river water.

This case study shows that when the river is expressed in an architectural and cultural way, it can define the city. This one major, architectural project using water has benchmarked the city and helped to change its culture. It suggests that one of the aims of urban design in the LCA could be to establish the right project in, or on, the river to benchmark Liverpool against other cities.



4. Ideas

Four ideas for a river sensitive Liverpool – overview



Idea 1. Riparian CBD

This idea reconnects the city centre to the Georges River and Brickmakers Creek by adopting the principles of a riparian zone: areas that directly influence or are influenced by the adjacent river. These influences will be incorporated into a mesh of blue and green opportunities that permeate the CBD and activate streets, malls, arcades and public parks.

Idea 2. Blue - green grid for Hargrave Park

This idea harnesses urban renewal of social housing in the Hargrave Park zone, to create a strategically placed and sufficiently functional green and blue grid. The idea proposes urban consolidation within higher density “nodes”, and strategic transfer and aggregation of private open space to public ownership to better service community needs.

Idea 3. Urban ecology hub for Liverpool Recycled Water Plant

This idea reimagines the site, the treatment processes and the surrounding land uses to align the waste, energy and water needs of the Sydney Water Liverpool Recycled Water Plant, Warwick Farm Turf precinct, and the Liverpool Hospital. The hub will recycle resources locally and provide a resource factory for the entire LCA. The hub will be further enhanced by ensuring the climate resilience of local ecological niches such as Horseshoe Swamp.

Idea 4. River activation for Moore Point

This idea embeds the Georges River in the cultural and built identity of Liverpool. Moore Point redevelopment will serve as a focal point to reimagine and re-express the Georges River in urban design and community living. It will act as a demonstration of river-first planning, where water drives planning of other city elements and where people are drawn to the waterfront.

Each of the four Ideas is explored in more detail on the following pages.

Idea 1: Riparian CBD

This idea reconnects the city centre to the Georges River by adopting the principles of a riparian zone: areas that directly influence or are influenced by the adjacent river. These influences will be incorporated into a mesh of blue and green opportunities that permeate the CBD and activate streets, malls, arcades and public parks.

Situational analysis

At present, the CBD is progressively evolving to a pure hardscape. Standing in the new Macquarie Street Mall, it is possible to contrast some of the older tree lined streets with the harder mall landscape, and to experience the difference. This difference exists in both climate as well as culture.

Existing street trees, where they exist, are generally in poor health and in decline reflecting inadequate soil volume and water availability. Many of the existing street trees will need to be replaced in the near future.

Connections between the CBD and the environs of the Georges River and Brickmakers Creek are currently poorly defined within the CBD's "Hoddle grid" street network. Additionally, the rail line forms a significant physical barrier between CBD and the Georges River. Despite its close proximity, the Georges River currently plays little part in the identity of the CBD.



Wide paved CBD streets with limited street trees



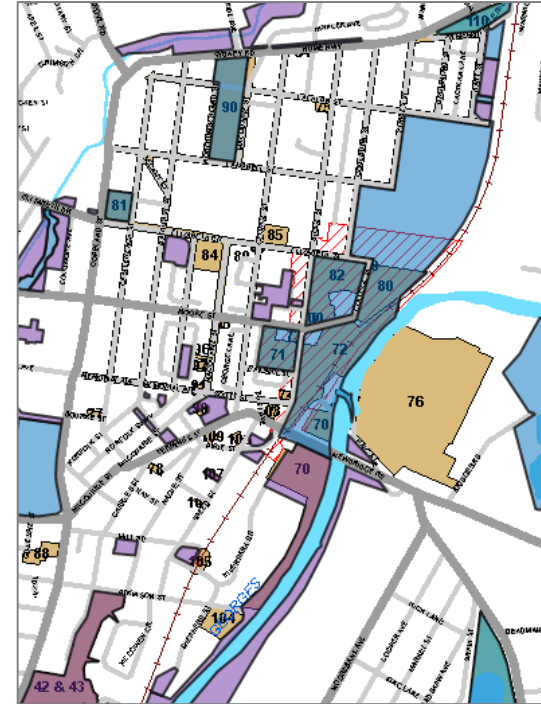
Macquarie Street Mall with extensive paving and poor tree species selection for provision of shade

Problem definition

- Extensive hard surfaces absorbing heat and restricting rainfall recharge to landscapes and soil moisture
- Low density of street trees that are generally in poor and declining health
- Poor tree selection in recent public realm redevelopment projects provide limited cooling benefits
- No expression of water in the landscape
- Poor visual and cultural connections between the CBD and Georges River environs

Opportunity to influence

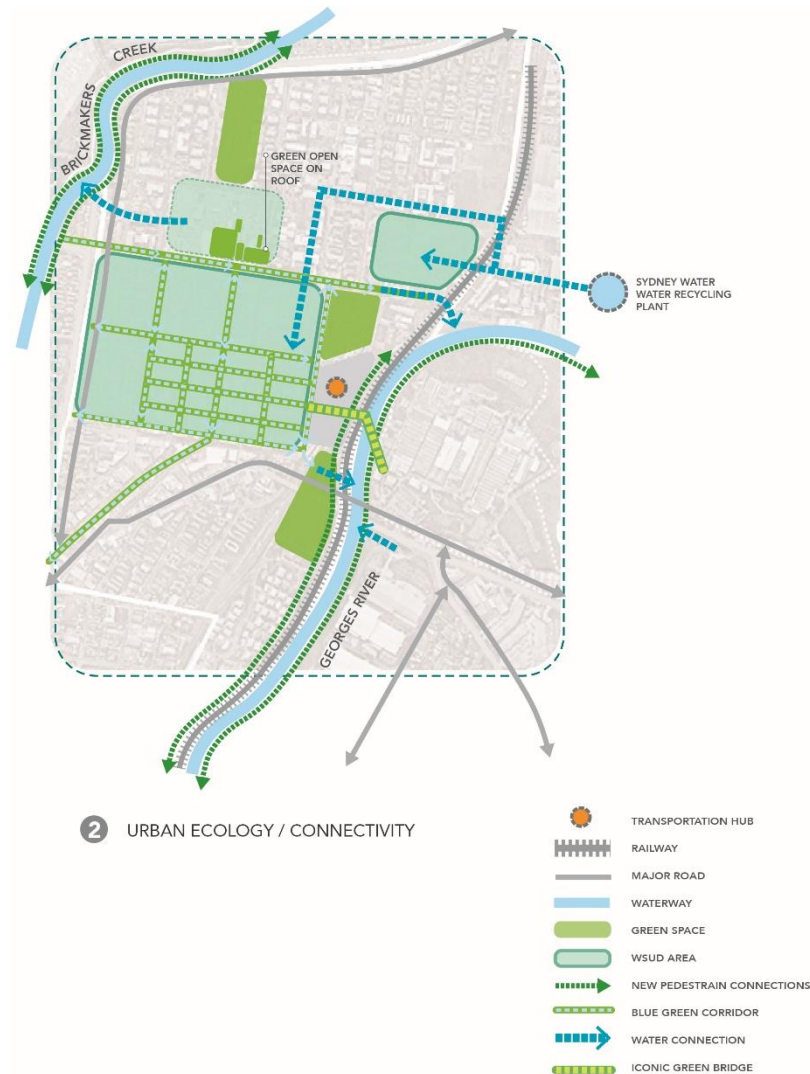
- Significant Council, State and Crown owned land holdings in the CBD provide opportunities for government agencies to promote and lead application of water sensitive cities principles in the planning and design of future CBD developments.
- Council's new public realm strategy for the CBD provides an opportunity to embed water as a fundamental place making and functional element in that strategy.
- Council's review of its planning scheme provides an opportunity to embed water sensitive cities principles and targets to influence future development outcomes in the CBD.
- Council's capital works in CBD streets and public open space provides an opportunity to incorporate water sensitive urban design and urban forest outcomes within those projects.
- The CBD's close proximity to Sydney Water's Liverpool Recycled Water Plant provides an opportunity to secure a reliable recycled water supply for the CBD streetscape and public open space irrigation.



Council owned land (Purple) and State and Crown owned land (blue) in the Liverpool CBD (source: Liverpool city Council)

The big moves

- Apply the **template of a riparian zone** to re-imagine the landscape character of the CBD. A riparian CBD will have a vegetated landscape based on riparian structures, keep and use water in the landscape to help cool public spaces and sustain vegetation, comprise water sensitive drainage infrastructure to treat and infiltrate stormwater to protect downstream waterways.
- Implement a **blue – green grid** that permeates the CBD's streets, arcades and public parks to create a cool and connected city.
- Pilot **“living arcades”** by working with local business owners and the community to create a laneway culture to increase permeability through the CBD.
- Provide an **iconic design green bridge** (pedestrian and public transport) across the Georges River to connect the CBD / Liverpool Rail Station to future development at Moore Point.
- Provide a **secure recycled water supply** from Sydney Water's Liverpool Recycled Water Plant for irrigation of the CBD's streetscapes and parks.



Shaded streets and malls support vibrant walkable places



Examples of water in the landscape as place making and functional elements

The next steps

- Council to incorporate the ideas of a riparian CBD and a blue – green grid in its new CBD Public Realm Strategy.
- Council to embed new planning provisions in its planning scheme to improve development outcomes in the CBD with respect to the urban heat and the sustainable use of water resources.
- Council and Sydney Water to develop a recycled water scheme for the CBD (as part of a broader recycled water scheme for Liverpool).

Related Place Strategy actions

- ✓ **Action 2:** Redevelop Liverpool Rail Station and bus interchange with mixed use development; easier pedestrian access to bus services; a pedestrian, cycle and public transport crossing of the Georges River; and a better interface with the river and open space.
- ✓ **Action 8:** Deliver great places by prioritising a people-friendly public realm and open spaces; providing fine grain and diverse urban form, a diverse land use and housing mix, high amenity and walkability; and recognising and celebrating the character of the place and its people.
- ✓ **Action 28:** Implement Green Grid principles as part of the Place Strategy implementation.
- ✓ **Action 29:** Develop a demonstration project that increases green open space and tree canopy coverage in line with the NSW Government's urban tree canopy target to reduce the urban heat island effect and temperature fluctuations.
- ✓ **Action 33:** Investigate and implement innovative initiatives to address the urban heat island effect.

Heat mitigation benefits of a riparian CBD

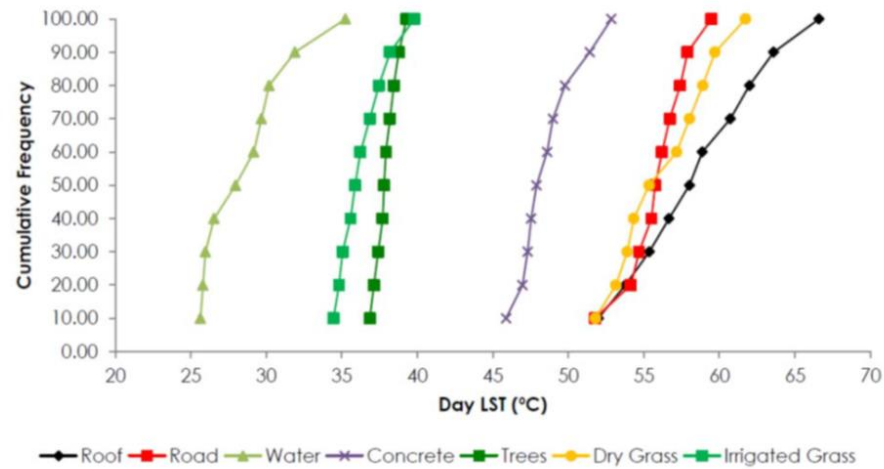
The CRCWSC's Scenario Tool was used to simulate land surface temperature reductions on CBD streets resulting from the proposed blue – green grid for the CBD.

The resultant heat maps shown on the following page illustrate that healthy irrigated street trees associated with the proposed blue – green grid can reduce land surface temperatures on the CBD streets by up to 4°C on an extreme heat day (>40°C).

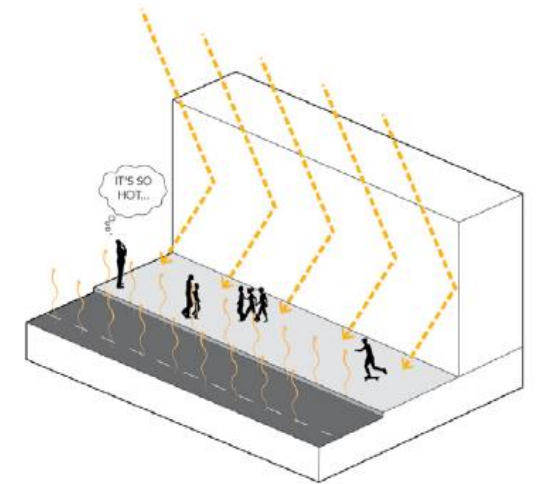
This magnitude of land surface temperature reduction is significant and improves the amenity and walkability of the CBD streets. Additionally, it helps reduce the overall urban heat island effect in the CBD.

Scenario Tool:

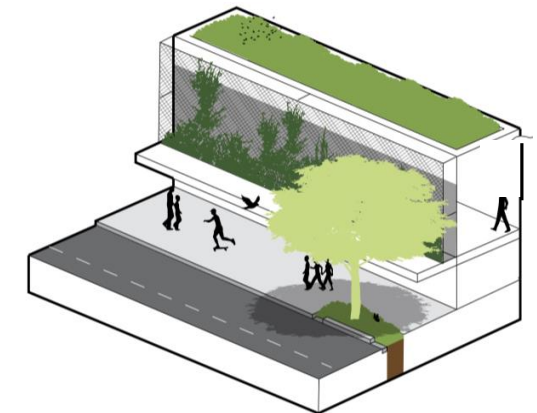
<https://watersensitivecities.org.au/solutions/water-sensitive-cities-scenario-tool/>



Recorded land surface temperatures (LST) on extreme 40°C heat day (Broadbent 2017)



Hard surfaces absorb and store heat during the day



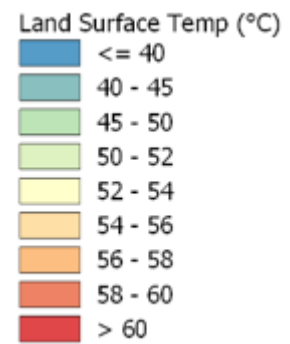
Street trees, green roofs and vertical gardens shade hard surfaces and cool local air temperature



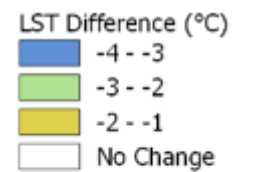
Existing conditions



Proposed blue – green grid



Difference



Modelled land surface temperatures for Liverpool CBD streets

Idea 2: Blue – green grid for Hargrave Park

This idea harnesses urban renewal of social housing in the Hargrave Park zone to create a strategically placed and sufficiently functional green and blue grid. The idea proposes urban consolidation within higher density “nodes” and strategic transfer and aggregation of private open space to public ownership to better service community needs.

Situational analysis

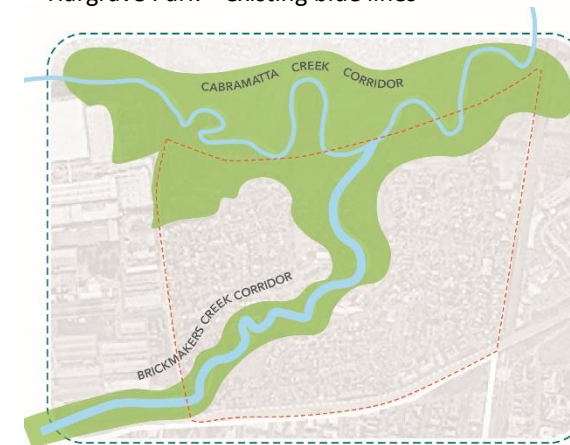
Hargrave Park is generally well serviced with “green” space and “blue” assets such as the Cabramatta and Brickworks Creeks and their floodplains. Because of past flooding, development has been kept back from the creeks – creating a connected linear open space network along the creek corridors. However, the network is poorly accessed and underused by the local community.

Future renewal of the ageing social housing stock may shift the area towards higher density housing forms which, if not planned carefully, could reduce the overall extent of green space and increase the amount of impervious surfaces. This could exacerbate local flooding and urban heat island.

Beyond the LCA Place Strategy, there is no clear strategic direction on how the Hargrave Park precinct will transform in the future.



Hargrave Park – existing blue lines



Hargrave Park – existing green lines



Creek line green space hidden behind back fences



Hot wide streets with limited street tree plantings

Problem definition

- Poor accessibility of existing open space
- Stormwater disconnected from the urban landscape, limiting passive watering and heat mitigation benefits
- Low density of street trees
- Degraded creeks
- Poor cultural connection between urban form and public landscapes
- Low socio-economic community segments vulnerable to extreme heatwaves and flooding

Opportunity to influence

- Renewal of social housing stock by Department of Family and Community Services provides an opportunity for this to be strategically planned to deliver improved community and ecological outcomes for Hargrave Park.
- Council's current review of its planning scheme provides an opportunity to influence the transformation of Hargrave Park through new planning provisions that can be included in the Local Strategic Planning Statement, Local Environment Plan and Development Control Plan.
- The close proximity of Sydney Water's Liverpool Recycled Water Plant provides an opportunity to secure a reliable recycled water supply to Hargrave Park for landscape irrigation

The big moves

This idea adopts a strategy to retain and enhance the current green and blue attributes of Hargrave Park while allowing higher density living.

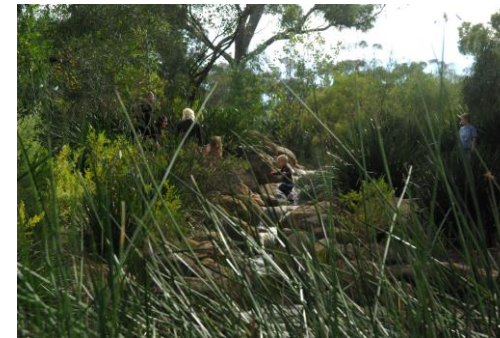
- Develop a **precinct master plan** for Hargrave Park to encourage urban consolidation within higher density “nodes” and the strategic transfer and aggregation of private open space to public ownership to better service community needs.
- Create an **urban forest strategy**, considering canopy targets, species selection (guided by iconic indigenous species) and irrigation needs.
- **Rehabilitate riparian areas and floodplains** of the Brickmakers and Cabramatta creeks to improve ecological and community health and improve access.
- **Improve pedestrian and cycle connections** within Hargrave Park and to surrounding areas (including the CBD) by taking advantage of “cool routes” along the Brickmakers and Cabramatta Creeks and along well shaded streets.

- **Unhide historic water courses** by “daylighting” stormwater flows and co-locating new public space along overland flow paths.
- Provide a **secure recycled water supply** from Sydney Water’s Liverpool Recycled Water Plant for irrigation of streetscapes, public parks, sports ovals and school grounds to sustain landscapes and mitigate the urban heat island.

A development application for re-development of a whole street block in Hargrave Park that is currently under multiple land ownership highlights the potential for re-development of the precinct to occur at a scale that can support implementation of many of these Big Moves.



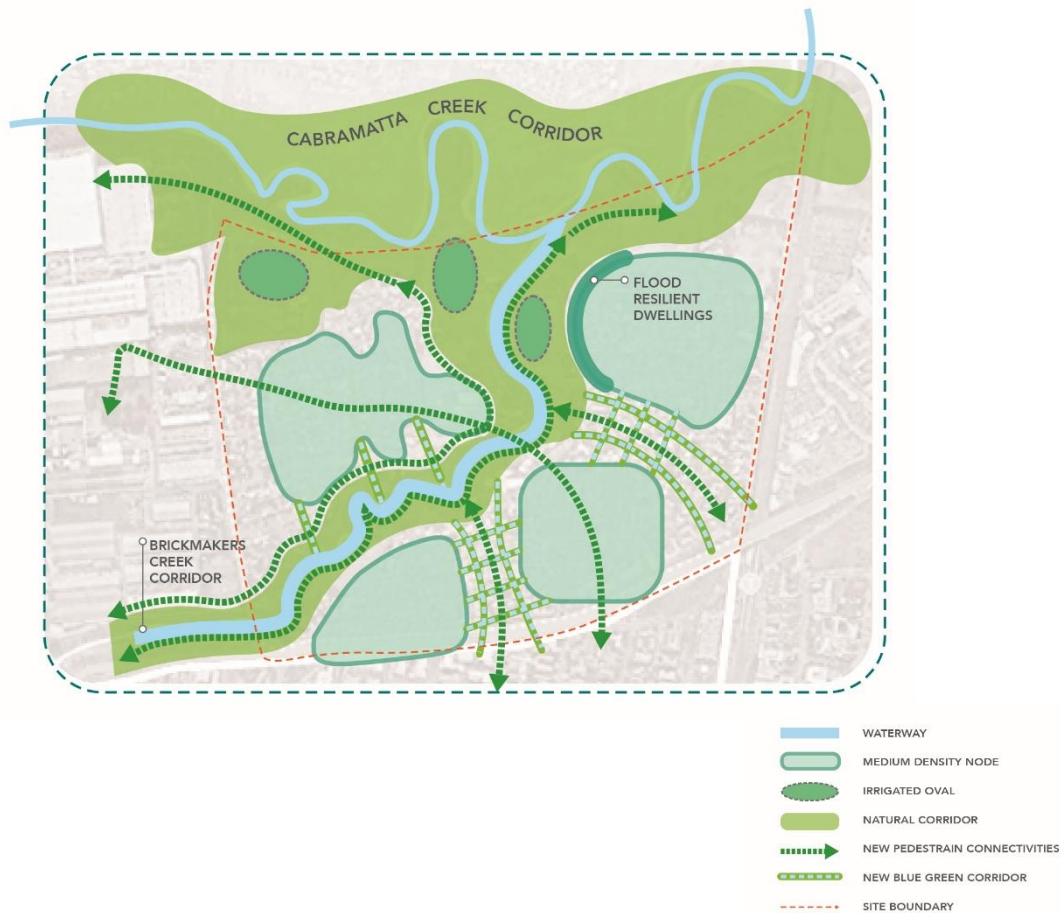
Unhidden flow path – keeping water on the surface



Restored creeks – cool places for nature-based play



Water sensitive urban design – protecting creeks and cooling streets



The next steps

- Council can lead the co-development of a precinct masterplan for Hargrave Park with the local community and Department of Family and Community Services.
- Council can give effect to the precinct masterplan in its planning scheme.
- Department of Family and Community Services can have due regard to the precinct masterplan when planning and designing new higher density social housing stock for Hargrave Park.
- Council can develop incentive mechanisms to encourage private landholders to contribute to the implementation of the precinct masterplan for Hargrave Park.
- Council and Sydney Water can develop a recycled water scheme for Hargrave Park (as part of a broader recycled water scheme for Liverpool).

Related Place Strategy actions

- ✓ **Action 8:** Deliver great places by prioritising a people-friendly public realm and open spaces; providing fine grain and diverse urban form, a diverse land use and housing mix, high amenity and walkability; and recognising and celebrating the character of the place and its people.
- ✓ **Action 28:** Implement Green Grid principles as part of the Place Strategy implementation.
- ✓ **Action 29:** Develop a demonstration project that increases green open space and tree canopy coverage in line with the NSW Government's urban tree canopy target to reduce the urban heat island effect and temperature fluctuations.
- ✓ **Action 33:** Investigate and implement innovative initiatives to address the urban heat island effect.

Idea 3: Urban ecology hub for the Liverpool Recycled Water Plant

This idea reimagines the site, the treatment processes and the surrounding land uses to align the waste, energy and water needs of the Sydney Water Liverpool Recycled Water Plant, Warwick Farm Turf precinct, and the Liverpool Hospital. The hub will recycle resources locally and provide a resource factory for the entire LCA. The hub will be further enhanced by ensuring the climate resilience of local ecological niches such as Horseshoe Swamp.

Situational analysis

Sydney Water's Liverpool Recycled Water Plant is located on approximately 50 Ha of land comprising the treatment plant facilities, Horseshoe Swamp and approximately 800 m of Georges River frontage. The recycled water plant is strategically located just 1 km from the Liverpool CBD.

The Horseshoe Swamp is currently a degraded remnant palustrine wetland. It contains ecological values that could be enhanced and made more accessible to the community.

Public access to Sydney Water's land holding is currently prohibited for safety reasons. However, contemporary water treatment techniques employed at the site have reduced the overall risks to the public, thereby opening up the possibility for a level of managed public access.

At present the recycled water plant focuses on treating wastewater for safe discharge to the Georges River or via the Malabar Wastewater System. Only a portion of this treated water is supplied as recycled water for nearby irrigation and industrial uses.

There is opportunity to increase the volume of recycled water produced and supplied from the plant, subject to future demand.

The Liverpool Recycled Water Plant will need to be upgraded in the future to accommodate population growth in its service catchment. Similarly, the Malabar Wastewater System will also need to be upgraded in the future to accommodate forecast population growth in its service catchment.



Existing green space at Liverpool Recycled Water Plant



Existing treatment ponds at Liverpool Recycled Water Plant

Problem definition

- Population and employment growth requires future augmentation of the Liverpool Recycled Water Plant and the Malabar Wastewater System.
- Restricted public access to the Sydney Water site prevents public access to the Georges River corridor for use as an active transport corridor connecting the Liverpool CBD to surrounding residential and commercial precincts.
- Restricted public access to the Sydney Water site prevents community interaction with a rare remnant ecological habitat (Horseshoe Swamp).
- Future urban development within areas surrounding the Liverpool Recycled Water Plant requires provision of new infrastructure to provide “fit-for-purpose” water and energy supplies to end users.
- Organic (green and food) waste streams from surrounding land uses provide additional resource recovery opportunities if harnessed.

Opportunity to influence

- Sydney Water’s strategic master planning for the Malabar Wastewater System provides the opportunity to collaborate with Liverpool City Council, State Government agencies and local Liverpool businesses to plan for future recycled water and other resource recovery / generation opportunities at the Liverpool Recycled Water Plant.

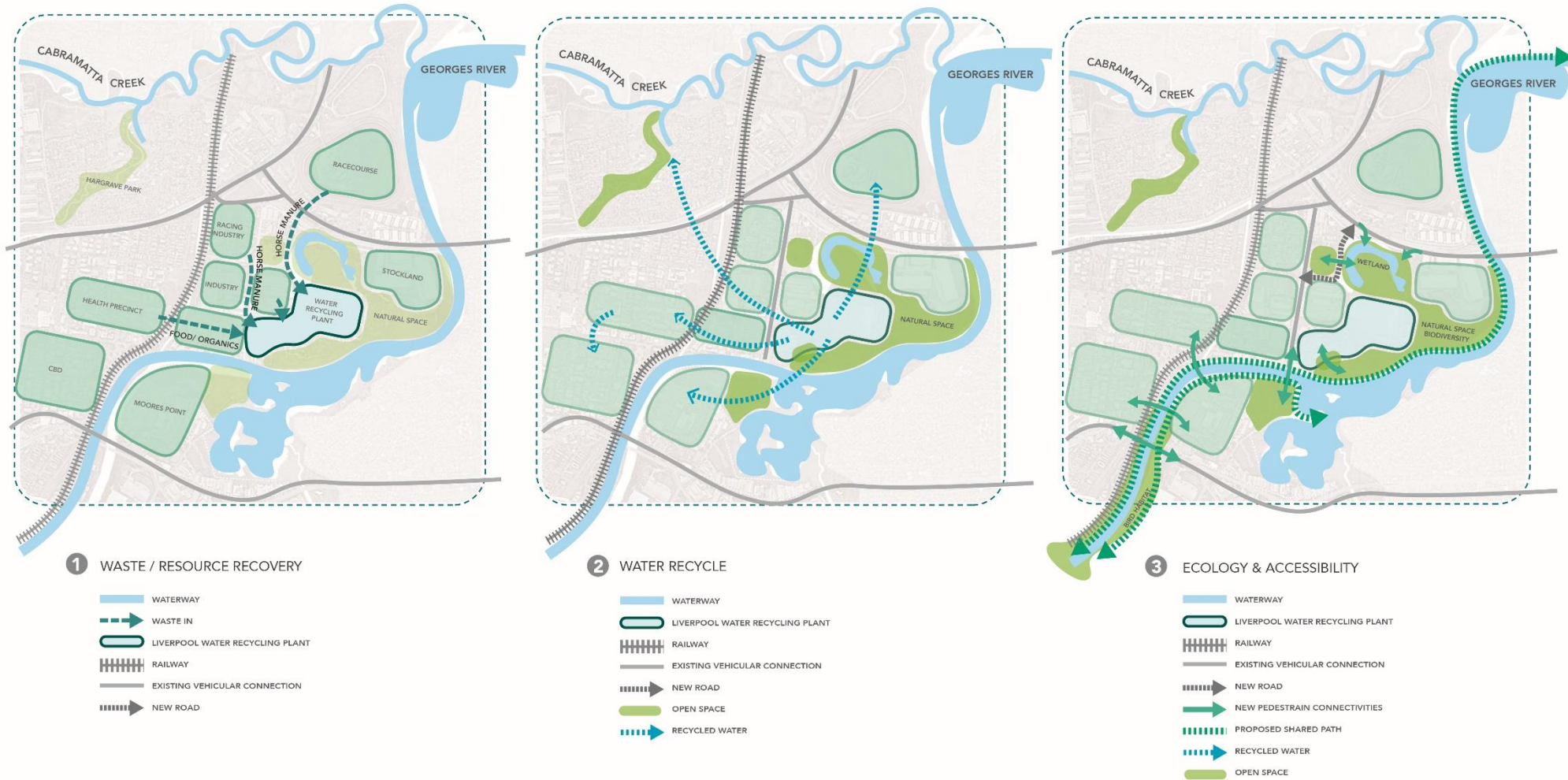
The big moves

Develop a strategic masterplan (operational, land use, ecological and cultural) for the Sydney Water site to facilitate:

- Public access to the Georges River riparian corridor and Horseshoe Swamp
- Ecological recovery and protection of riparian and wetland habitats
- Generation of “fit-for-purpose” water and energy supplies derived from locally sourced resources (e.g. *waste to energy”)
- Generation of fertiliser and soil amelioration products for nearby landscape and horticultural uses
- Creation of cultural connections to place (e.g. create an Ochre Trail).

** Specific local waste resource opportunities include green waste from Liverpool city Council, commercial food waste from the Liverpool Hospital and the new function facility of the equine precinct, and animal waste from Warwick Farm.*

URBAN ECOLOGY HUB



The next steps

- Sydney Water to assess the business case for a waste to energy facility co-located at its Liverpool Recycled Water Plant.
- Sydney Water to assess the business case for a reticulated recycled water scheme to end users in the LCA (as part of a broader regional recycled water scheme).
- Sydney Water and Council to co-develop the strategic masterplan for the Sydney Water site.
- Council and other key stakeholders tasked with implementing the LCA Place Strategy to have regard to the strategic masterplan for the Sydney Water site when making land use planning decisions and infrastructure investment decisions.
- Council to ensure its planning scheme and internal capital works programs support and prioritise use of locally generated water and energy supplies, where these are “fit for purpose” and cost competitive.

Related Place Strategy actions

- ✓ **Action 8:** Deliver great places by prioritising a people-friendly public realm and open spaces; providing fine grain and diverse urban form, a diverse land use and housing mix, high amenity and walkability; and recognising and celebrating the character of the place and its people.
- ✓ **Action 20:** Investigate opportunities to increase public and equine access through Sydney Water’s water recycling facility as part of a network of high quality open space linked to the Greater Sydney Green Grid.
- ✓ **Action 25:** Improve the quality, environmental amenity and useability of the riverbank to respond to uses associated with precinct renewal and increase walking trails and open space, in accordance with sustainable urban water management principles
- ✓ **Action 26:** Develop a linear parkland and a continuous network of public open spaces aligned with Green Grid priorities along the Georges River that links the CBD with the Sydney Water site, Warwick Farm, Chipping Norton Lakes and the Holsworthy Defence site.



Active transport along river corridors

- ✓ **Action 31:** Develop a precinct-wide integrated water management strategy exploring opportunities for innovative resource management (including water and energy), public access, and eco-development to integrate Sydney Water’s water recycling facility seamlessly into the surrounding city, river, and community.

Idea 4: River activation

This idea embeds the Georges River in the cultural and built identity of Liverpool. Moore Point redevelopment will serve as a focal point to reimagine and re-express the Georges River in urban design and community living. It will act as a demonstration of river-first planning, where water drives planning of other city elements and where people are drawn to the waterfront.

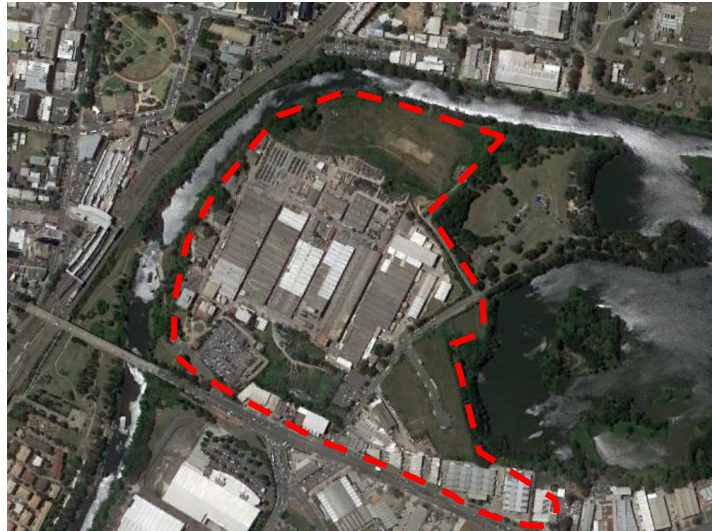
Situational analysis

The Moore Point redevelopment area is strategically located on land with 1 km of Georges River frontage directly adjacent the Liverpool CBD. The land is currently zoned for light industrial uses and is subject to rezoning applications by current landowners for future mixed use development.

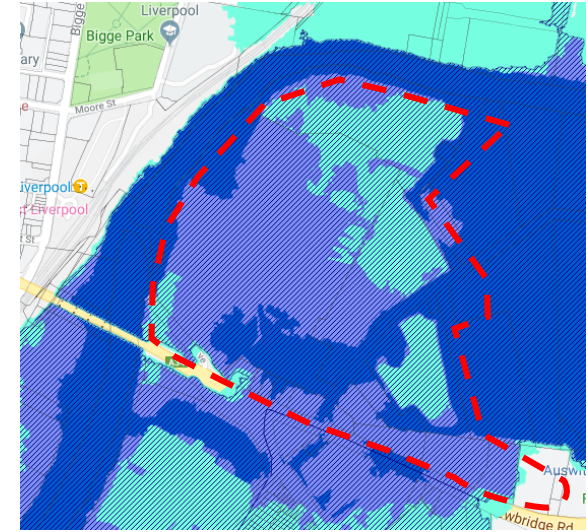
The land enjoys vistas to Georges River floodplain environs and Lake Moore, with current road access into the site limited to two small local access roads off Newbridge Road. There is currently no active transport connections from the site to the CBD.

Fluvial (riverine) and pluvial (local stormwater) flooding currently impacts the site and demands careful consideration to ensure the future flood resilience of buildings, infrastructure and the community.

Two private land development firms currently own all of the land parcels within the Moore Point redevelopment area. The developers have expressed a willingness to collaborate with Council and State Government agencies to prepare a precinct masterplan for the area that supports the directions established by the LCA Place Strategy and that adopts water sensitive city principles.



Moore Point redevelopment area



Riverine flood risk (light blue: low; dark blue: high)
source: Liverpool City Council



Lake Moore vista



Heritage industrial buildings



Heritage bridge structure across
Georges River

Problem definition

- Flooding and flood resilience
- Urban heat
- Stormwater runoff impacts on Georges River and Lake Moore
- Limited river / waterfront access and recreation
- Lack of cultural connections
- Lack of effective road and active transport connections with CBD and broader green grid network

Opportunity to influence

- Collaborative implementation of the LCA Place Strategy includes a willingness by the two land developers to embed the vision and direction established by the Place Strategy into a precinct masterplan for the area.
- Council's current review of its planning scheme provides an opportunity to influence the transformation of Moore Point through new planning provisions that can be included in the Local Strategic Planning Statement, Local Environment Plan and Development Control Plan.
- The close proximity of Sydney Water's Liverpool Recycled Water Plant provides an opportunity to secure a reliable recycled water supply to Moore Point for landscape irrigation and other "fit-for-purpose" end uses.

The big moves

Develop a new precinct masterplan for Moore Point that:

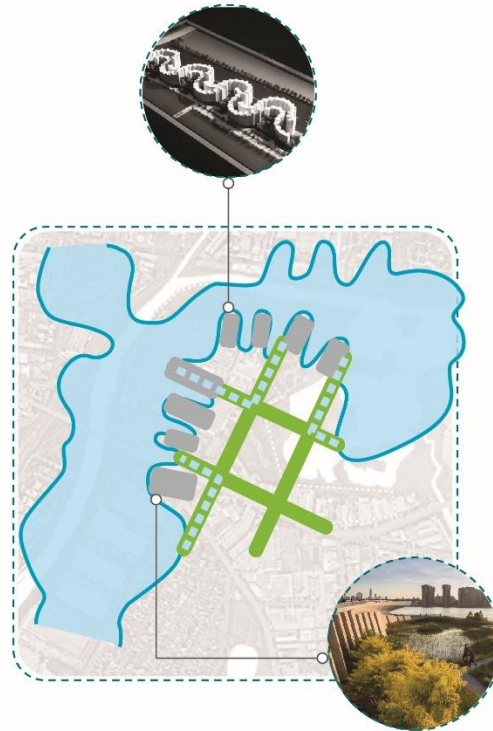
- Improves access to and interaction with the Georges River
- Builds a cultural focus around the Georges River
- Delivers an iconic feature such as a new bridge connecting to Bigge Park. The design of the bridge can be a place-maker that creates a new identity for Liverpool as a river sensitive city
- Provides for urban developments that are resilient to floods by design
- Provides for ecological regeneration, and public spaces for community congregation that define community identity
- Delivers a blue – green grid replicating the "Hoddle grid" structure of the CBD
- Provides biodiversity connectivity through the development, and allows productive landscapes to be established at street scale to enhance connections to greening and local food production
- Delivers architectural and landscape design responses that serve as a focal point to reimagine and re-express the Georges River. This may involve using trade-offs between building height and open space to create high density islands along with areas for flood waters to safely move through the precinct.



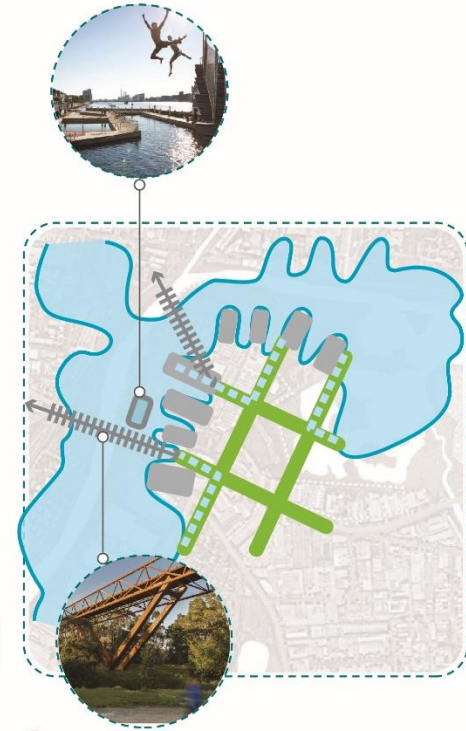
1 FLOODING RIVER



2 BLUE GREEN CORRIDOR



3 INCREASED WATERFRONT DEVELOPMENT



4 COMMUNITY INFRASTRUCTURE

-  WATERWAY
-  BLUE GREEN CORRIDOR
-  NEW ROAD CONNECTION
-  WATERFRONT SETTLEMENT

The next steps

- Council and developers of Moore Point to work collaboratively to develop a new precinct masterplan for Moore Point that embodies these ideas and is commercially feasible.

Related Place Strategy actions

- ✓ **Action 8:** Deliver great places by prioritising a people-friendly public realm and open spaces; providing fine grain and diverse urban form, a diverse land use and housing mix, high amenity and walkability; and recognising and celebrating the character of the place and its people.
- ✓ **Action 25:** Improve the quality, environmental amenity and useability of the riverbank to respond to uses associated with precinct renewal and increase walking trails and open space, in accordance with sustainable urban water management principles.
- ✓ **Action 26:** Develop a linear parkland and a continuous network of public open spaces aligned with Green Grid priorities along the Georges River that links the CBD with the Sydney Water site, Warwick Farm, Chipping Norton Lakes and the Holsworthy Defence site.
- ✓ **Action 28:** Implement Green Grid principles as part of the Place Strategy implementation.
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