

Transitioning to a Water Resilient Harbour City

Eastern Sydney Regional Master Plan



Sydney
WATER



A message from Roch Cheroux

I am delighted to launch Sydney Water's *Transitioning to a Water Resilient Harbour City – Eastern Sydney Regional Master Plan*, developed in partnership with key stakeholders in the region.

Eastern Sydney is a dynamic and thriving region, home to the Central Business District and a hub of economic activity in Greater Sydney. By 2056, Eastern Sydney's population is forecast to increase by 50 per cent, reaching a total population of 4.1 million. This master plan outlines Sydney Water's vision for the Harbour City and our plans to ensure our world-class water services can continue to be enjoyed by the residents and visitors to Eastern Sydney well into the future.

As the region has grown, water services in Eastern Sydney have also evolved. From the First Nation's people through to the Tank Stream in Sydney Cove, the city's first engineered water supply, the main source of water for the Eastern Sydney region has moved further west. Eastern Sydney currently receives most of its water from remote catchment dams in Western Sydney and most of its treated

wastewater is released into the ocean. Urban renewal in Eastern Sydney gives us an opportunity to re-evaluate the way we manage the entire water cycle to ensure a greener, cooler and more sustainable future.

This master plan provides a framework for understanding the challenges and opportunities of an integrated water management approach in Eastern Sydney. It goes beyond conventional water servicing to consider alternative water servicing pathways that integrate, enhance and enable a transition to a water resilient Harbour City.

We look forward to continuing to work with our stakeholders and the community to ensure the right infrastructure and services are delivered at the right time to support thriving, liveable and sustainable communities now, and well into the future.

Roch Cheroux
Managing Director



Rock art in Woronora

Acknowledgements

Acknowledgement of Country

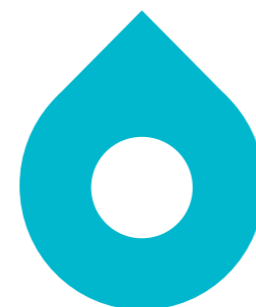
Sydney Water acknowledges the traditional owners of the Eastern Sydney region: the Dharug or Eora and Dharawal nations.

Sydney Water recognises that the traditional owners have occupied and cared for this country over countless generations and celebrates their continuing contribution to the life in the region. Their lore, traditions and customs nurtured, and continue to nurture, the waters (Salt Water and Sweet Water) in Sydney Water's operating area, creating wellbeing for all.

The Eastern Sydney Regional Master Plan is led by Sydney Water in collaboration with AECOM, Arup and Aurecon.

Sydney Water thanks the following organisations for their contribution to the development of the master plan:

- Bayside City Council
- City of Canada Bay
- City of Canterbury Bankstown
- City of Ryde
- City of Sydney
- Cooks River Alliance
- Department of Planning, Industry and Environment (DPIE)
- NSW Environment Protection Authority (EPA)
- Greater Sydney Commission (GSC)
- Inner West Council
- Local Government NSW
- Macquarie University
- Mosman Council
- North Sydney Council
- Northern Beaches Council
- NSW Health Infrastructure
- Randwick City Council
- Sydney Airport
- Sydney Coastal Councils Group
- WaterNSW
- Waverley Council
- Woollahra Council.





Johnstons Creek

About the Eastern Sydney Regional Master Plan

The Eastern Sydney Regional Master Plan supports Sydney Water’s vision to create a better life with world-class water services and aligns with the NSW Government’s vision of creating a more liveable, productive and sustainable Eastern Harbour City.

The master plan sets the long-term direction for servicing the Eastern Sydney region. It proposes that an adaptable and integrated water cycle management approach will deliver greater economic value for the region over a traditional servicing approach.

The context for a secure water supply in the master plan is set by the Greater Sydney Water Strategy (GSWS) currently being developed by the NSW Government. We expect the GSWS to consider all supply options – dams, desalination and purified recycled water – within a framework that delivers integrated water, carbon reduction and better environmental outcomes.

Stakeholder engagement has been central to the development of this master plan. A diverse group of stakeholders representing NSW government agencies, local councils and other groups and institutions have been involved in workshops to help shape the master plan. The stakeholders include subject matter experts from the planning, infrastructure, environment, resource, land management and development sectors.

The master plan’s vision, developed in collaboration with our stakeholders, is:

‘Water sustains a greener, cooler and more resilient city for our vibrant communities.’



Why Eastern Sydney?

The NSW Government, through the Greater Sydney Commission (GSC), envisages Greater Sydney as a metropolis of three cities; the Western Parkland City, the Central River City, and the Eastern Harbour City, founded on the principles of liveability, productivity and sustainability.

The scope of Sydney Water's Eastern Sydney region aligns with the GSC's Eastern Harbour City and includes the Bayside, Burwood, City of Canada Bay, City of Canterbury Bankstown, City of Ryde, City of Sydney, Inner West, Mosman, Northern Beaches, North Sydney, Randwick, Strathfield, Waverley and Woollahra local government areas.

The challenges and opportunities unique to this well-established region present a case for managing water differently. Rethinking the ways in which water is valued, used and managed, and how water services are provided, will be vital to delivering the GSC's vision for the Eastern Harbour City.

Along with servicing growth, the master plan takes an integrated approach to multiple opportunities, challenges and complexities, including:



Growth and urban form

Eastern Sydney is characterised by some of the oldest urban forms in Greater Sydney, with many of these legacy buildings having undergone renewal

at various stages since their initial development. Much of the urban densification in the region has come from medium- to high-density developments. With the population forecast to reach 4.1 million by 2056, urban development presents the opportunity to adopt integrated water cycle management principles.

Other opportunities include:

- providing open green spaces in parallel with ongoing densification
- achieving greater water conservation through smart water management systems
- mitigating floods from legacy and new developments.

Water security

Eastern Sydney's water supply is largely dependent on rainfall over catchment dams, with only 15% of the supply coming from the Sydney Desalination Plant at Kurnell. The recent severe drought highlighted the need for a more resilient water supply in Eastern Sydney.



Other water security issues include:

- water demand vs supply in the next 10–30 years
- recurring drought cycle at shorter frequencies (<10 years).



Assets condition/reliability

Water servicing in Eastern Sydney has evolved organically since the beginning of the 20th century. Some of the existing assets are 50–100

years' old, resulting in sections of the network infrastructure experiencing performance issues.

Other challenges and opportunities include:

- diminished capacity of the existing infrastructure to service growth provides an opportunity to renew ageing assets
- high-dependency on the City Tunnel to supply water to the region poses a resilience risk and provides an opportunity to consider alternative sources of drinking water
- potential changes to environmental regulations could impact the volume of treated wastewater released to the ocean
- community impacts from treatment operations.

Waterway health

Urban growth will place more pressure on our waterways, including the Lower Parramatta, Georges and Cooks Rivers.

Other challenges and opportunities of urban development include:

- limited stormwater re-use provides an opportunity to harvest stormwater for non-drinking purposes
- water quality impacts from wastewater overflows and stormwater runoffs
- uncoordinated catchment management
- artificial nature of waterways that receive stormwater could be naturalised.



Climate change

Eastern Sydney will experience an increase in the number of hot days (>35°C) due to climate change.

Other urban heat impacts include:

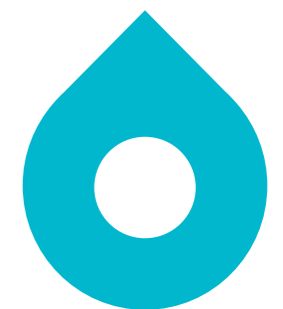
- increase in natural events, such as drought and rainfall
- frequent flooding of assets
- sea level rise
- saltwater ingress.

Resources

Harnessing wastewater resources can play an important role in sustainability.

Moving to a more circular economy approach would assist with:

- carbon reduction imperatives
- offset energy costs through renewable sources, such as biogas
- nutrient recovery from wastewater as a replacement for chemical fertilisers
- diminishing landfill space for waste.



The master plan approach

The master plan was developed through a phased approach. Key stakeholders were engaged at each stage to confirm the direction.

Issues and directions

- Understand the servicing context for the region.
- Outline the planning challenges, issues and opportunities.
- Propose alternative servicing concepts.

Concept development

- Analyse alternative servicing concepts and a base case.
- Develop water and resource balance for each concept.
- Evaluate high-level investment costs and economic benefits.

Pathway development

- Combine concepts into four servicing pathways that reflect different levels of water integration.
- Re-evaluate water and resources balance.
- Develop high-level investment costs for each pathway.
- Evaluate economic benefits for each pathway.

Adaptive plan

- Monitor external uncertainties likely to emerge.
- Reassess the application of servicing pathways in response to uncertainties.
- Select primary pathway and develop adaptive plan.
- Roll out analysis into next steps of planning.

2019

September 2019 – Workshop 1

Framing workshop:

- Introduced the master plan process to external stakeholders.
- Co-developed vision and outcome. Feedback sought on opportunities and issues.

November 2019 – Workshop 2

Development of servicing concept:

- Showcased the alternative servicing concepts, including water and resource balance.
- Collaborated with stakeholders to identify key enabling factors for each concept.

2020

March 2020

Servicing pathway development:

- Conducted a series of collaborative team sessions with internal stakeholders.
- Gathered insights from customer forums and similar projects.

July 2020 – Workshop 3

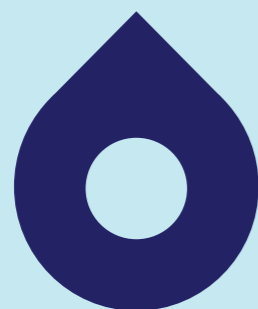
Servicing pathways analysis:

- Reviewed and tested the thinking behind preliminary servicing pathways and completed a water and resource balance assessment.
- Received feedback on work completed. Identified events which may influence an adaptive strategy.

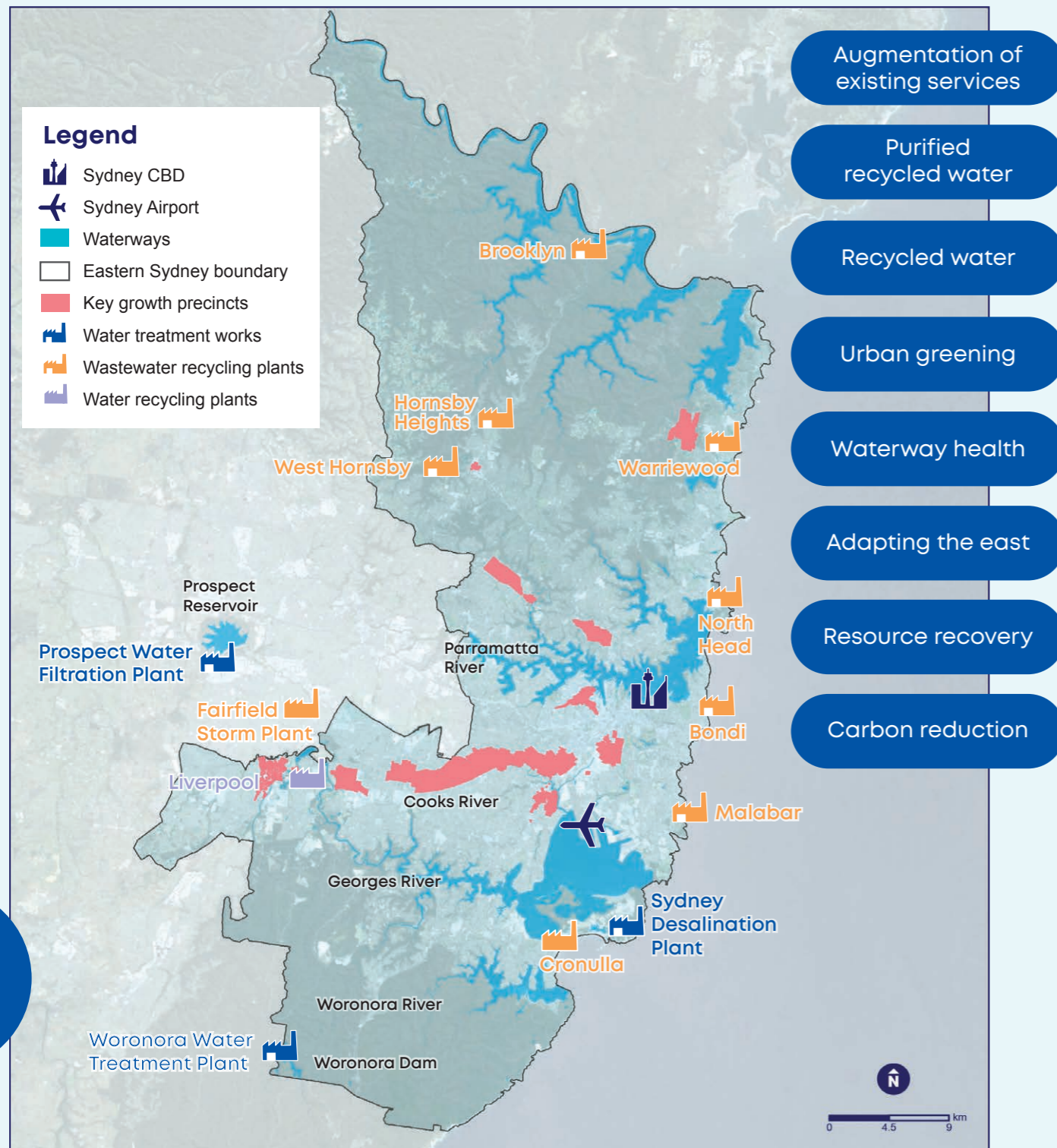
November 2020

Master plan outcomes

(Report with supporting studies on various servicing concepts.)

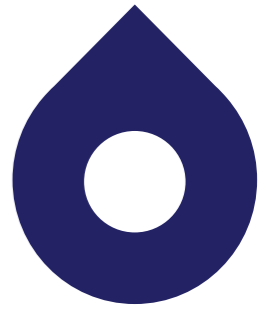


Servicing concepts considered in the master plan



Current state of services in the Eastern Sydney region

Servicing pathways considered in the master plan

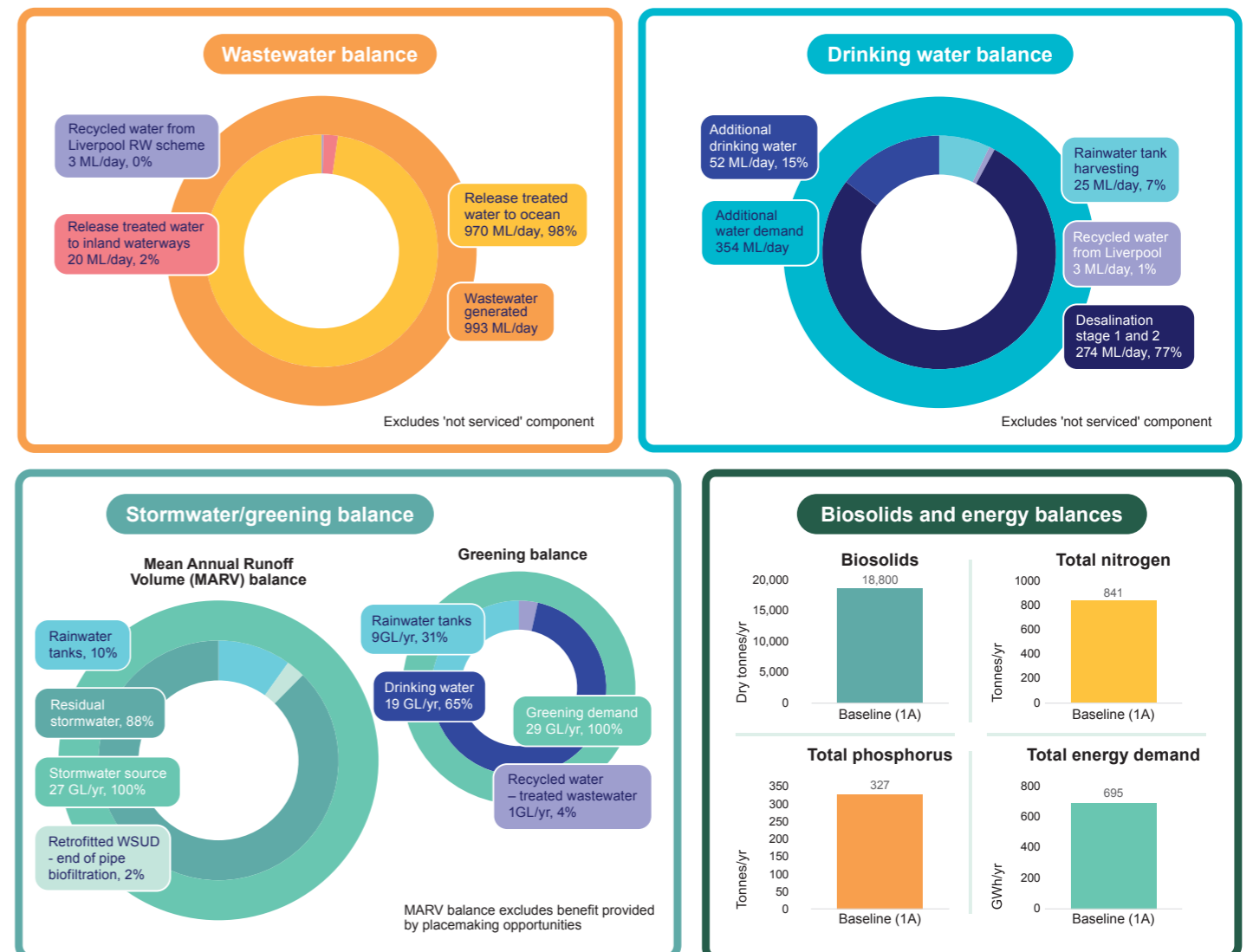


Pathway 1 Traditional City

Conventional servicing principles with reference to existing regulation, policy and governance. Fresh water is used once by residential, commercial and industrial customers and wastewater is collected, treated and released into waterways.

Two scenarios were considered within the Traditional City pathway:

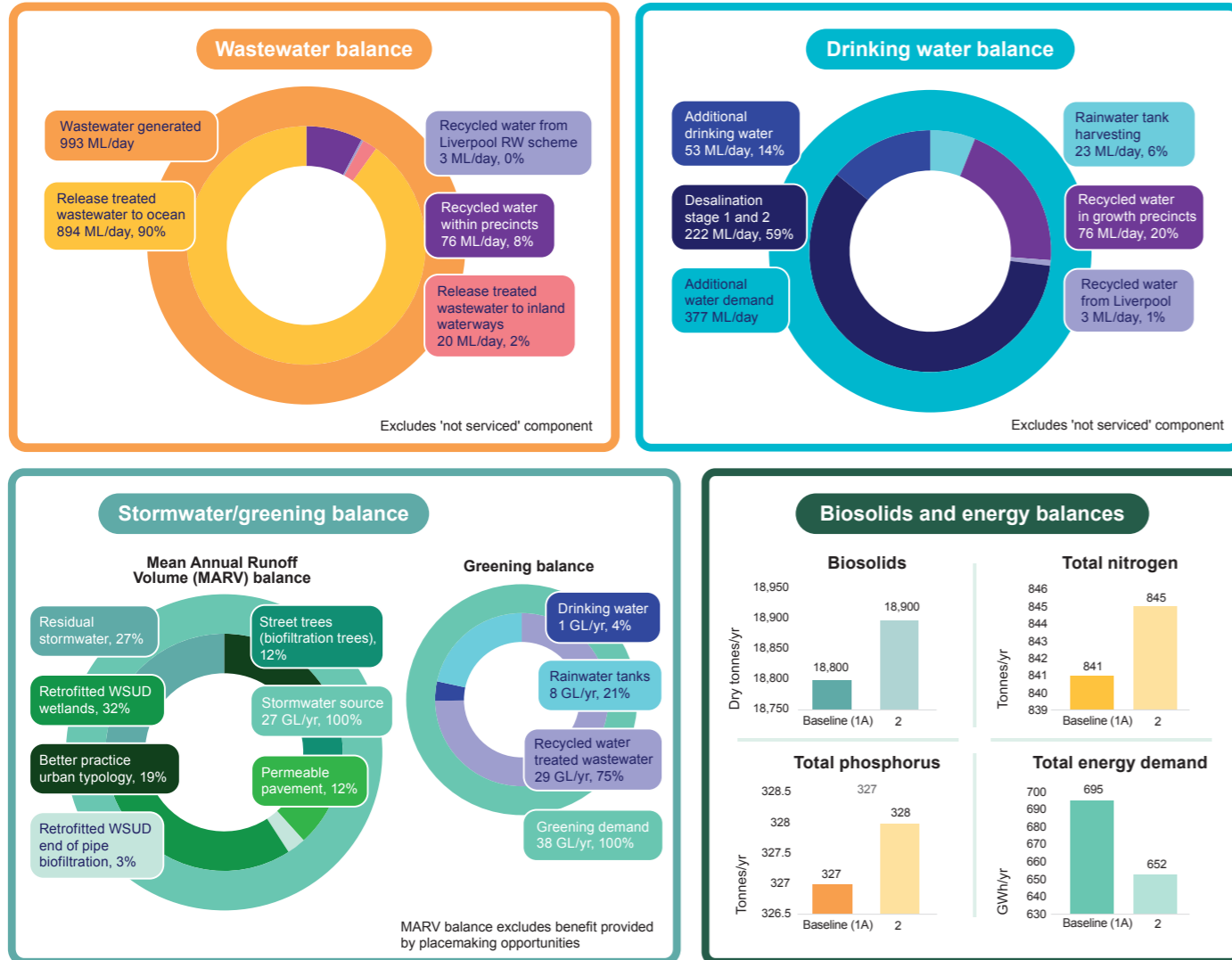
- 1A – new precinct developments do not incorporate water sensitive urban design principles.
- 1B – green infrastructure is incorporated in twelve key growth precincts.



Pathway 1 – Water, resource and energy balance

Pathway 2 Resource Efficient City

Wastewater is considered a vital resource as biosolids can be recovered from the wastewater treatment process. Decentralised precinct-scale water solutions are targeted in new growth areas, where there's greater integration of urban form, greening and the water cycle.



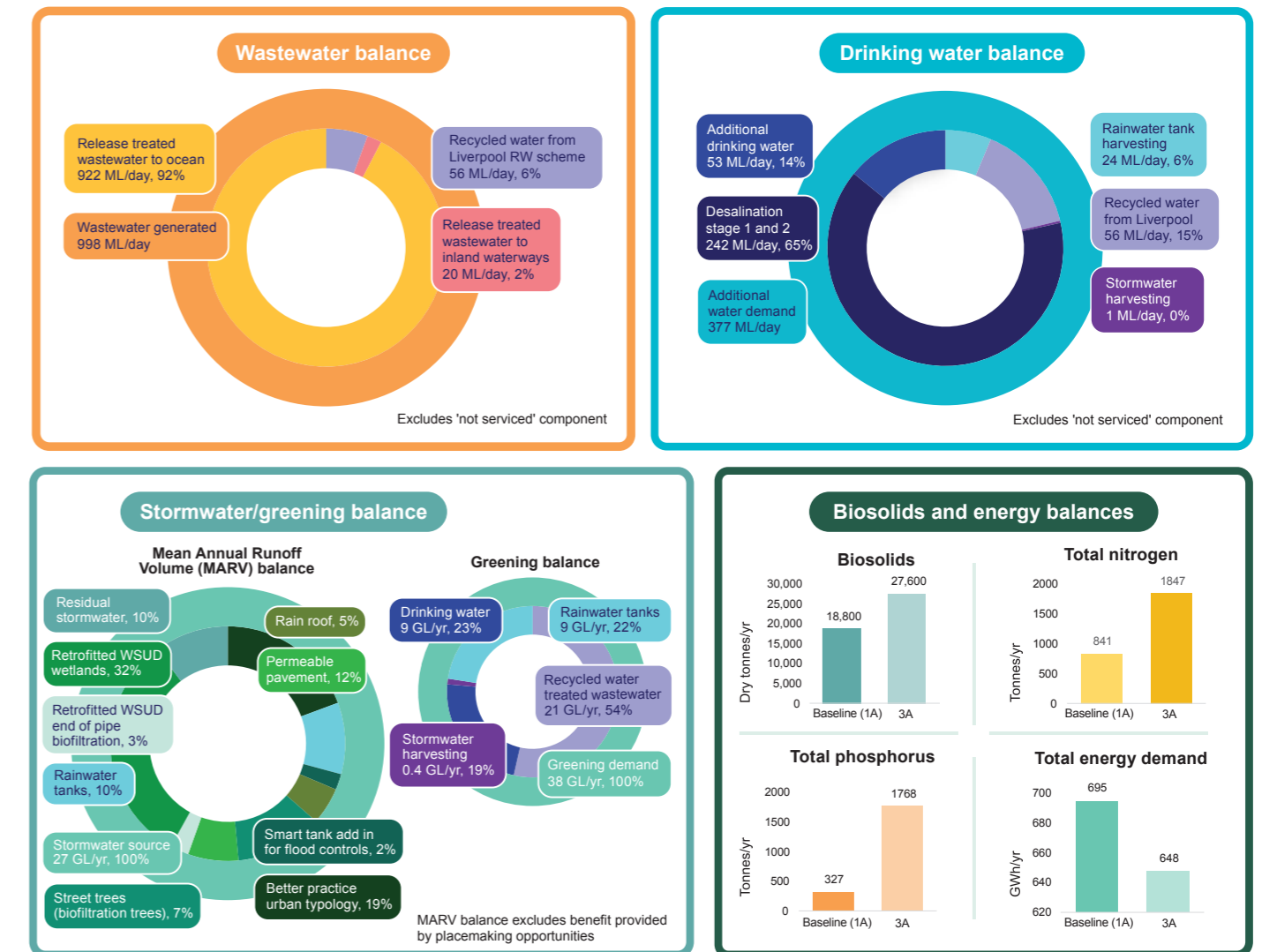
Pathway 2 – Water, resource and energy balance

Pathway 3 Water Cycle City

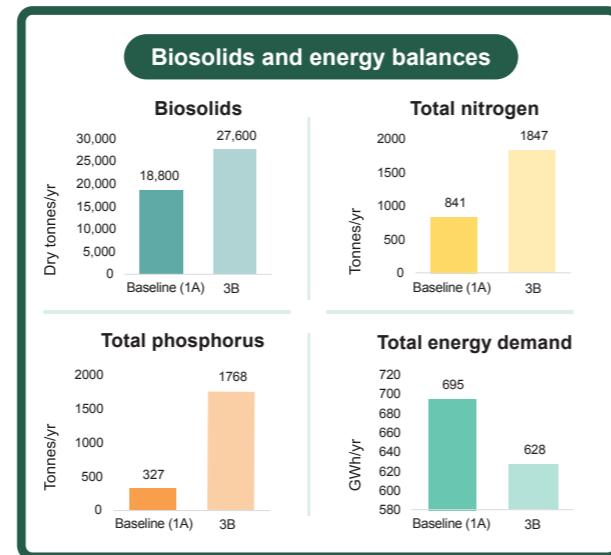
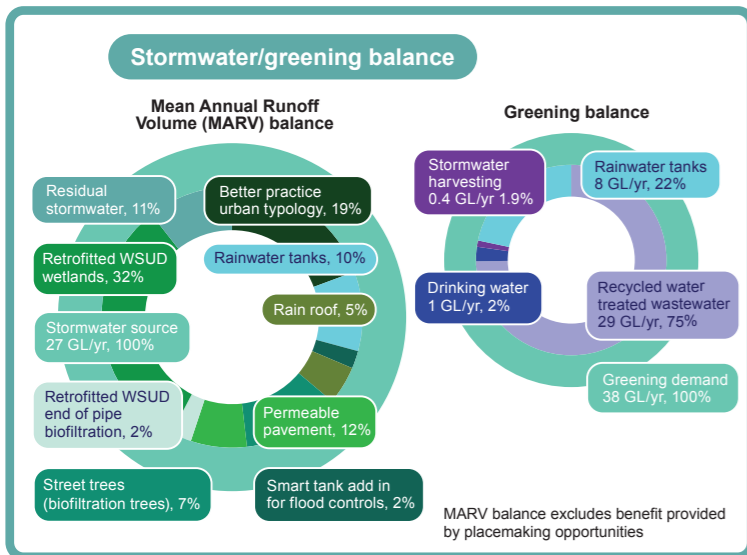
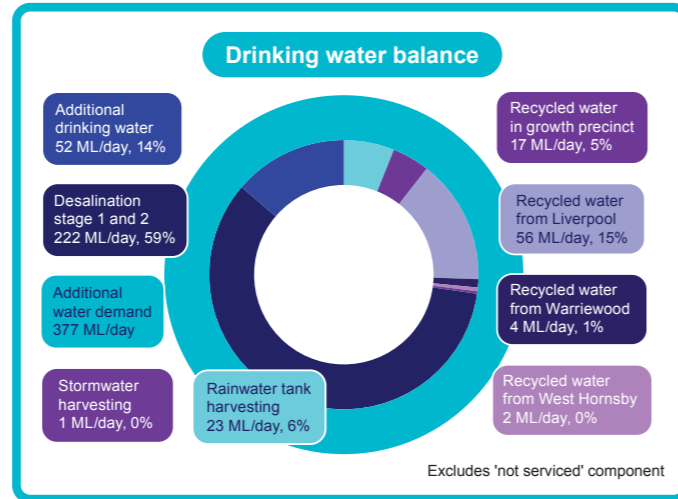
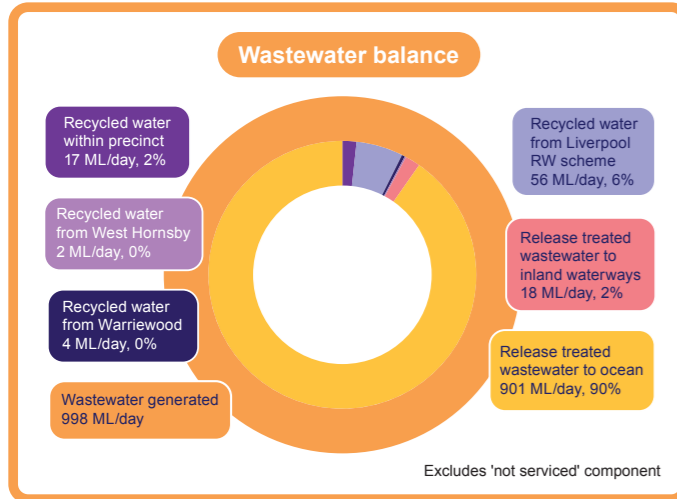
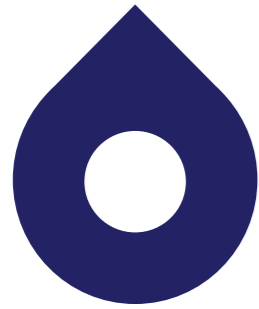
Energy and resource recovery are significantly increased. The recycled water network for non-drinking uses is centralised. Sydney Water's coastal wastewater treatment plants use energy generated on-site and resource recovery is maximised.

Two scenarios were considered within the Water Cycle City pathway:

- 3A – a centralised recycled water scheme serviced from Liverpool Wastewater Recycling Plant, through the extension of the Liverpool to Ashfield pipeline, to supply key growth precincts.
- 3B – a hybrid of centralised and decentralised recycled water (non-drinking) services.



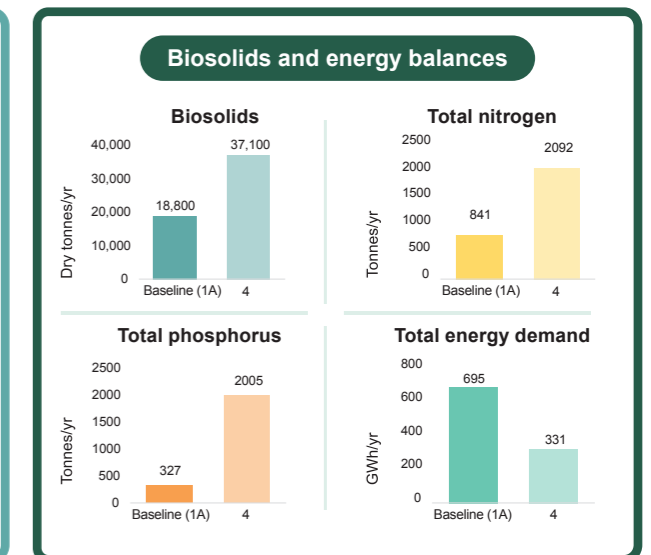
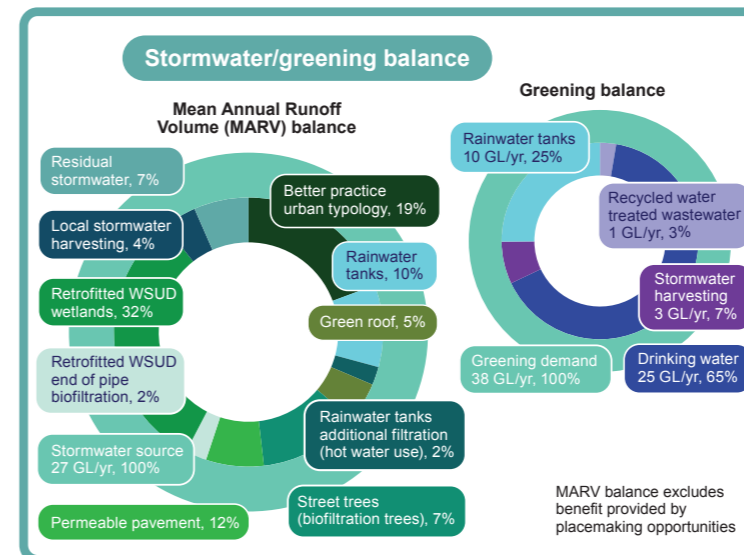
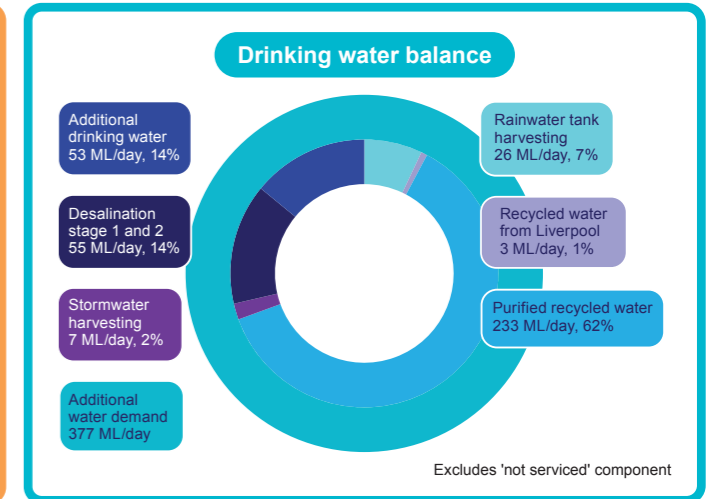
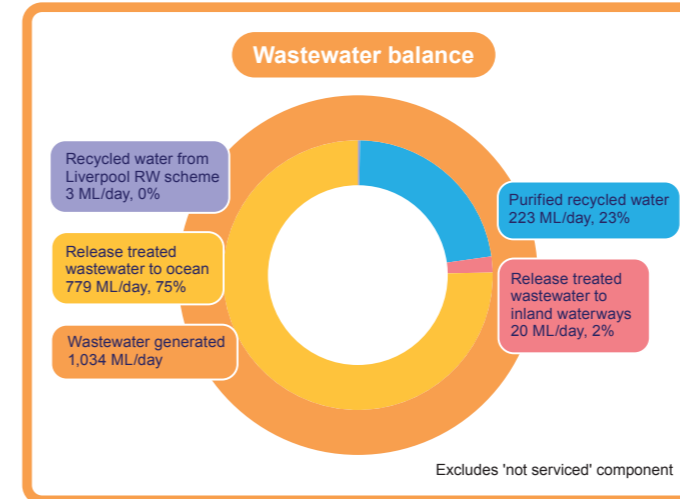
Pathway 3A – Water, resource and energy balance



Pathway 3B – Water, resource and energy balance

Pathway 4 Regenerative City

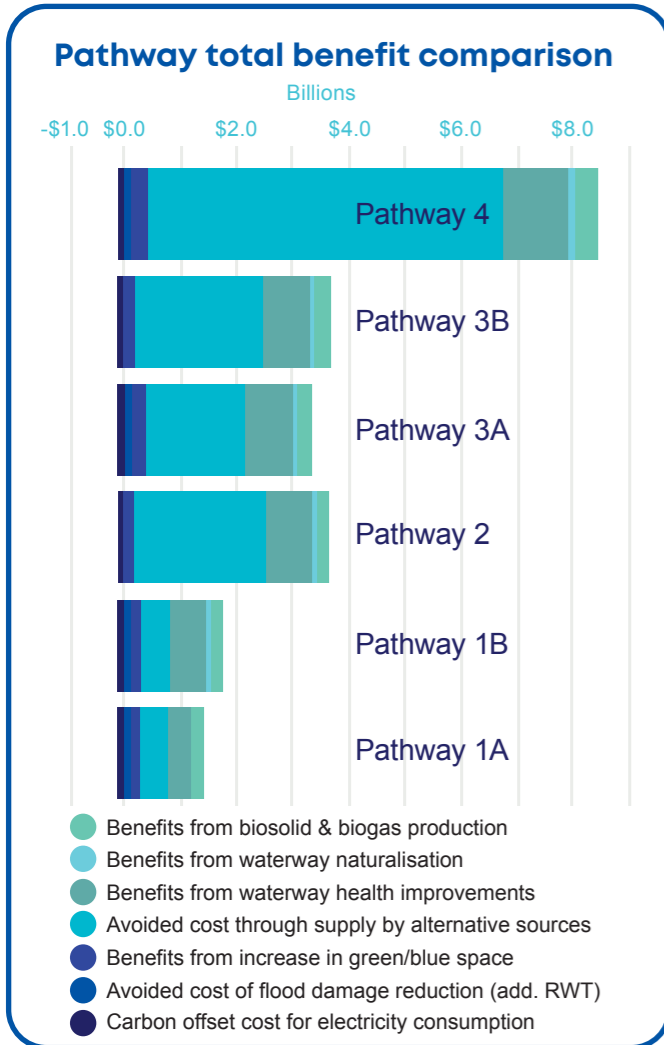
Purified recycled water is used for drinking purposes and energy and resource recovery at coastal treatment plants is maximised. The Cooks River catchment is disconnected from the Malabar wastewater system and connected to a new water recycling plant near the airport with more advanced wastewater treatment processes. This pathway significantly reduces the release of treated water into our waterways.



Pathway 4 – Water, resource and energy balance

Improved water services to bring value to Eastern Sydney

The four servicing pathways were evaluated through a Cost Benefit Analysis (CBA) to determine the value each pathway would bring to Eastern Sydney. The findings of the CBA are shown in the table below.



Urban greening

- Health and wellbeing improvements from exposure to irrigated green spaces.
- Urban greening improves air quality by storing carbon.
- Reduced urban heat island effect.

Waterway improvements

- Waterway naturalisation improves wildlife habitats.
- Social and amenity improvements.
- Improved quality of coastal waters from removal of rubbish from waterways and reduction in wastewater ocean outflow.

Carbon offsets

- Carbon offset cost for electricity consumption of operations.

Diverse water supply

- Reduction in costs from introducing alternative water sources, such as centralised/decentralised recycled water, purified recycled water, rainwater tanks and stormwater capture.

Biosolid production

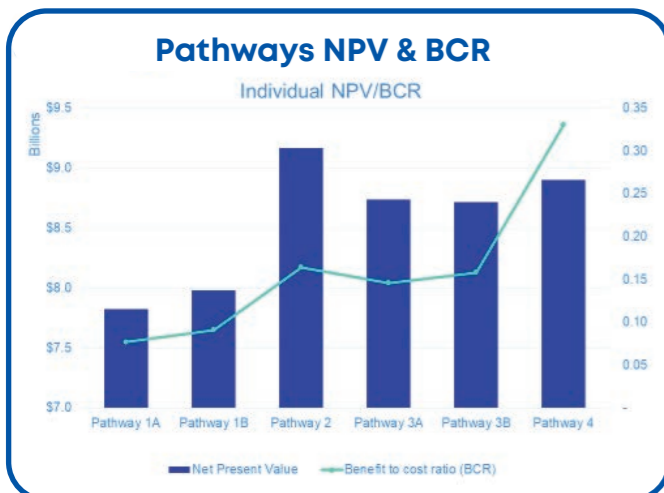
- Biogas produced to offset energy consumption.
- Nutrient-rich biosolids produced for beneficial use in agriculture.

Flood damage mitigation

- Reduction in residential and commercial property flood damage.

Key takeaways:

- **Pathway 1B – Traditional City** (with new typologies) demonstrates the most desirable net present value (NPV), relative to the base case, Pathway 1A.
- **Pathway 2 – Resource Efficient City** requires the largest investment, most of which is required in the early years.
- **Pathways 3A and 3B – Water Cycle City** provides similar benefits compared with Pathway 2, at a lower relative cost.
- **Pathway 4 – Regenerative City** has a significantly higher benefits-to-cost ratio (BCR) than the other pathways and a similar NPV. This indicates that it is the leading pathway from an investment perspective.



How we are supporting Eastern Sydney

Moving from a Traditional City pathway to a Regenerative City pathway in Eastern Sydney means:

- more diverse sources of water supply
- more recycled water for non-drinking purposes
- ability to transition to purified recycled water in the future
- increased capture of resources from wastewater, reducing carbon emissions from biosolids and energy
- increased focus on local retention and reuse of stormwater supported by co-ordinated management of waterways
- land use planning adopts water sensitive urban design, reducing the loss of pervious land.

The master plan aspirations for water in the Eastern Sydney region go beyond delivering clean, safe, reliable and efficient water and wastewater services that meet our customers' needs. The plan considers managing the water cycle as a whole.

The analysis highlights that water plays a key role in achieving sustainable outcomes, through greening and cooling, to support liveable communities.

The analysis found:

- **The Traditional City**, while viable, would not deliver the GSC's vision and would return the lowest economic benefits in the long-term.
- **The Resource Efficient City and Water Cycle City** are both favourable as they deliver greater economic value than the Traditional City.
- **The Regenerative City** delivers the GSC's vision and is supported by the greatest economic value.

The Regenerative City pathway is the primary pathway for the Eastern Sydney region; however, Sydney Water will leverage parts of the Resource Efficient City and the Water Cycle City for individual projects in the short- to mid-term.





A flexible, adaptive plan approach

The future rates of growth, climate patterns, technological advancements, catchment system responses to changes, social and political environments can all be forecast; however, the level of certainty decreases over time. Adaptive planning can be used for decision-making in the face of uncertainty and features:

- Provisions for adaptation as conditions change and knowledge is gained, with the ability to accelerate decisions in response to specific triggers.
- A combination of immediate actions, those that make important commitments to shape the future and those that preserve flexibility.
- Specification of a monitoring system, along with the actions required when specific trigger values are reached.

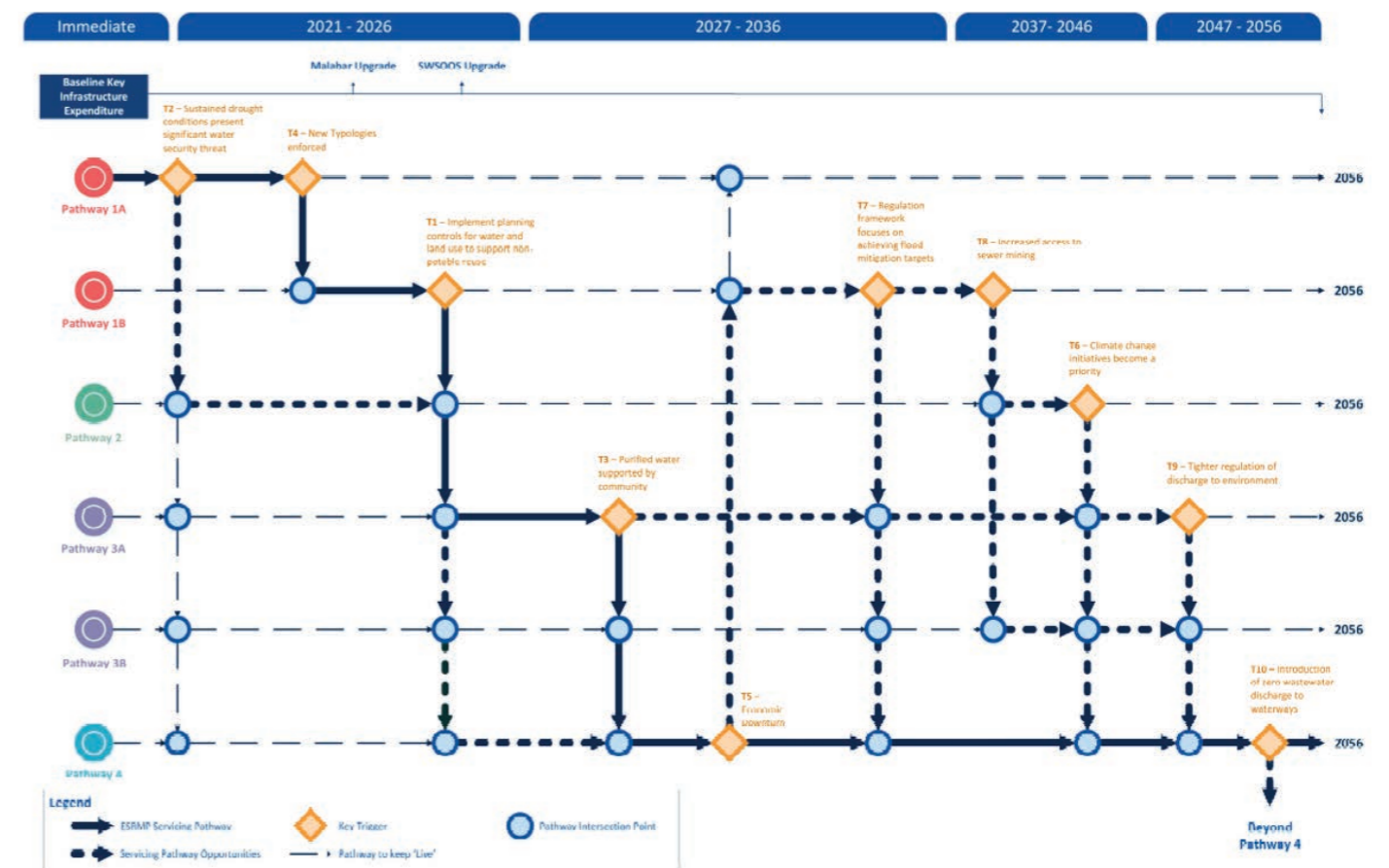
Sydney Water has developed an adaptive servicing plan to explore how to transition from the current Traditional City pathway, to the Resource Efficient City pathway in the short- to mid-term, and to the Regenerative City pathway by 2056.

The adaptive servicing plan diagram on the right outlines the possible interconnectivity between the servicing pathways, as well as the horizons where certain pathways are expected to become redundant.

The diagram also depicts the key decision points for each servicing pathway. At certain points in the future, decisions will be made to adopt and/or discontinue the pursuit of alternate servicing pathways based on the latest information available at the time.

Continued stakeholder collaboration and monitoring of actual growth, climate, environmental responses to development, technological advancements, and community values and attitudes to water recycling will be necessary to inform decisions at key times during the region's evolution. Planned infrastructure will be scalable to be responsive to changing needs and circumstances.

An adaptive plan supported by robust monitoring, comprehensive trigger identification and planned response protocol can help realise opportunities as they arise over time.



Pathway 1: Traditional City (Current)

The Traditional City is characterised by a core traditional wastewater and stormwater servicing concept that aims to release to waterways and the ocean. It includes better practice urban typologies in twelve key growth precincts.

Pathway features



Wastewater

Plant upgrades in line with existing strategies and plans.



Stormwater

Typology changes result in more perviousness and increased street trees and wetlands.



Drinking water

Augmentation of existing drinking water supplies with continued reliance on Prospect Water

Filtration Plant (WFP) and Woronora WFP. Desalination Stage 1 and 2 form part of normal operations to address long-term water security. Marginally higher demand (new typologies).



Recycled water

No new recycled water schemes owned by Sydney Water. Support for existing private providers, such as Central Park and Sydney Airport.



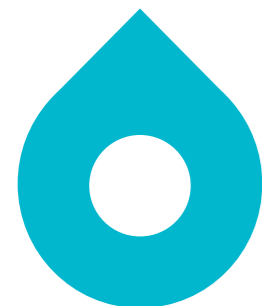
Land use

Key growth precincts adopt better practice urban typology with increased green spaces and pervious areas. Remaining growth precincts and infill growth retain existing typologies.



Biosolids

No change to current planning and strategies for all treatment plants.



Pathway 4: Regenerative City (by 2056)

The Regenerative City uses purified recycled water and maximises energy and material recovery at ocean plants for biomethane export. The Cooks River catchment is disconnected from the Malabar system and the flow is redirected to a new water recycling plant near the airport with more advanced wastewater treatment processes.

Pathway features



Wastewater

North Head, Malabar, Bondi, Cronulla and Liverpool as per Pathway 3A, plus biomethane export. Cronulla and Fairfield upgraded to advanced water treatment plants. New wastewater recycling plant for Cooks River catchment. Hornsby Heights, Brooklyn, Warriewood and West Hornsby as per Pathway 1A.



Stormwater

As per Pathway 3B, plus rainwater tanks in all growth precincts and green roofs in Sydney Water catchments. Stormwater harvesting services support green spaces in five placemaking opportunities. Local stormwater harvesting outside of placemaking opportunities.



Drinking water

Reduced reliance on rainfall dependent supply and reduced need for augmentations at Prospect Water Filtration Plant (WFP) and Woronora WFP. Desalination Stage 2 as part of normal operations (prior to 2056) is avoided.



Recycled water

Centralised purified recycled water schemes at Fairfield Wastewater Treatment Plant to Prospect Reservoir, including recycled water transfers from Liverpool Wastewater Recycling Plant (WRP) and new WRP, and Cronulla Advanced Water Treatment Plant to Woronora Dam, including recycled water from Cronulla WRP.



Biosolids

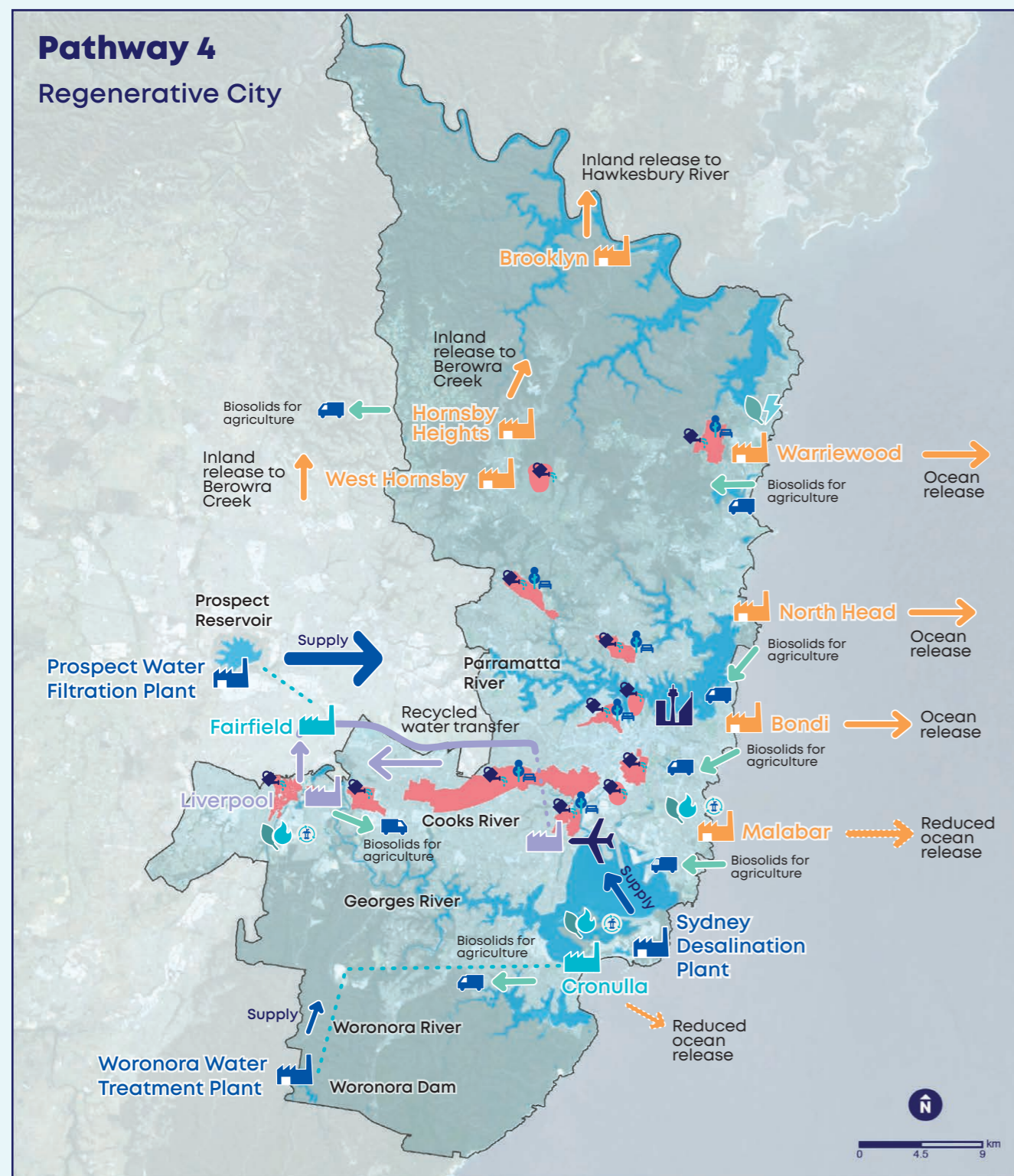
Biomethane replaces fossil fuel-derived natural gas in domestic gas network. Grade A stabilised biosolids can be used in urban gardens.



Land use

Key growth precincts adopt newer practice urban typologies with increased green spaces and pervious areas. Remaining growth precincts and infill growth retain existing typologies.

Regenerative City pathway



Next steps



Outcome

Water services deliver social, economic and environmental value, enabling growth and development.

Action plan

- 1–3 years: Progress sub-regional planning for high-priority precincts, considering appropriate typology principles for urban renewal.
- 1–3 years: Investigate local options for each sub-region to achieve urban greening outcomes.
- 1–5 years: Stage infrastructure by establishing 'no regrets' investment that provides flexibility to implement new servicing concepts.



Outcome

Integrated water management improves waterway health, biodiversity and amenity values.

Action plan

- 1–3 years: Complete integrated water servicing options planning for sub-regions.
- Ongoing: Continue water conservation measures to achieve reduced water demand per capita.



Outcome

A sustainable future is achieved through adoption of innovative water solutions.

Action plan

- 1–3 years: Investigate decentralised recycled water options for growth precincts.
- 2–4 years: Develop a business case for beneficial reuse of resources.
- 1–3 years: Partner with developers and customers to deliver innovation in water servicing.
- 1–5 years: Implement projects that support resource recovery.



Outcome

Our communities celebrate the cultural value of water and are custodians of this beautiful region.

Action plan

- 1–3 years: Work with state and local government to establish regional waterways governance.
- 1–3 years: Shape planning controls to protect and improve local waterways and riparian corridors.

Open to new opportunities

Sydney Water is working closely with our partners and customers to deliver a sustainable, resilient water supply for the city. We are open to new partnerships and looking for new ways to nurture Eastern Sydney's water and environment and drive sustainable, economic growth for future generations.

For further information or to discuss partnership and investment opportunities, please contact:

Raju Mangalam
Lead Planner, Systems and Asset Planning
Raju.Mangalam@sydneywater.com.au
0418 961 225



