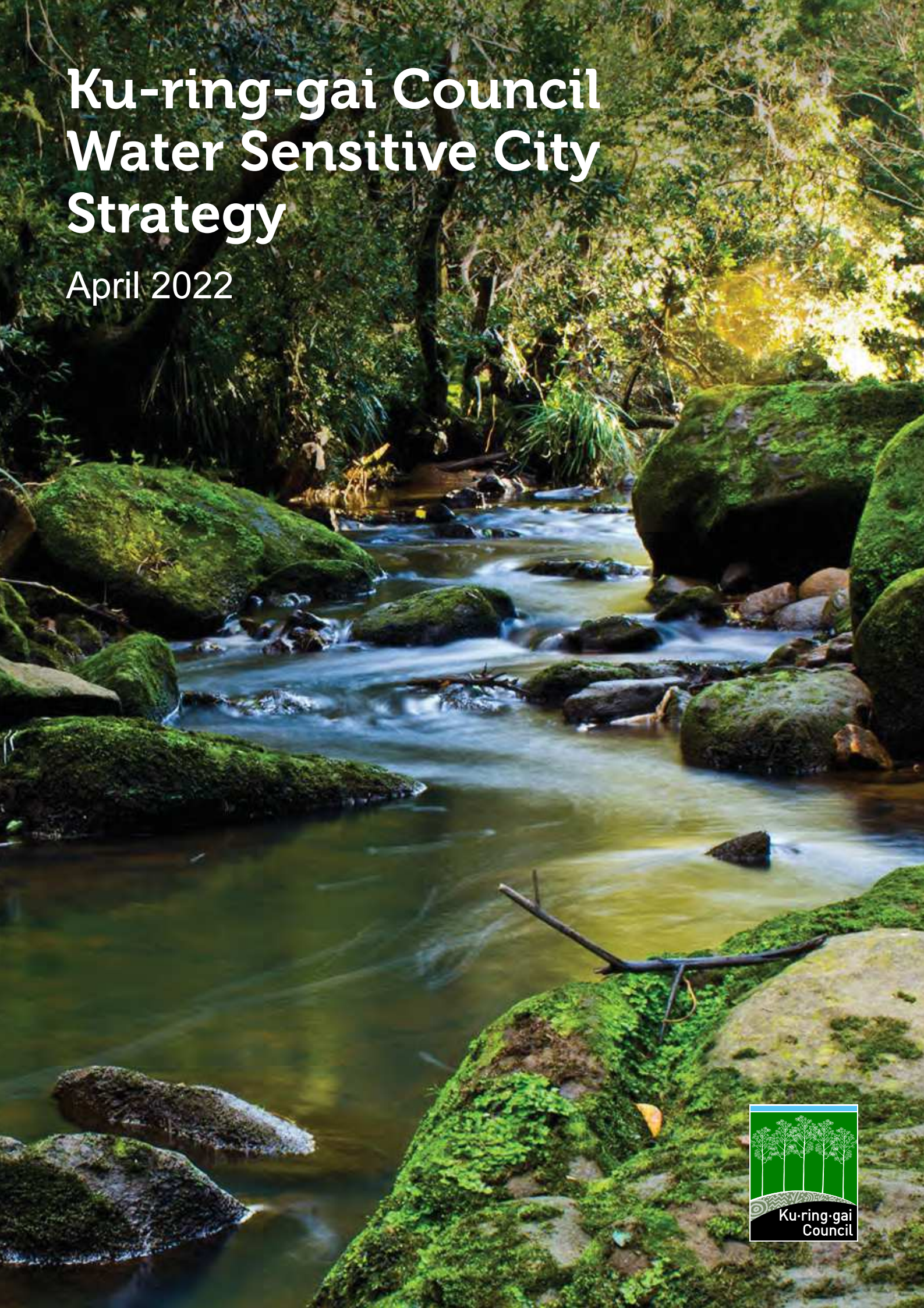
Ku-ring-gai Council Water Sensitive City Strategy

April 2022



The authors wish to acknowledge the traditional owners of Ku-ring-gai, and that this project and work is located in Darramurragal Country.

Acknowledgments

The authors wish to acknowledge the Environment and Sustainability Team within Ku-ring-gai Council for their leadership and direction in this project.

Authors

Wave Consulting Australia drafted this strategy, in collaboration with Three Seeds Agency.

Cover image: West Pymble Creek. Photographer: Tim Hall

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Executive Summary

Ku-ring-gai lies 16km north of the Sydney CBD, is 85 square kilometres in size, and is bound by three national parks (Ku-ring-gai Chase, Garigal, and Lane Cove National Parks). It is known as the 'Green Heart' of Sydney owing to its significant urban forest, 177 kilometres of waterways, 1,150 hectares of bushland, dense existing tree canopy and it being regarded as one of the last remaining areas of biodiversity significance in the Sydney metropolitan area.

Ku-ring-gai is on the land of Darramurragal Country.

This water strategy serves as a roadmap for how Ku-ring-gai Council can transition towards a vision of a water sensitive city. This document outlines the nature of water use and values in Ku-ring-gai, the vision, outcomes, actions, targets, benefits, risks and responsibilities for all stakeholders. The strategy is based on the Water Sensitive Cities Index, a framework developed by the CRC Water Sensitive Cities (CRCWSC) that has been used around the world to benchmark and assess regions and their transition to a water sensitive city. This strategy is the result of a three-year process within Council, beginning in 2018, when the Water Sensitive Index tool was first utilised by Council.

A water sensitive city is one that efficiently uses a diverse set of water sources to provide water security, safeguards the health of its waterways and related habitats, and builds resilience to floods through good urban design principles and community preparedness. It is one that creates public spaces that collect, cleanse, and reuse water whilst delivering shared green and blue spaces to increase the liveability of a city.

The WSC Index assesses all aspects of a place, organisation and infrastructure. There are seven goals to the Index, and the strategy is based around improving the performance of these indicators and ultimate achieving the outcomes under each of these goals. The goals are:

- Achieve equity of essential services
- Ensure good water sensitive governance
- Ensure quality urban space
- Improve ecological health
- Improve productivity and resource efficiency
- Increase community capital
- Promote adaptive infrastructure

There are 31 specific actions listed in this strategy, that cover each of the seven goals, and are delivered by teams from across Council, as well as through partnerships with other agencies and community engagement.

These actions are linked to nine targets, that cover community engagement, waste reduction, potable water savings (a 50% reduction in Council consumption for example) and increases in alternative water use.

The strategy is funded through a combination of existing funding mechanisms including the Special rate variation environmental levy (water and catchment management), Stormwater Management Charge, and General Revenue. These funding mechanisms will support the delivery of this strategy and provide over $22 million over ten years. In the past 10 years KRG has been able to leverage this funding to attract over $12 million in external funding. The funding of new water sensitive infrastructure, and the maintenance of existing infrastructure though is an ongoing budget problem that must be addressed over time.

It should be acknowledged that the benefits from the delivery of this strategy will flow to the community and Council both in the short term (through reductions in potable water bills and increases in property values where investments are made), and in the long term (ecological values, microclimates and increased physical and mental health of the community). The benefits of delivering this strategy can be classified under the following themes:

- City shaping
- Ecological
- Social
- Resilient infrastructure
- Financial
- Smarter water management and positive influence on the water balance

The strategy includes specific recommendations regarding capacity building and governance, which are critical to the transition to a water sensitive city. The strategy is coordinated within Council by the Environment and Sustainability team.

Glossary

Aquatic macroinvertebrates: commonly known as ‘water bugs’ – are animals without a backbone that live all or part of their lives in water. They include insects, mites, crustaceans, molluscs, sponges and worms (Chessman 2003).

Directly connected imperviousness: “Defined as the proportion of impervious surfaces directly connected to the stream through conventional drainage”. Sydney Water www.sydneywater.com.au

Ecologically sustainable development: Using, conserving, and enhancing the community’s resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

Hydraulic: Pertaining to the energy, momentum, and continuity effects of liquid in motion. The term usually refers to the flow of liquids in natural environments such as rivers or manmade structures such as pipes.

Hydrology: The study of water occurrence, distribution, movement, and balances in ecosystems; the seasonal patterns of a river’s flow.

Integrated water cycle management: Management of all sources of water to ensure that optimal use is obtained within the catchment resource context. This includes consideration of traditionally compartmentalised sectors (potable water, sewerage, stormwater) in an integrated manner by recognising the inherent connections and the opportunities to optimise the resource.

Potable water: means water that meets the standards or values for drinking water recommended from time to time by the National Health and Medical Research Council.

Rainwater tanks: A water tank used to collect and store rainwater runoff from a property’s rooftop via pipes, used for non-drinking water purposes in metropolitan areas. Using rainwater can provide multiple benefits, including reduced demand on drinking water and environmental benefits.

Stormwater: Runoff from rainfall events that is conveyed separately from sewerage.

Stormwater harvesting and reuse: Collecting, storing and treating stormwater from urban areas for reuse, typically for non-drinking purposes. Stormwater harvesting schemes provide multiple benefits to communities, including improving environmental and social benefits through the provision of green open space and healthier waterways.

Stormwater treatment measure:
A stormwater treatment measure is a hard or soft engineering device or feature installed to trap pollution and improve stormwater quality. These treatment measures include GPTs and WSUD assets like raingardens and wetlands.

Water recycling: the treatment of sewage effluent, stormwater or wastewater for use as an alternative supply to mains water, groundwater or river water (including, in particular, sewer mining works).

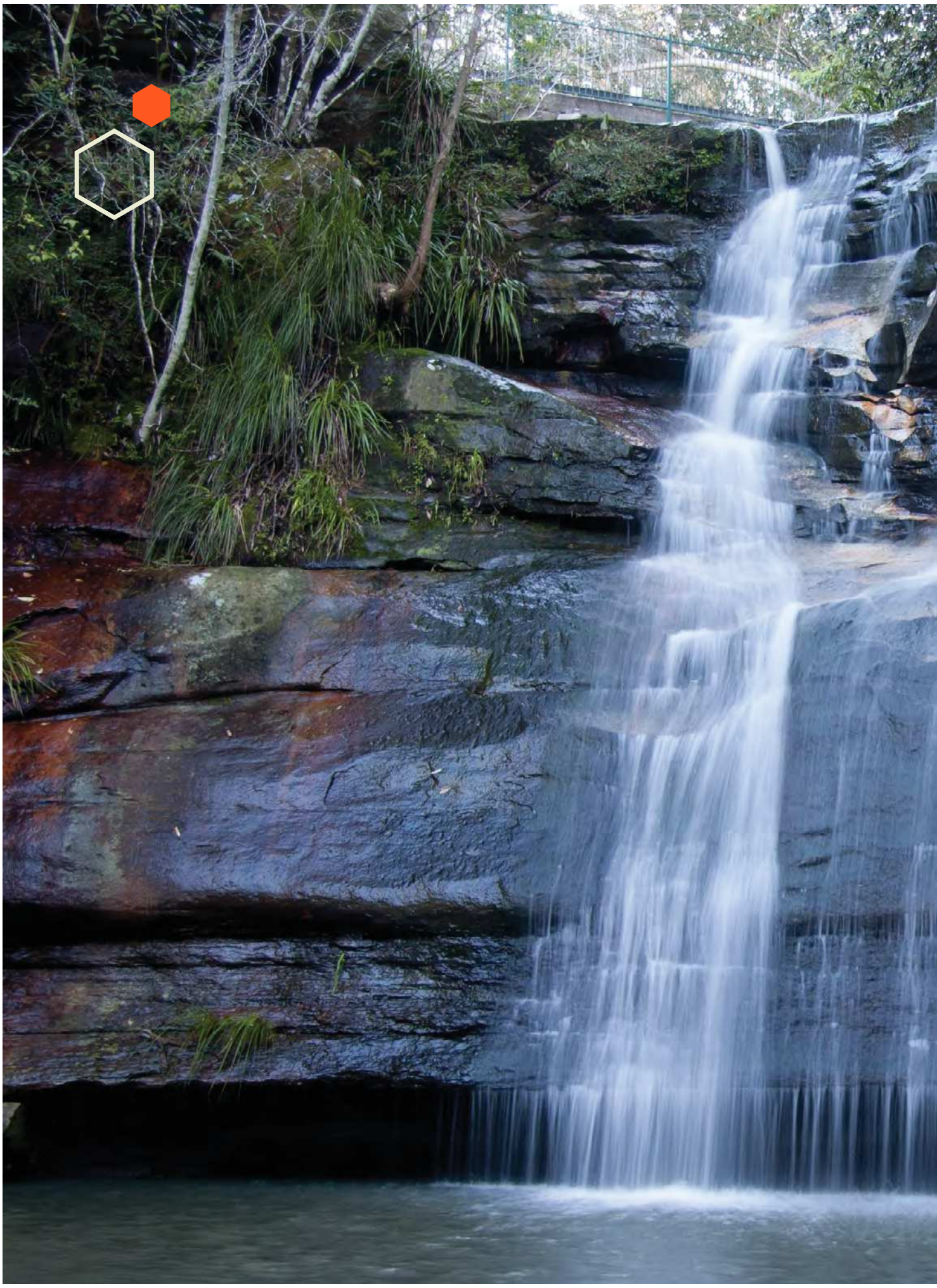
Water sensitive urban design: Integration of urban planning with the management of urban hydrology and the water cycle.

Watercourse: The integration of urban planning with the management, protection and conservation of the urban water cycle, that ensures urban water management is sensitive to natural hydrological and ecological processes.

Recycled water for non-drinking: Recycled water is sourced from wastewater and treated to provide water for non-drinking purposes including irrigation, industrial and household uses such as toilets and washing machines. Using recycled water reduces demand on drinking water systems and limits discharge of wastewater to the environment.

Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
AUSMAP	Australian Microplastic Assessment Project
BASIX	Building Sustainability Index
CAP	Catchment Action Plan
CBD	Central Business District
CRCWSC	Cooperative Research Centre for Water Sensitive Cities
DCI	Directly Connected Imperviousness
DCP	Development Control Plan
DPE	Department of Planning and Environment
EPA	Environment Protection Authority
ESD	Ecologically Sustainable Development
GPT	Gross Pollutant Trap
IWCM	Integrated Water Cycle Management
IPART	Independent Pricing and Regulatory Tribunal
LEP	Local Environment Plan
LG	Local Government
LGA	Local Government Area
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NSW	New South Wales
RRA	Rapid Riparian Assessment
TfNSW	Transport for NSW
SEPP	State Environmental Planning Policy
SIGNAL	Stream Invertebrate Grade Number – Average Level
SCA	Sydney Catchment Authority
STM	Stormwater Treatment Measure
SWC	Sydney Water Corporation
WSC	Water Sensitive City
WSCA	Water Sensitive Cities Australia
WSUD	Water Sensitive Urban Design



1. Introduction

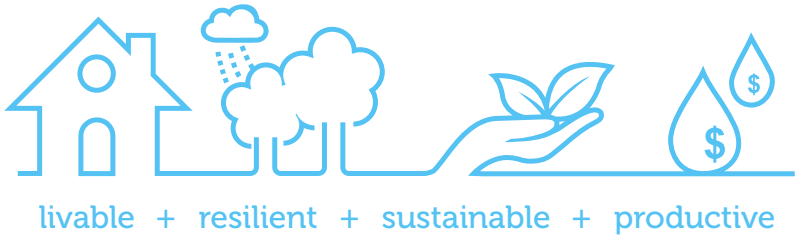
Ku-ring-gai Council is located to the north of Sydney's CBD and is best known for its natural beauty and urban villages dominated by green leafy streets with large residential blocks. Environmental values and water management are important to the community, and Council has a history of prioritising and investing in environmental issues and water sensitive urban design (WSUD) assets to protect high quality waterways.

This document outlines the Council's strategy towards becoming a water sensitive city, and measures how far Council has progressed towards a water sensitive city as benchmarked by the 'Water Sensitive City Index'[1]. This strategy details the type of targets, outcomes, and actions that Council is committed to as it progresses towards becoming a water sensitive city state.

1.1 What is a water sensitive city?

A water sensitive city is one that takes an integrated approach to urban water management. In practice, this requires a holistic view of both the challenges and solutions related to urban water. It is a city that understands the complex and inter-related nature of the urban water cycle and seeks to deliver a more sustainable, liveable, and prosperous city through smarter water management[2].

A water sensitive city is



Outcomes from a water sensitive city
(Source: CRC Water Sensitive Cities)

1. B.C. Rogers, G. Dunn, W. Novalia, F.J. de Haan, L. Beck, R.R. Brown, K. Hammer, S. Lloyd, C. Urich, T.H.F. Wong, C. Chesterfield (submitted for peer review) An interdisciplinary and catchment approach to enhancing urban flood resilience: A Melbourne case. Water Sensitive Cities Index: A diagnostic tool to assess water sensitivity and guide transitions. Submitted to Water Research journal.
2. CRC Water Sensitive Cities, 2021. What is a water sensitive city? Accessed at https://watersensitivecities.org.au/what-is-a-water-sensitive-city/

A water sensitive city is one that efficiently uses a diverse set of water sources to provide water security, safeguards the health of its waterways and related habitats, and builds resilience to floods through good urban design principles and community preparedness. It is one that creates public spaces that collect, cleanse, and reuse water whilst delivering shared green and blue spaces to increase the liveability of a city[3]. It builds on a series of other city transition states, as defined by Brown et al. 2009 and represented graphically below.

The concept of 'the water sensitive city' was the driving force behind the Cooperative Research Centre for Water Sensitive Cities (CRCWSC), a federal government scientific research program established in 2012 with a stated purpose to: "help the way we design, build and manage our cities and towns by valuing the contribution water makes to economic development and growth, our quality of life, and the ecosystems of which cities are a part"[4].

The CRCWSC has developed a Water Sensitive Cities Index (WSC Index), a tool designed to benchmark a city's current performance against seven goals of a water sensitive city. There are 34 indicators within the seven goals, which are assessed through a self-assessment workshop process to assess a city's performance with respect to these indicators.

The results of a WSC Index process are presented in several ways: The city's performance within the respective seven goals that the 34 indicators lie under, the city's performance with regards to the urban water transitions framework (the journey from a water supply city to a water sensitive city), or the city's

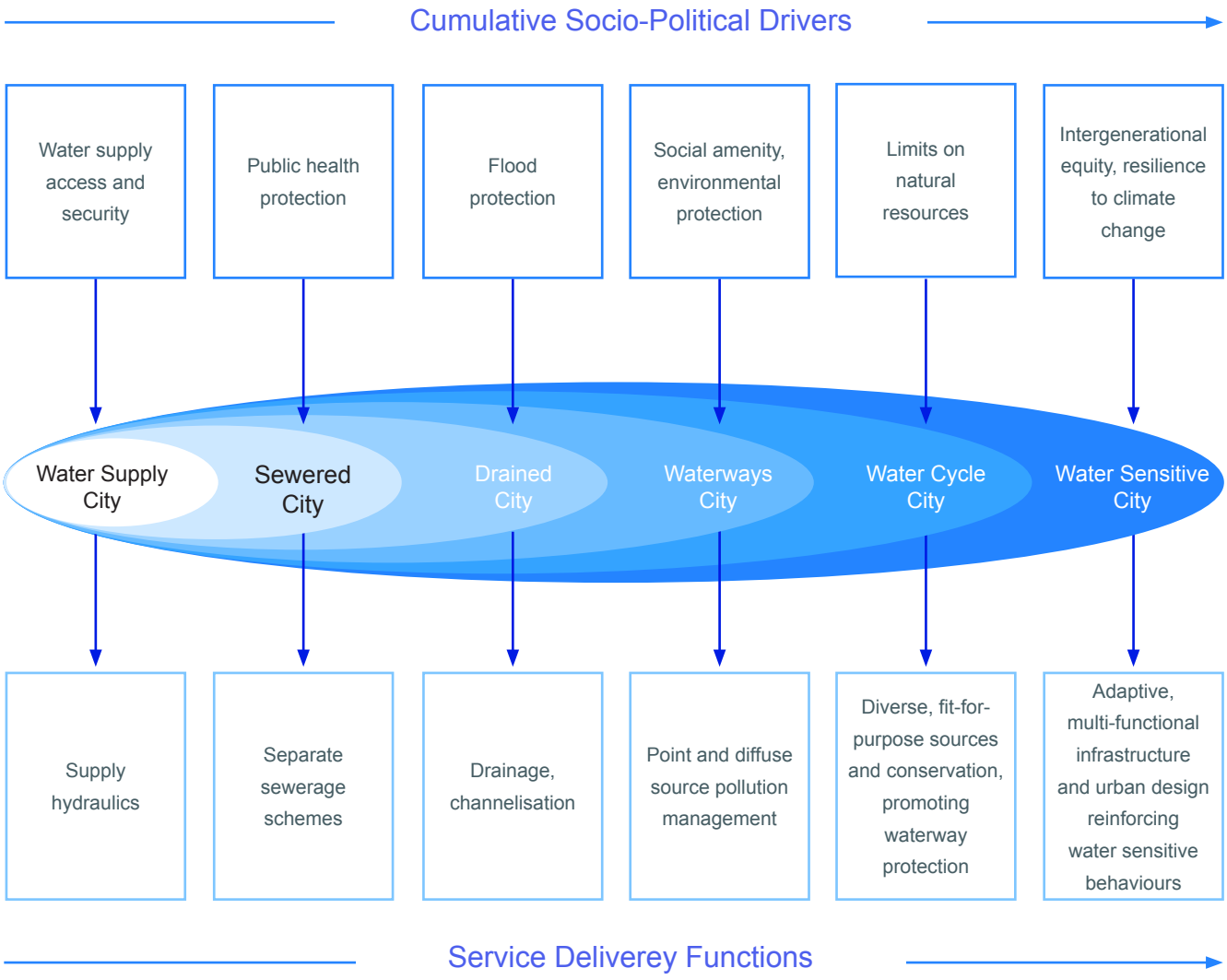


Figure 1: Urban Water Transitions Framework (Brown, Keath & Wong, 2009)

3. CRC for Water Sensitive Cities. 'What is a Water Sensitive City?', CRC for Water Sensitive Cities. https://watersensitivecities.org.au/what-is-a-water-sensitive-city
4. CRC for Water Sensitive Cities. 'What is a Water Sensitive City?', CRC for Water Sensitive Cities. https://watersensitivecities.org.au/what-is-a-water-sensitive-city

performance from a purely outcomes perspective assessing performance from liveability, sustainability, resilience, and productivity perspectives.

The water sensitive cities framework and index tool were developed on the back of core water sensitive urban design principles and thus provides a well-researched and streamlined process to not only assess a city's current performance but to provide a roadmap of how a city can improve its performance and potentially accelerate its journey towards becoming a water sensitive city.

1. Ensure good water sensitive governance	2. Increase community capital	3. Achieve equity of essential services	4. Improve productivity and resource efficiency	5. Improve ecological health	6. Ensure quality urban space	7. Promote adaptive infrastructure
1.1 Knowledge, skills and organisational capacity	2.1 Water literacy	3.1 Equitable access to safe and secure water supply	4.1 Benefits across other sectors because of water-related services	5.1 Healthy and biodiverse habitat	6.1 Activating connected pleasant urban green and blue space	7.1 Diversify self-sufficient fit-for-purpose water supply system
1.2 Water is key element in city planning and design	2.2 Connection with water	3.2 Equitable access to safe and reliable sanitation	4.2 Low GHG emission in water sector	5.2 Surface water quality and flows	6.2 Urban elements functioning as part of the urban water system	7.2 Multi-functional water system infrastructure
1.3 Cross-sector institutional arrangements and processes	2.3 Shared ownership, management and responsibility of water assets	3.3 Equitable access to flood protection	4.3 Water-related business opportunities	5.3 Groundwater quality and replenishment	6.3 Vegetation coverage	7.3 Integration and intelligent control
1.4 Public engagement, participation and transparency	2.4 Community preparedness and response to extreme events	3.4 Equitable and affordable access to amenity values of water-related assets	4.4 Low end-user potable water demand	5.4 Protect existing areas of high ecological value		7.4 Robust infrastructures
1.5 Leadership, long-term vision and commitment	2.5 Indigenous involvement in water planning		4.5 Maximised resource recovery			7.5 Infrastructure and ownership at multiple scales
1.6 Water resourcing and funding to deliver broad societal value						7.6 Adequate maintenance
1.7 Equitable representation of perspectives						

Figure 2: The 7 goals and 34 indicators that cities are assessed against in the WSC Index

A 'water sensitive city' is an idealised end state and is not 100% achievable, as by its very nature a water sensitive city should aim to deliver better outcomes for the environment and its citizens.

1.2 Drivers to developing this strategy

Developing water sensitive strategies have become a powerful tool for organisations to deliver water and environmental services efficiently and sustainably in the face of challenges posed by population growth, climate change, land use changes, environmental decline, and shifting community needs and expectations.

There was a need to develop a strategy for Ku-ring-gai Council to integrate a range of issues that the organisation and community were grappling with, such as:

- How to ensure that water management is consistent with our knowledge of climate change.
- How to more efficiently and strategically spend water related Council funds including those collected through the Stormwater Management Charge and the Environmental Levy (water and catchment management). Please see Appendix C: Water Sensitive City Strategy – Water related funding sources, for current funding sources.
- How to ensure that the impact of the 'Housing Strategy to 2036' does not have a detrimental impact on our waterways and water management.
- How to align works with the Climate Change Strategy, Green Grid Strategy, and Urban Forest Strategy, all within the framework of the Greater Sydney Commission's Three Cities Plan.
- To set targets for long term potable saving, pollution reduction, and use of alternative water projects such as sewer mining and stormwater harvesting.
- How to ensure there is a sustainable maintenance model to support the building and operation of a range of decentralised water infrastructure projects.

1.3 Strategy horizon and strategic alignment

The Ku-ring-gai Community Strategic Plan (CSP) sits at the top of Council's strategic planning framework and provides long term direction for the organisation to align its delivery policies, programs, projects and services. It also integrates with key Council plans and policies and acts as a guide for other stakeholders (organisations, government agencies, business and individuals) in planning and delivering services for our area.

In 2018, the New South Wales (NSW) Government introduced new plans for both metropolitan Sydney and the northern area of Sydney. These are 'A Metropolis of Three Cities – The Greater Sydney Region Plan' and the 'North District Plan' for the northern councils of Sydney. The Ku-ring-gai LGA is part of the North District Plan. The North District Plan provides a 20-year plan to manage growth and achieve the 40-year vision, while enhancing Greater Sydney's liveability, productivity and sustainability into the future.

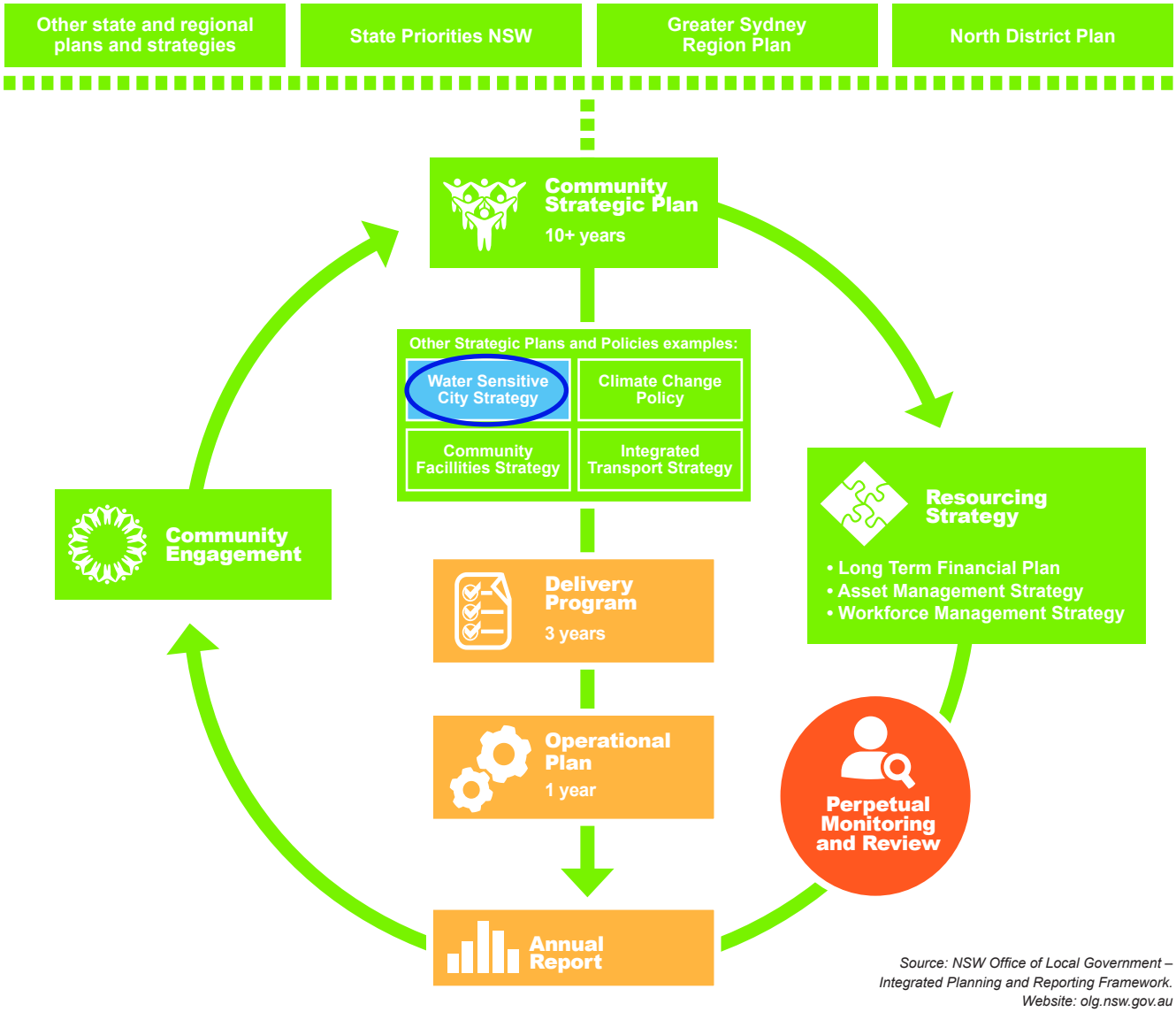
The district plans require each council to prepare a Local Strategic Planning Statement (LSPS) for their area to guide future land use planning and development.

The LSPS brings together established council policies and community views to set a framework as to how Ku-ring-gai will evolve into the future, while also ensuring that those elements that are special to the character of the area are maintained.

This Strategy is closely aligned with these plans, and table 1 in Appendix D: Ku-ring-gai's CSP & LSPS and North District Plan Links outlines the strategic links between the Strategy, the Ku-ring-gai CSP and LSPS, and the NSW North District Plan Directions and Priorities.

The Water Sensitive City Strategy covers the period from 2021 to 2030, which aligns with the proposed budget submission for the Environmental Levy and is similar to the horizon of the Housing Strategy. As a strategic document, its focus is on the medium and long term.

NSW strategic planning framework as it relates to the Strategic Planning Statement



Source: NSW Office of Local Government – Integrated Planning and Reporting Framework. Website: olg.nsw.gov.au

The IP&R Framework and where the Water Sensitive City Strategy sits in relation

1.4 Process of developing the strategy

Ku-ring-gai Council developed an Integrated Water Cycle Management Strategy in 2008, and a Water Sensitive City Policy in 2016. With a range of new drivers to update the Integrated Water Cycle Management Strategy, Council started in 2018 to create a new Water Sensitive City Strategy.

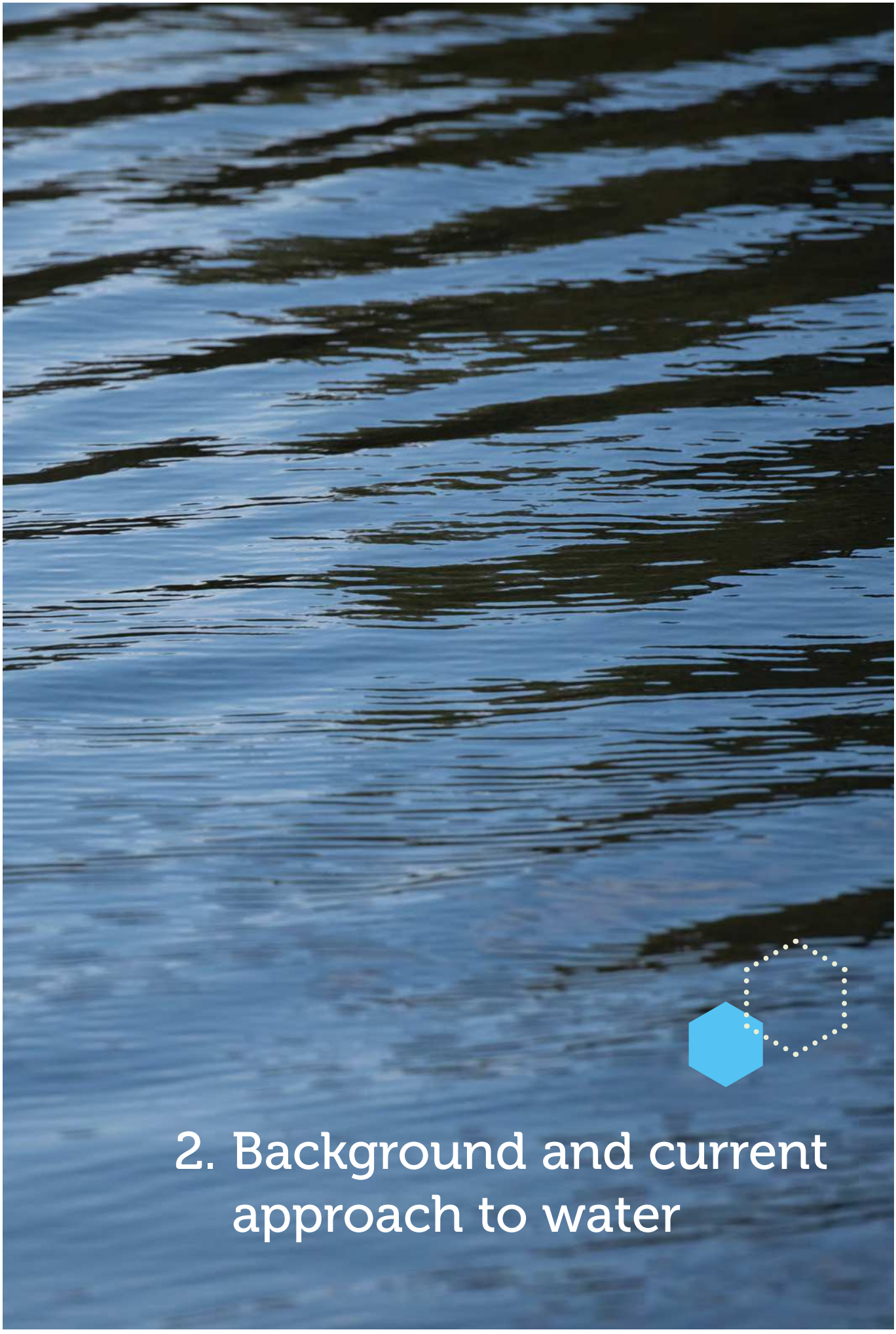
In 2018 Council worked with the CRCWSC to complete an assessment of the place and organisation in regard to its progress towards a water sensitive city. A summary of this assessment is presented in Section 5. Following this result, Council worked with internal teams to review the outputs from this work, and then in 2021 the Environment and Sustainability team held internal workshops and set up a process to finalise the actions and outcomes that will guide Council to continue to move towards a water sensitive city.

Community input and data was continually fed into the process through the multiple engagements and surveys that were conducted, including the consultation regarding the proposed Special Variation to the Environment Levy as submitted to IPART[5]. This consultation that found the community very supportive of this funding and environmental outcomes, included:

- An excerpt in the July 2018 rates notice, sent to 43,986 households, containing information about the current Environmental Levy which is due to expire on 30 June 2019, the average dollar impact of the Levy on ratepayer categories, the Council's intention to apply for a permanent extension, and opportunities for the community to provide feedback.41
- A direct mail out to 773 business ratepayers, containing similar information as the July 2018 rates notice.42
- Recruiting an independent market research company to conduct a survey (online, telephone and street intercept) of 495 residential ratepayers from September 2018 to November 2018.
- A community consultation workshop with 29 attendees.43
- A dedicated SV online engagement platform on the Council's website.
- A printed survey, available at the Council's Customer Service desk and the Council's libraries.
- Social media posts on Facebook and Twitter.
- Advertisements in local newspapers.

The information collected through all these activities was then combined with reviews of relevant asset databases and the LGA's water balance to develop this water sensitive city strategy.

5. IPART, 2019. Special variation increase Ku-ring-gai Council 2019-20. Final Report. Accessed at https://www.ipart.nsw.gov.au/Home/Industries/Local-Government/Reviews/Special-Variations-Minimum-Rates/Special-Variations-Minimum-Rates-2019-20



2. Background and current approach to water

2.1 The place

Ku-ring-gai lies 16 km north of the Sydney CBD, is 85 square kilometres in size, and is bound by three national parks (Ku-ring-gai Chaise, Garigal, and Lane Cove National Parks). It is known as the 'Green Heart' of Sydney owing to its significant urban forest, 177 kilometres of waterways, 1,150 hectares of bushland, dense existing tree canopy and it being regarded as one of the last remaining areas of biodiversity significance in the Sydney metropolitan area[6].

The local government area sits across three catchments, with areas flowing north into the Hawkesbury River catchment, south-east into Middle Harbour (Sydney Harbour Catchment), or south-west into the Lane Cove River (Sydney Harbour Catchment). The majority of the residential and commercial development is along the ridge top, in close proximity to the Pacific Highway, Ryde Road and Mona Vale Road.

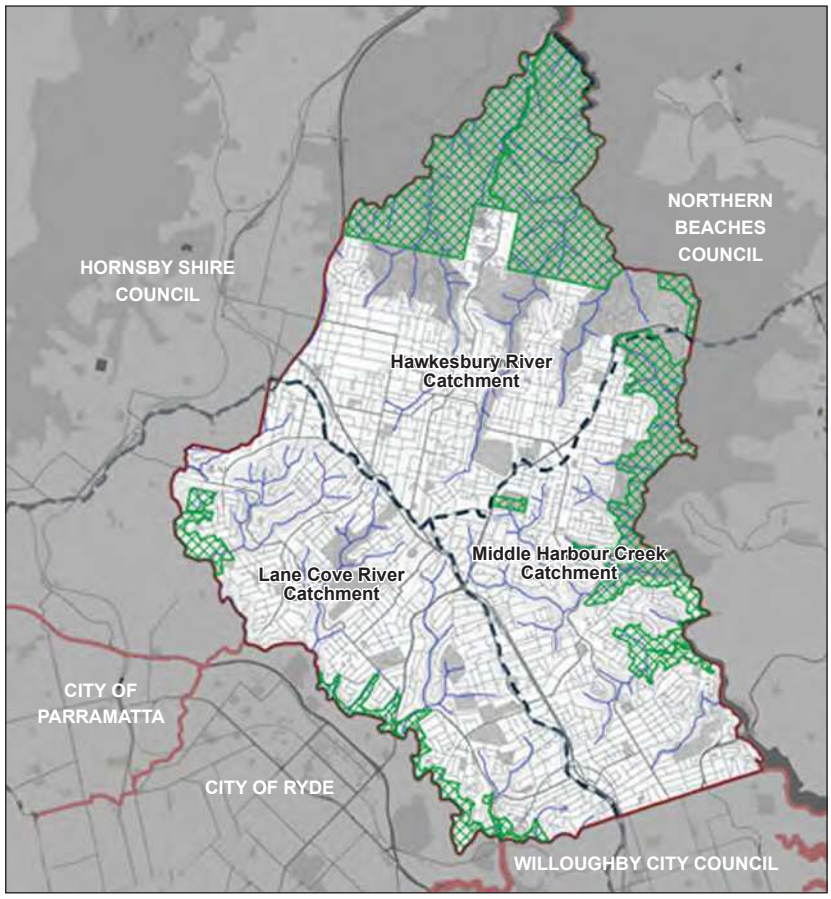


Figure 3: Ku-ring-gai local government area

6. KRG, 2020. Annual Report. pp-37

2.2 History

Council have been at the forefront of many urban water management practices in New South Wales, both in terms of water infrastructure and policy. The following is a list of water related milestones and firsts relevant to the region and Ku-ring-gai Council:

1980

Ku-ring-gai Council is the first Council in Sydney to implement an OSD policy (O'Loughlin, et al. 1995)[7].

1998

Council begins conducting water and macroinvertebrate sampling within waterways throughout the LGA[8].

2004

Adoption of Council's Riparian Policy providing protection for natural watercourses and riparian zones by controlling the type of development in and around waterways.

2005

Council's first Special Rate Variation for an Environmental Levy to fund range of environmental works and programs.

First stormwater harvesting system built at Barra Brui sports field[9].

2006

First raingardens are built within the LGA at Normurra Ave.

Adoption of Council's Biodiversity Strategy providing a framework for the management and conservation of local biodiversity on public and private lands.

2007

Council prepares a Water and Energy Savings Action Plan. The plan identifies the top 20 water and energy intensive Council sites and recommends potential reduction strategies

2008

Council introduces a Stormwater Management Charge allowing for greater funding of water treatment and runoff control[10], possible under the Section 496A of the Local Government Act, 1993.

Council is awarded the Local Government and Shires Association's Environmental Award in the Stormwater and Urban Waterways Award category for their Catchment Remediation Program that delivered multiple stormwater harvesting assets.

Adoption of Council's Integrated Water Cycle Management Strategy

2011

Adoption of Council's Interim Water and Recycling and Reuse Policy.

First sewer mining/water recycling projects within the LGA at Gordon Golf Course with contributing grant funding from NSW Department of Environment and Climate Change (DECC)

2013

Introduction of Council' WaterSmart rebate program

2016

Adoption of five environmental policies and strategies that provide a management framework for protecting and conserving Ku-ring-gai's natural environment including Ku-ring-gai's Water Sensitive City Policy and Climate Change Adaptation Strategy

2018

Water Sensitive City Index benchmarking assessment for Ku-ring-gai Council.

2021

Council drafts this new Water Sensitive City Strategy.

▶ Further information on Ku-ring-gai's water related projects and achievements are found at **krg.nsw.gov.au/Environment/Environmental-levy**

7. O'Loughlin, G, Beecham, S, Lees, S, Rose, R and Nicholas, D 1995 "On-site stormwater detention systems in Sydney" Water Science and Technology Vol 32, No. 1, pp,169-175.
8. KRG, 2016. Ku-ring-gai Council Water Quality and Aquatic Macroinvertebrate Sampling: Background Report. p 3
9. J. Jonasson, 2010. Did we get what we paid for? Comparing Design Estimates to Real Volume Usage for Stormwater Harvesting.
10. KRG, 2008. Integrated Water Cycle Management Strategy.

2.3 The value of green and blue spaces

Ku-ring-gai has many amazing green spaces and national parks within its LGA. A key aspect of a water sensitive city is one that understands the multi-faceted benefits that are realised from a city's green and blue spaces and associated infrastructure. By integrating water and landscape assets a city can create spaces that serve multiple end uses.

Green and blue open space assets in urban environments provide[11]:

- Recreation opportunities
- Mental and physical health benefits to the community
- Greater amenity, leading to increased property prices
- Various irrigation needs (storage, passive irrigation)
- Peak flow and flood controls
- Water quality treatment
- Food and habitat for native fauna where appropriate
- Cooler urban areas

Green and blue spaces and assets make for more liveable, resilient, sustainable, and productive cities.

2.4 Asset condition and value

From an asset perspective Council have a range of assets that save potable water, increase the harvesting and reuse of stormwater, and filter pollution from stormwater runoff. This section documents how many of these assets are located across the LGA.

- There are 24 WSUD or STM assets in Council, ranging from bioretention systems to swales and wetlands. They cover a surface area of 1,770 m2, and these assets filter stormwater from a total upstream area of 133 hectares[12]. The current scale and size of WSUD assets are still only addressing stormwater runoff from a small portion of the whole LGA.
- There are two sewer mining assets[13], providing irrigation for Ku-ring-gai's public golf courses.
- There are two leachate treatment and reuse assets[14] at sties containing former landfill.
- There are 18 stormwater harvesting assets[15].
- There are 140 enviropods (stormwater pit baskets) and 76 gross pollutant traps[16], that remove up to 100 tonnes of rubbish per year. Council's street sweeping program also prevents thousands of tonnes of rubbish from washing into our stormwater drains and waterways (see Section 7 for Targets).

Figure 4: Bobbin Head Waterways

11. DELWP, 2017. Planning a Green-Blue City.
12. KRG, 2021. WSUD asset database. Internal Excel document.
13. KRG, 2020. Annual Report. p 189.
14. KRG, 2020. Annual Report. p 189.
15. KRG, 2020. Annual Report. p 189.
16. KRG, 2020. Annual Report. p 286.

The asset value of stormwater infrastructure in Council is $162 million in net carrying amount (Note 11 of Annual Report and value of assets)[17]. Council expenditure in 2019/20 for drainage and stormwater management was $7.71 out of every $100 of rates and charges collected, or approximately $6.8 million per year[18]. Drainage structures capital expenditure of $1,560,860[19]in 2019/20.

2.5 Infrastructure capacity, renewal and budgets

A key pressure facing most councils is the capacity of the organisation to manage the ever-increasing scale and value of assets, in the context of limited revenue streams and community expectations. WSUD assets have traditionally been difficult to classify, variously considered to be either the responsibility of drainage, open space, operations, and sustainability team/s. They have also often been left off asset management databases and maintenance schedules, and therefore do not have adequate operational funding.

A transition to a water sensitive city, over the long term, should enable Council to address these long-term capital renewal requirements associated with underground and grey infrastructure, and transition to infrastructure that is greener and delivers multiple benefits. A city that adequately allocates time and funding for the maintenance of its WSUD assets whilst routinely reviewing the operational and maintenance requirements of these assets against their intended benefits is consistent with a water sensitive city.

2.6 Monitoring

Council have had an active water quality and aquatic macroinvertebrate monitoring system in place since 1998. This program involved the identification of reference sites which represent areas that have been least impacted by the urbanisation of the local area and therefore represent the closest local example of the best natural water quality to serve as a baseline to compare against. Twenty-three other ‘urbanised’ sites were then chosen within the LGA to actively compare against the chosen baseline reference sites[20].

By measuring and analysing the physical and chemical parameters of water, specific stressors which are detrimental to water quality and ecological health may be identified. More detail on the monitoring methods and scoring is outlined in Appendix A.

17. KRG, 2020. Annual Report. p 339.
18. KRG, 2020. Annual Report. p 48.
19. KRG, 2020. Annual Report. p 49.
20. KRG, 2016. Ku-ring-gai Council Water Quality and Aquatic Macroinvertebrate Sampling: Background Report 2016. p-11.

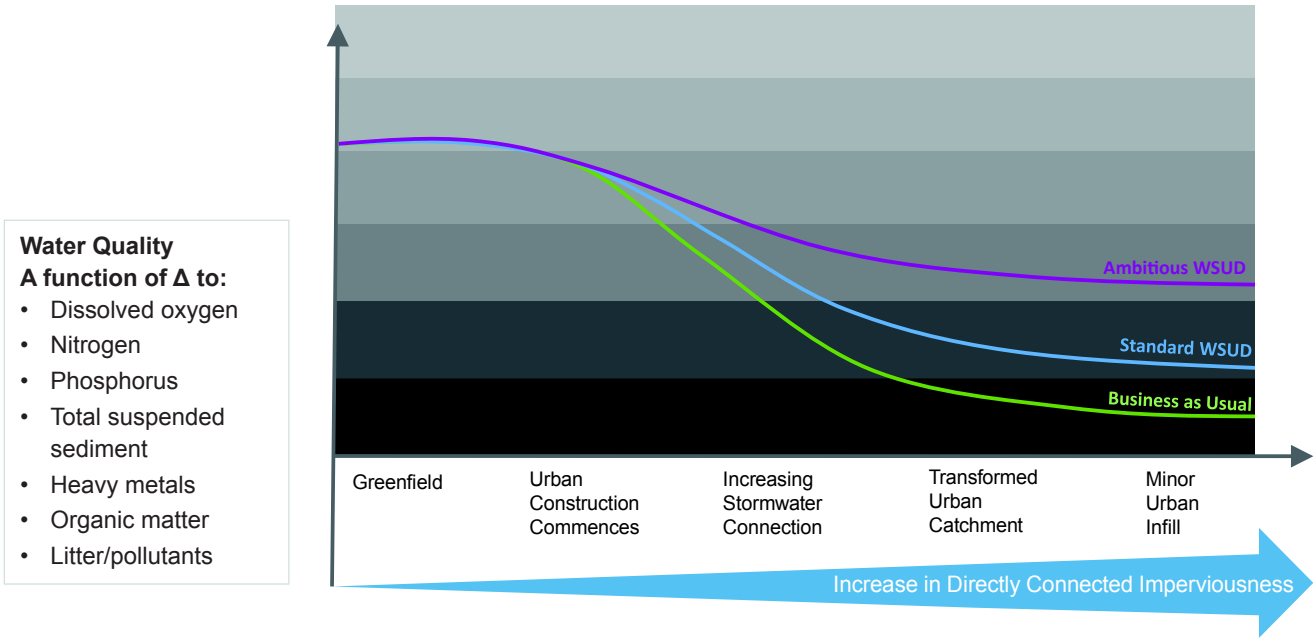


Figure 5: Water quality and directly connected imperviousness (Source: Streamology, 2020)

Data is provided on council's website and updated annually following completion of the spring round of creek sampling. The latest results from this program, in the spring 2021 water quality report card, indicate that the majority of reference sites are good to excellent overall. However, urban reference sites generally report fair to good scores, whilst the macroinvertebrate scores across all sites have significant room for improvement, with all but four of the twenty-six sites reporting a score of D or F.

It should be noted that whilst Ku-ring-gai's waterways are in general of a good quality, maintaining this level of water quality and ecosystem health will become more and more challenging in the face of increased urbanisation. As Ku-ring-gai experiences further new and infill development the resulting increase in directly connected imperviousness will require strict compliance and well-designed WSUD assets to maintain the current condition of Ku-ring-gai's waterways.

Without a strategy to mitigate the impact of stormwater runoff, that will increase with new developments and with climate change, Ku-ring-gai will experience a decline in ecological health. This is conceptually captured in the figure 5.

The condition of waterway health in Ku-ring-gai is well documented in the Water Quality Report Card, as shown in Figure 6.

Council continues to work with the NSW State Government and neighbouring Councils, participating financially and in-kind for both the Hawkesbury-Nepean and Sydney Harbour Coastal Management Program projects. These Coastal Management Program projects are actively undertaking background research and data collection for the improved management of our local waterways.

Council also continues to support and encourage relevant student research projects in the area and actively participates in the AUSMAP microplastic monitoring program with annual sampling at two sites, Echo Point Beach, Roseville Chase and Ku-ring-gai Creek, St Ives. Further information can be found on the AUSMAP website: **https://www.ausmap.org**

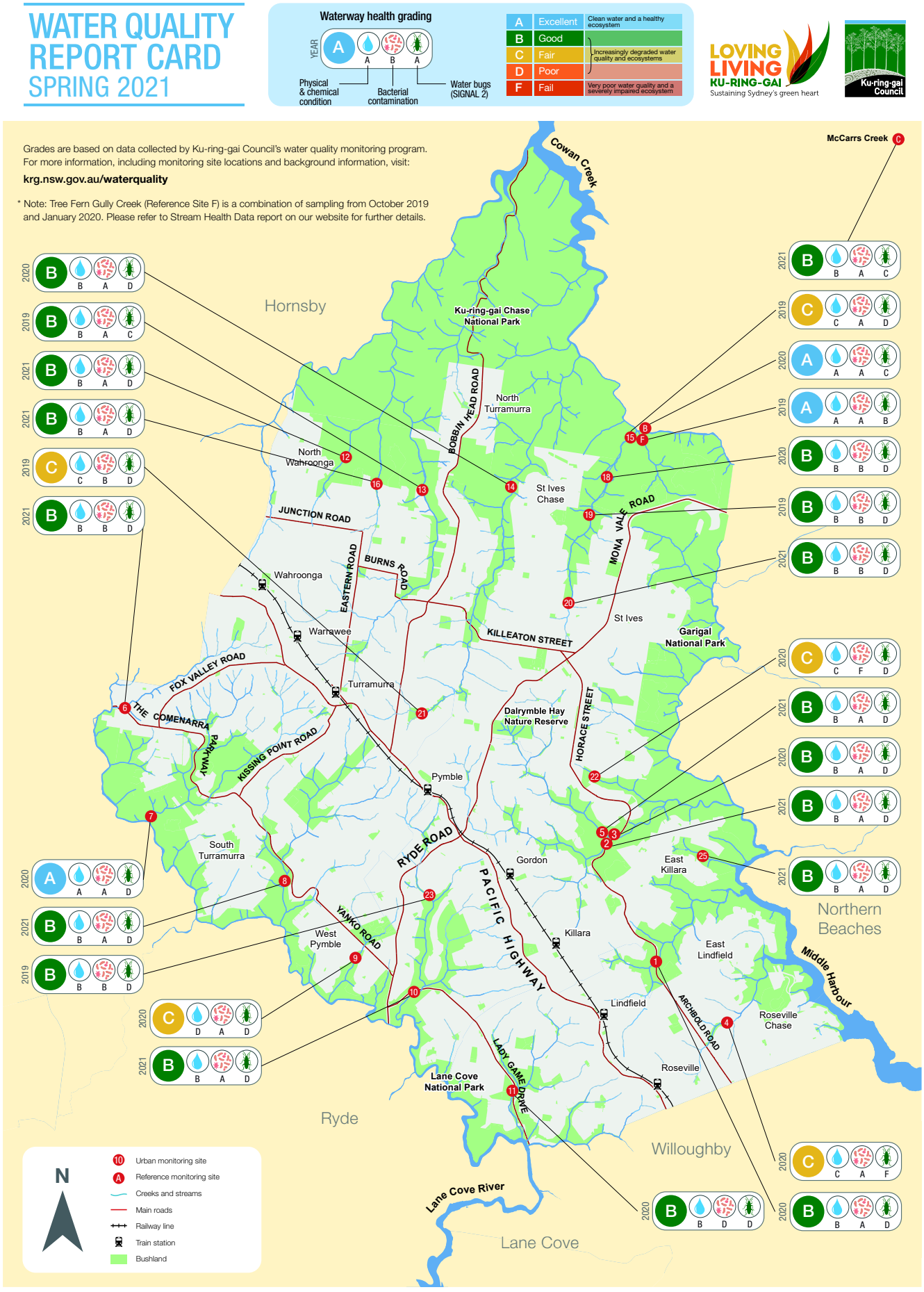


Figure 6: Water quality report card - Spring 2021. (Source: Ku-ring-gai Council)

2.7 Data and knowledge

An evidence-based policy position is critical to delivering this strategy, and the ability to monitor, report on, design and advocate for cost effective water sensitive infrastructure is only as good as the knowledge base it is built upon.

Ku-ring-gai Council manages and coordinates a range of databases that enable the organisation and stakeholders to accurately track and manage water and associated assets and issues. This includes water metering, water billing, asset management data (including plans), geospatial data, and community engagement events. Tracking the asset condition and the maintenance of assets (e.g., cost of maintenance visits and pollution removed) is critical to achieving the water management objectives of this strategy.

The ability to integrate and share data between organisations, particularly DPE and Sydney Water, is a very useful and progressive method to move towards a water sensitive city. In some instances, this requires publishing in near real-time data on websites and in other instances it is a data sharing agreement between agencies. The sharing of sewer overflows and upgrades to infrastructure is one example of this.

Beyond just storing data, corporate knowledge and critical thinking within the organisation is important and will support and enable this transition to a water sensitive city. As such working groups have been recommended to facilitate uptake and review the success of strategy actions. The ability to stored and file data and documentation to enable the sharing of insights is important and will continue to drive the organisation towards the vision.

2.8 How stormwater harvesting assets contribute to a water sensitive city?

The millennium drought in the late 2000s brought water supply and water security issues to the forefront of the Australian public and political sphere, and in particular to water users, small and large. It became increasingly clear that cities need a diverse range of water sources to cope with a variable climate and increasing growth, and less reliance on potable water. Potable water reductions can come either in the form of demand management (through various efficiency gains) or through increasing alternate supplies.

The urban water cycle offers many opportunities to reuse water from various sources and use that water to replace the need for potable water. These alternative options include:

- Rainwater
- Greywater
- Stormwater
- Recycled water (from centralised sewage treatment plants)
- Sewer mining (the treatment and reuse of sewage at a local scale)
- Groundwater

These alternative water supply options are often only feasible when there is alignment between the demand and supply for the site. At the subcatchment scale stormwater harvesting often represents the best alternative to using potable water for irrigating large open spaces. Over the course of the last 25 years, such systems have become commonplace across Australia's major cities.

These assets often have multiple benefits, and can be justified not purely on the basis of delivering an alternative water supply for the purposes of irrigation, but also[21]:

- Improves water quality of runoff entering waterways
- Returns the catchment hydrology to a situation more similar to the catchment's pre-development hydrology
- Prevents the need to prioritise the supply to various end uses
- Reduces pressure on existing water systems
- Creates multi-functional waterways which commonly results in higher property prices

They therefore deliver on the four major outcome categories of the water sensitive index tool: liveability, sustainability, resilience, and production.

21. Philp et al., 2008. Review of Stormwater Harvesting Practices

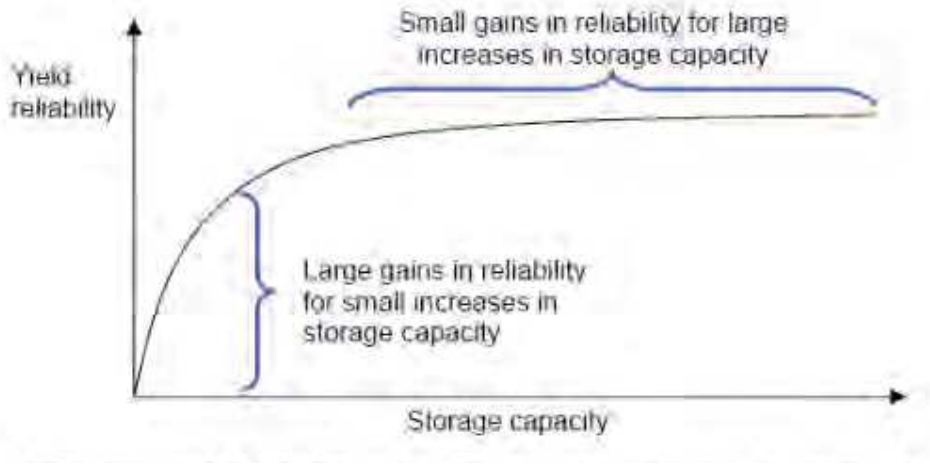


Figure 7. Relationship between yield reliability and storage capacity (Source: Philp et al., Review of Stormwater Harvesting Practices)

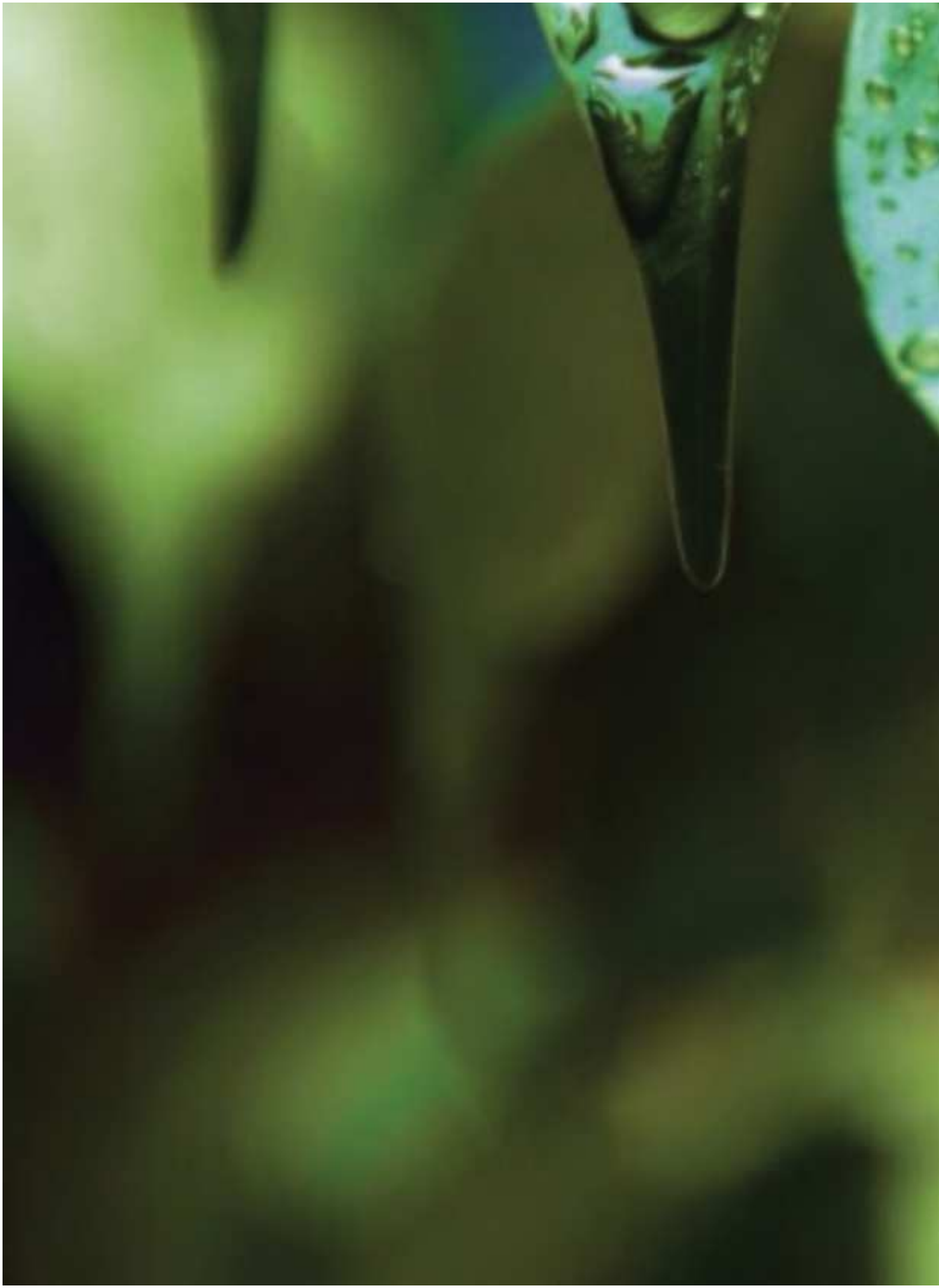
However, stormwater harvesting systems do have risks and challenges in their implementation. From an end user perspective, the biggest question is how much water can be saved and how much will they cost to run? This largely depends on two factors, the designed reliability of the system, which is a measure of the proportion of the water demanded of a system and the water it can provide, and the amount of downtime the system experiences. Supply dynamics are difficult if not impossible to control, whilst demand can be optimised through efficiency gains and better irrigation timing, but the factor that can most easily be altered is the size of the storage.

The relationship between reliability and the size of a given storage is one of diminishing returns, as can be seen in Figure 7[22].

Open spaces can rely purely on stormwater harvesting if there is an acceptance that in some months there will be no irrigation, and clear communications with the community are required to explain why this is a more sustainable option. Due to both the increased capital cost of larger storages, and the area required, many systems opt for a potable backup and are designed to have a reliability of 70-80%, the 20-30% of potable use mostly occurs in summer months when severe intermittent rainfall results in the tank running dry.

The other, often unaddressed, factor impacting the amount of potable water that can be saved, is system maintenance. Poor design and lack of, or improper maintenance result in unreliable systems. Ensuring there is adequate operational funding for system maintenance will ensure that potable water savings are maximised.

22. Philp et al., 2008. Review of Stormwater Harvesting Practices



3. Future pressures on water

3.1 Climate change

Council is well aware of the area's vulnerability to climate change and in the Council's Climate Change Adaptation Strategy (2016)[23] it identified four key risks:

- Bushfire vulnerability
- Storms and flooding
- Heat stress
- Drought

This is based on regional modelling that indicates more days of extreme bushfire weather, more frequent periods of extreme heat, major storms building in intensity and longer droughts. As identified within Ku-ring-gai Council's Climate Change Adaptation Strategy[24], responding to these pressures requires carefully scrutinised, appropriate, and timely adaptations. The increased occurrence of 'one in a hundred year' storms will have a demonstrable impact on Council's infrastructure demands and planning controls, longer droughts places more pressure on the efficient and sustainable management of open space, and extreme heat dramatically increases the health and safety needs of the community.

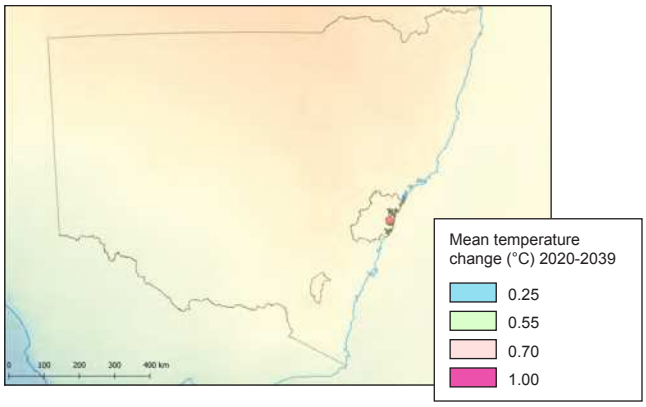
A water sensitive city that is liveable, sustainable, resilient and productive has the capacity to enable such adaptations to the changing climate we face.

Climate change projections for the region, as sourced from the NSW Government's Climate Projections project dataset[25] suggest that over the ten-year horizon (2021-2030) of this strategy:

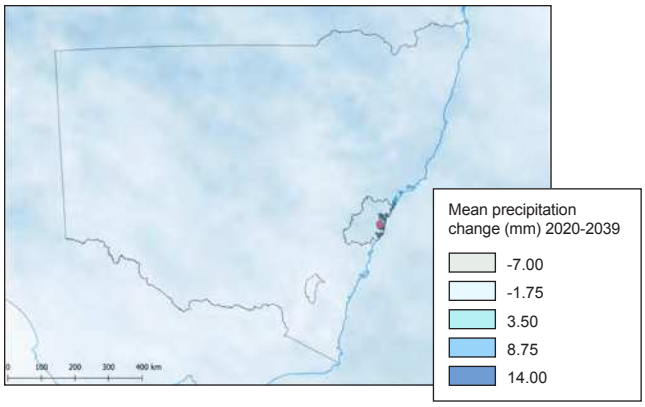
- Maximum temperatures will increase by 0.67 C°
- There will be, on average, three more days a year of above 35 C°
- The forest fire danger index score for Ku-ring-gai will increase by 0.22, resulting in a greater fire risk

The water cycle will be significantly affected by climate change, noting that it is already very variable. A resilient and flexible water system and asset management approach is critical to managing water and infrastructure now, and into the future.

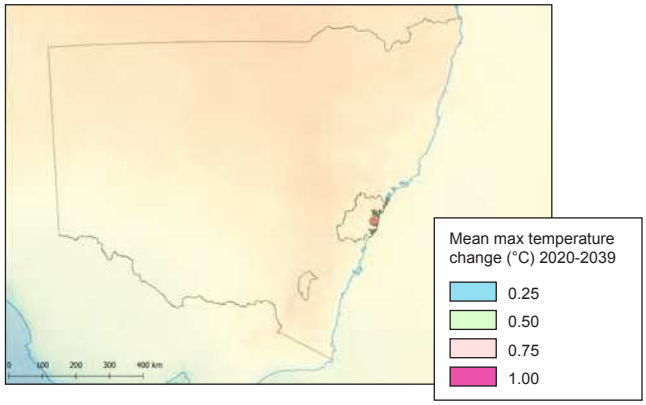
23. KRG, 2016. Climate Change Adaptation Strategy. p 21
24. KRG, 2016. Climate Change Adaptation Strategy. p 21
25. DPIE, 2021. NSW and ACT Regional Climate Modelling



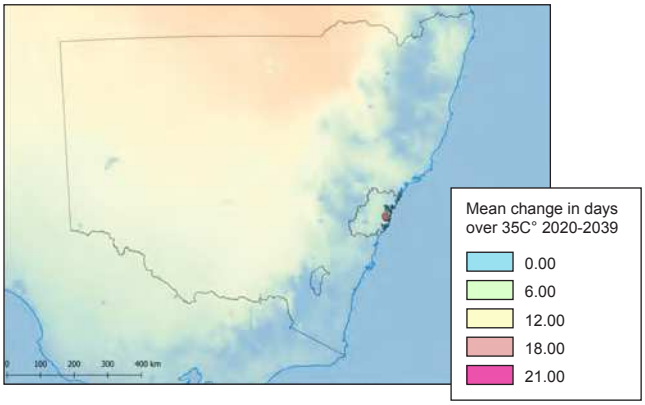
Change in mean temperature (C°) 2020-2039



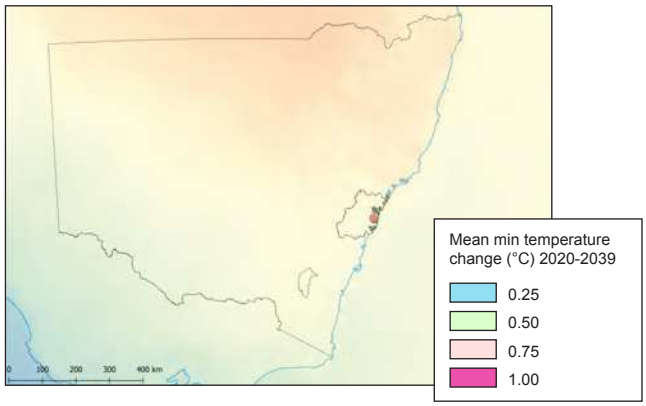
Change in mean precipitation (mm) 2020-2039



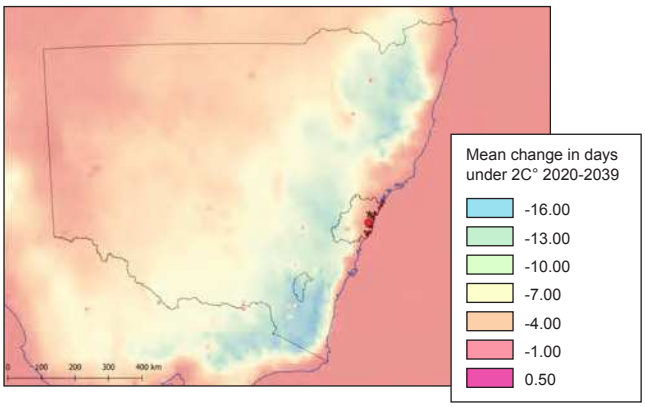
Change in mean max temperature (C°) 2020-2039



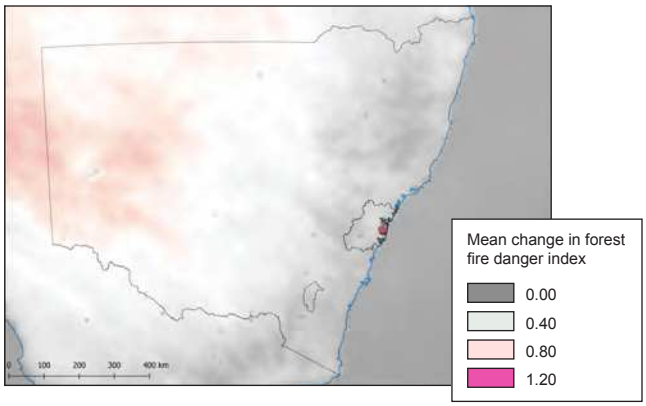
Change in days over 35 C° 2020-2039



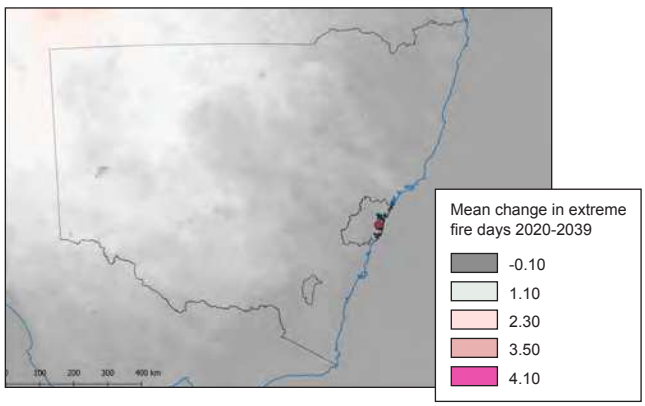
Change in mean min temperature (C°) 2020-2039



Change in days under 2 C° 2020-2039



Change in forest fire danger index 2020-2039



Change in extreme fire days (FFDI 50+) 2020-2039

Key ● Ku-ring-gai – – Greater Sydney — New South Wales — Coastline

Figure 8: NSW and ACT Regional Climate Modelling (NARCliM) climate change projection for NSW for the period 2020-2039.

3.2 Urban development

The population of Ku-ring-gai is expected to grow by more than 25,000 people in the next 20 years[26]. Whilst not as rapid growth as in many other urban areas, this increased density will require further urbanisation of the area through urban development.

Urban density and urban development are the key pressures on the water cycle in our cities, it is one of the fundamental reasons we need water sensitive cities.

Council and DPE forecast that there will be 12,000 new dwellings in the LGA[27] by 2036. The main activity zones are around the local centre areas and are outlined in the Draft Housing Strategy (2012). The location of these activity zones is important in the context of waterway management, particularly as further development in the LGA is focussed in headwater areas high in the catchments.

The latest Australian Bureau of Statistics estimated resident population for 2020 is 127,603 which is currently on the low side of the Ku-ring-gai projected population graph above.

A water sensitive city has capacity for increased population density and urban development through the use of smart planning controls and water sensitive solutions such as the 'sponge city' would explicitly mitigate the impact of urban development on downstream waterways and ecological health.

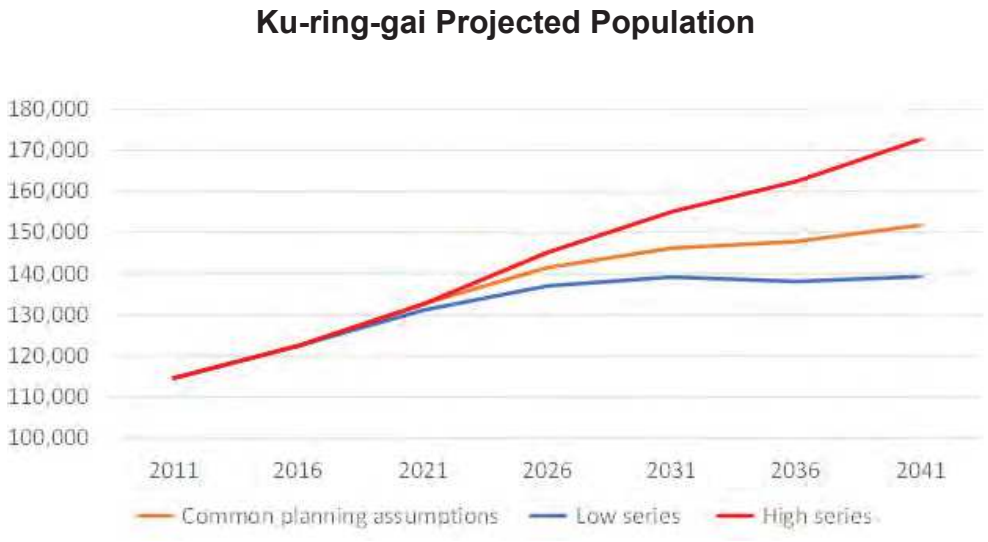
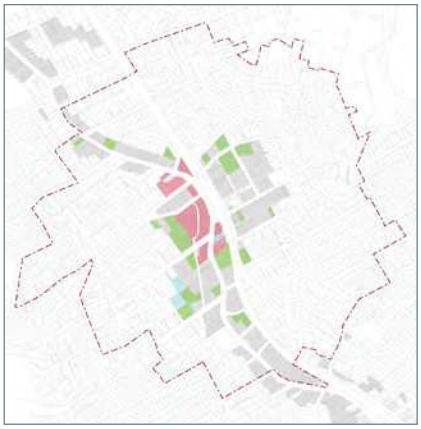


Figure 9. Projected population within Ku-ring-gai

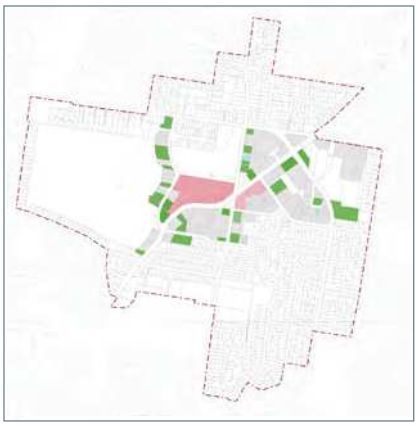
26. KRG, 2020. Ku-ring-gai Housing Strategy to 2036 December 2020 (Revised). p 11.
27. KRG, 2020. Ku-ring-gai Housing Strategy to 2036 December 2020 (Revised). p 10 and 11

Turramurra (Local Centre)

Gordon (Local Centre)

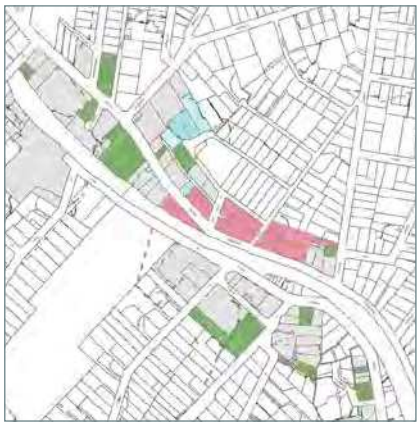


Lindfield (Local Centre)



St Ives (Local Centre)

Killara



Pymble

Roseville

Wahroonga

Key

- Undeveloped land – residential (R3 and R4 Zones) – moderate to high levels of take-up (72%)
- Undeveloped Land – Mixed use (B2 zones) – very low take-up (<5%)
- Developed land – residential and mixed use (R3, R4, B2 and B4 zones)
- Pipeline – currently under construction
- Other – low density residential (R2 and E4 zones) and other zones (SP2, RE1 etc) – no change

Figure 10. Estimated future development of medium and high-density residential zones in activity centres (Source: KRC Housing Strategy revised 14/12/ 2020).

3.3 Water balance today

The current water and nutrient balance for today is presented below, based on recent analysis of the catchment, water bills and current assets[28].

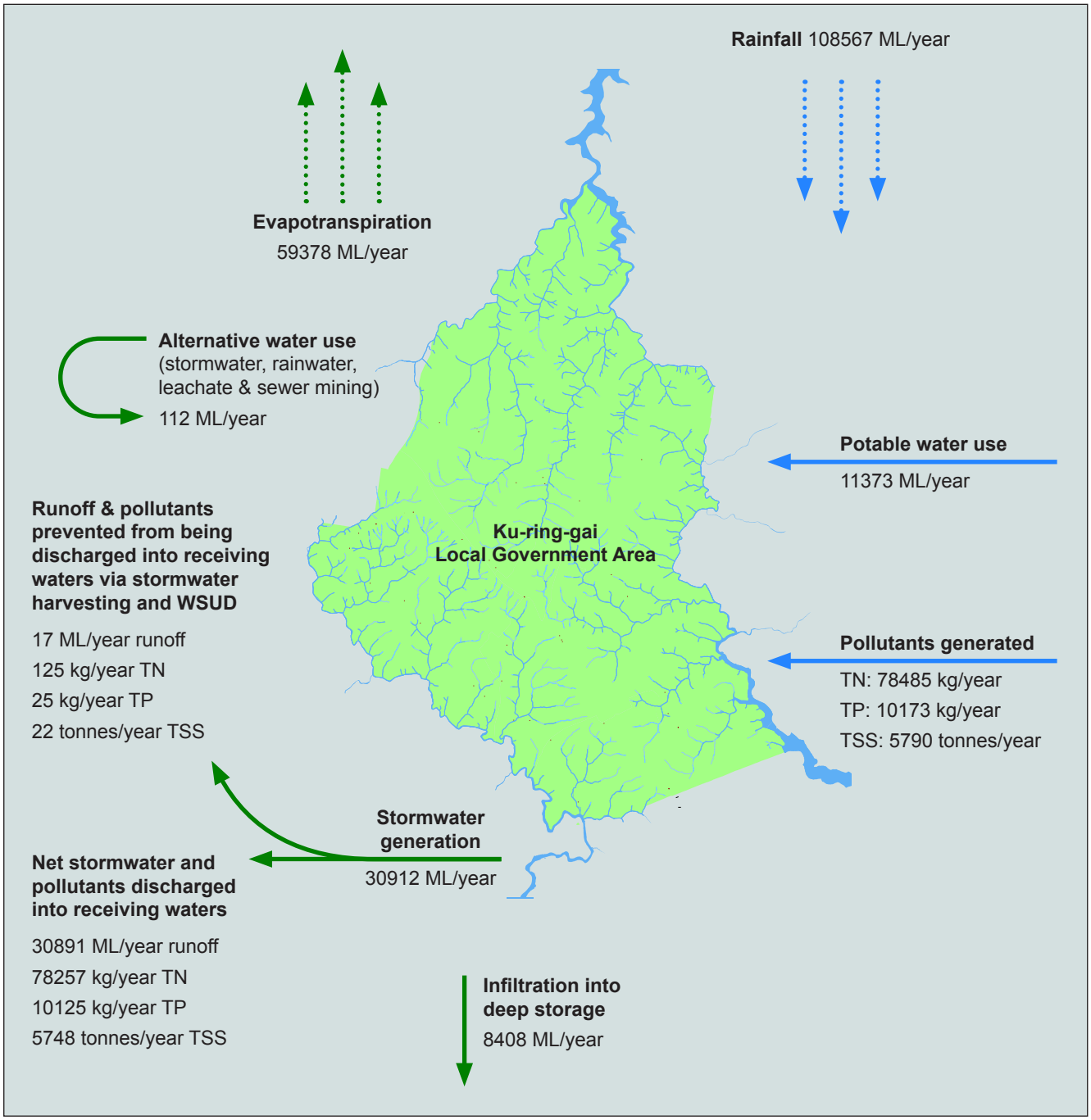


Figure 11: Ku-ring-gai's water balance estimate (today).

28. E2 Design, 2021. Current water balance within Ku-ring-gai LGA.

3.4 Water balance 2030

To calculate a possible future water and nutrient balance, various parameters are changed to take account of a new climate, new development, and the delivery of new assets to manage water within the LGA[29]. The results from this analysis and forecast are presented below.

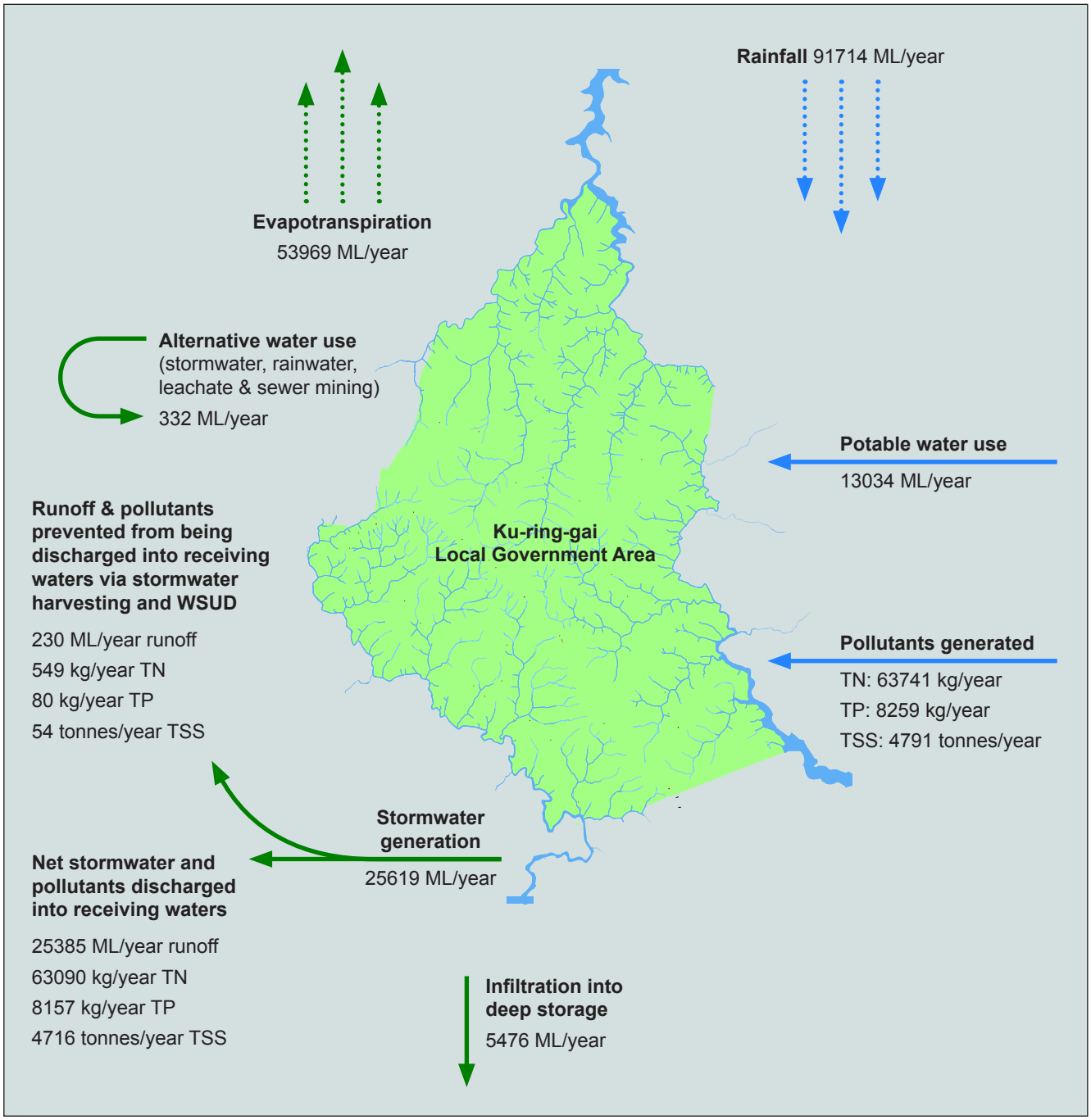


Figure 12: Ku-ring-gai's forecast water balance estimate (2030)

29. E2 Design, 2021. Future water balance within Ku-ring-gai LGA.

4. Vision and outcomes

As shown in Table 1 below, we can compare Ku-ring-gai's estimated water balances from the past and into future, to further help our decision making process for achieving our vision of Ku-ring-gai becoming a water sensitive city.

Water cycle component	2008 (ML)	2021 (ML, %)	2036 (ML, %)
Rainfall	93,912	108,567 (+16%)	91,714 (-16%)
Evapotranspiration	47,895	59,378 (+24%)	53,969 (-9%)
Potable Water Use	10,662	11,373 (+7%)	13,034 (+15%)
Runoff	36,626	30,912 (-16%)	25,619 (-17%)
Groundwater recharge	9,391	8,408 (-10%)	5,476 (-35%)

Table 1: Key comparisons between 2008, 2016, and 2036 (prospective) water balances.

The vision is that 'Ku-ring-gai will become a water sensitive city'. This vision will be achieved through the smart management of water, catchments, and waterways, and will result in a more liveable, resilient, sustainable, and productive Ku-ring-gai.

Through the investment of $5 million (over ten years) from the Environment Levy, $6.7 million on community engagement (across all sustainability issues), and the ongoing spending of $10 million from the Stormwater Management Charge and General Revenue (also over 10 years), alongside changes to the way organisations collaborate, monitor and engage stakeholders, Ku-ring-gai will move in a positive direction towards a water sensitive city, but will still require funding for ongoing maintenance of water sensitive assets.

Using the Water Sensitive Cities Index framework, the Council has documented the intended outcomes within each of the goals of the index, that takes account of the investment and commitment to date, and the physical, ecological and policy environment that exists in New South Wales.

The outcomes to achieve this water sensitive city are as follows, listed under each of the goals of the Water Sensitive City Index.

- **Ensure good water sensitive governance**
  - An organisation that is equipped and committed to achieving a WSC with a community engaged and influencing outcomes.
- **Increase community capital**
  - Increase community awareness on the subject of water in cities and provide resources and support for residents, community organisations and schools.
- **Achieve equity of essential services**
  - Making sure the way we apply flood controls equitably so that all dwellings are not affected by flooding and people are safe.
  - Impacts of flooding are understood, prepared for, and mitigated in the context of Ku-ring-gai so all structures and habitable floor areas are not affected.
  - Proactive research and maintenance programs, and planning controls to promote flood protection and mitigation in Council.
- **Improve productivity and resource efficiency**
  - Minimise/reduce potable water use and maximise resource recovery.
- **Improve ecological health**
  - Council has clean and healthy waterways through research and implementation of WSUD.
- **Promote adaptive infrastructure**
  - Future proof infrastructure utilising new technology and iterative monitoring and maintenance reporting, based on proactive maintenance and intelligent networks.
- **Promote adaptive infrastructure**
  - Taylor capital improvement budgets to incorporate intelligent networks and new technologies.

These outcomes are presented in Figure 13.

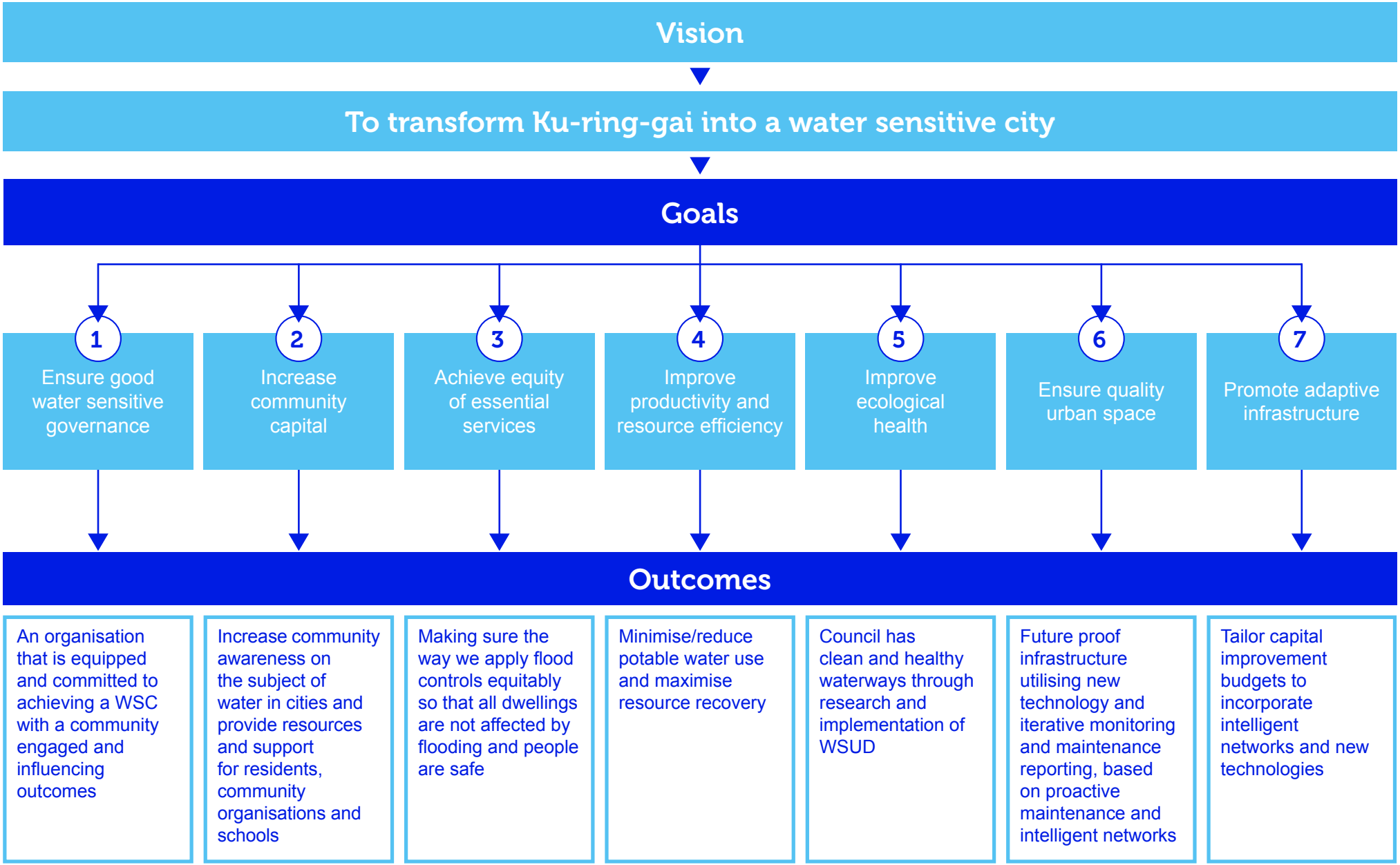


Figure 13. Linking outcomes to the vision of a water sensitive city.

Figure 13 does not capture the connectivity and relationships between the actions, outcomes, goals, and vision. Each of the actions will contribute to multiple outcomes, and then each outcome will contribute to multiple goals, and all goals contribute to the vision.

For example, an action that is focused on developing a stronger partnership with Sydney Water to review the frequency and impact of sewer overflows into Lane Cove River (and other creeks and rivers) will support the outcome for more adaptive infrastructure, improved ecological health, and improved water governance.

This vision and outcomes are consistent with the objectives of Council's Water Sensitive City Policy[30], which are to:

1. Protect, conserve and improve the condition of our waterways and riparian corridors, including native biodiversity
2. Manage the quantity, frequency and quality of stormwater runoff to improve ecological stream health
3. Reduce Council and the community's potable water use by diversifying water sources at different scales in fit-for-purpose applications and increasing water efficiency
4. Deliver programs that support and enable a continued shift in the community to more water sensitive practices
5. Integrate water infrastructure within the urban landscape to enhance the liveability of Ku-ring-gai, including stormwater treatment, flood protection, heat mitigation, ecological health, microclimate and landscape amenity

30. Ku-ring-gai, 2022. Water Sensitive City Policy. Version Number 2. Effective: 16 March 2022

5. Benefits

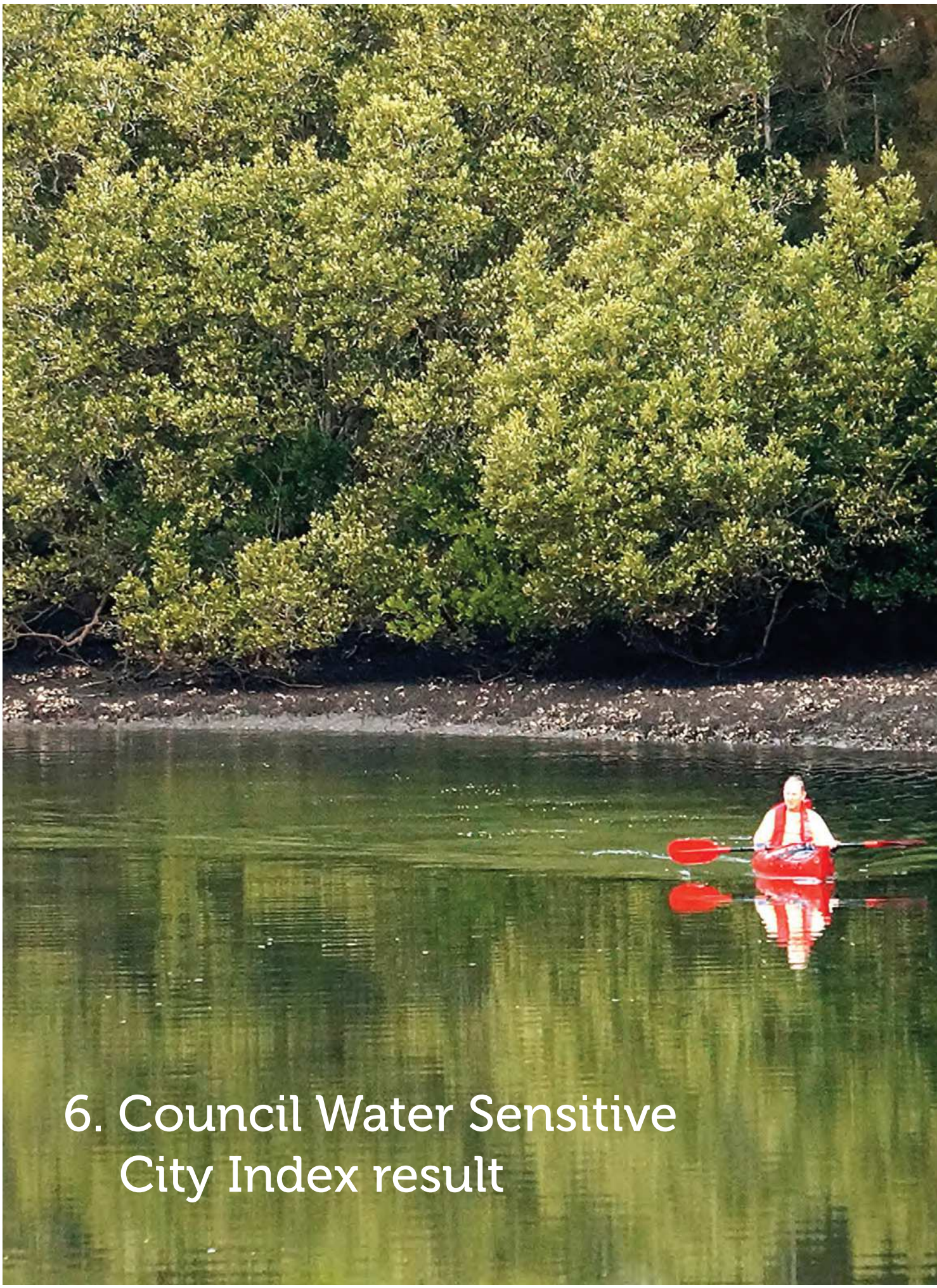
The benefits of a water sensitive city for the residents, businesses, and for Council have been well researched by the CRC for Water Sensitive Cities and many others.

The benefits to the delivery of this strategy can be broadly categorised into the following themes:

1. **City shaping**
    a. Support and ongoing maintenance of Ku-ring-gai as a green city with a healthy and diverse urban forest
    b. A cooler microclimate through the location of WSUD in local areas
2. **Ecological**
    a. A healthier creek and harbour system
    b. A reduction in pollution that flows to creeks and the harbour
    c. A diverse and resilience ecological community
3. **Community**
    a. Access and use of natural waterways and native open space environments
    b. Safe spaces to support improved physical and mental wellbeing
    c. An increased water awareness and literacy within the community
    d. An involved and collaborative decision-making structure
    e. Indigenous representation and involvement
    f. A vision for the community to strive for and be inspired by
4. **Infrastructure**
    a. Multi-faceted benefits from infrastructure
    b. Longer lasting infrastructure through maintenance
5. **Financial**
    a. A reduction in the cost of potable water, for residents and for Council
6. **Water balance**
    a. A reduction in the use of potable water and an increase in the diversity of water sources

Cost benefit studies are traditionally very difficult for these types of strategies, as most of the benefits are qualitative/intangible and mostly classified as 'non-monetary values'.

It should be acknowledged that the benefits from the delivery of this strategy will flow to the community and Council both in the short term (through reductions in potable water bills and increases in property values where investments are made), and in the long term (ecological values, microclimates and increased physical and mental health of the community).



6. Council Water Sensitive City Index result

6.1 Goals and indicators

Council conducted a Water Sensitive City Index benchmarking assessment in October 2018. This involved a workshop facilitated by Alluvium Consulting where Council staff self-assess Ku-ring-gai's performance across 34 indicators. Below in Figure 14 and Table 2, we can see how Ku-ring-gai compares to both the idealised water cycle city and against Greater Sydney (data collected through a different process) when looking at the seven goals and the 34 indicators.

Table 2. WSC Index scores (goals and indicators) for Ku-ring-gai and Greater Sydney (for comparison).

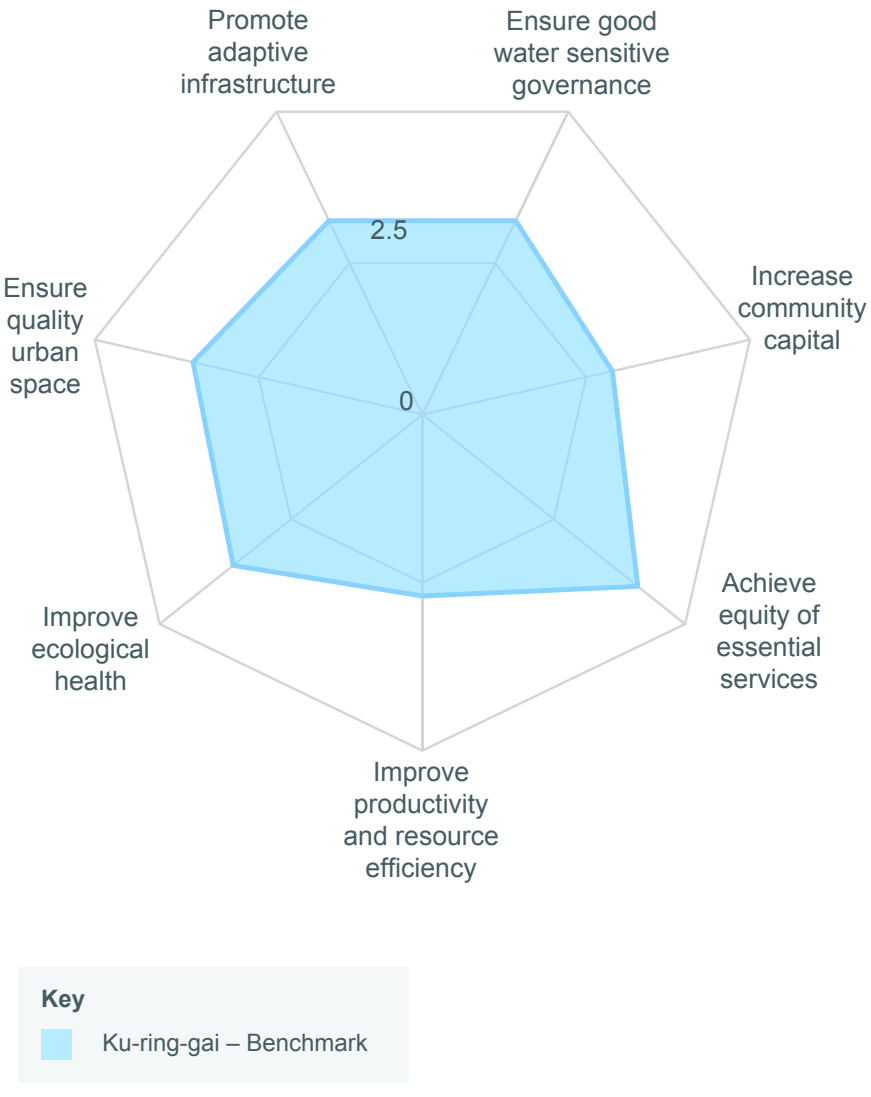


Figure 14: Ku-ring-gai's performance (shaded area) for the seven WSC Index goals compared to the idealised Water Cycle City.

WSC Index scores

		Ku-ring-gai	Greater Sydney
1.	Good governance	3.2	2.4
1.1	Knowledge, skills and organisational capacity	4.0	2.0
1.2	Water is key element in city planning and design	3.0	2.0
1.3	Cross-sector institutional arrangements and processes	2.0	2.0
1.4	Public engagement, participation and transparency	3.0	2.5
1.5	Leadership, long-term vision and commitment	4.0	2.5
1.6	Water resourcing and funding to deliver	3.5	2.5
1.7	Equitable representation of perspectives	3.0	2.5
2.	Increase community capital	2.9	2.3
2.1	Water literacy	3.0	3.0
2.2	Connection with water	3.0	3.0
2.3	Shared ownership, management and responsibility of water assets	3.0	2.0
2.4	Community preparedness and response to extreme events	3.5	2.0
2.5	Indigenous involvement in water planning	2.0	1.5
3.	Achieve equity of essential services	4.1	3.9
3.1	Equitable access to safe and secure water supply	5.0	5.0
3.2	Equitable access to safe and reliable sanitation	4.0	4.5
3.3	Equitable access to flood protection	4.0	3.0
3.4	Equitable and affordable access to amenity values of water-related assets	3.5	3.0
4.	Improve productivity and resource efficiency	2.7	2.7
4.1	Benefits across other sectors because of water related services	3.0	2.5
4.2	Low GHG emission in water sector	3.5	3.0
4.3	Low end-user potable water demand	2.0	3.5
4.4	Water-related economic and commercial opportunities	2.0	2.0
4.5	Maximised resource recovery	3.0	2.5
5.	Improve ecological health	3.6	3.0
5.1	Healthy and biodiverse habitats	4.0	2.0
5.2	Surface water quality and flows	3.5	3.0
5.3	Groundwater quality and replenishment	3.0	3.0
5.4	Protect existing areas of high ecological value	4.0	4.0
6.	Ensure quality urban space	3.5	2.0
6.1	Activating connected urban green and blue space	3.0	2.5
6.2	Urban elements functioning as part of the urban water system	3.0	2.0
6.3	Vegetation coverage	4.5	1.5
7.	Promote adaptive infrastructure	3.2	2.8
7.1	Diverse fit-for-purpose water supply	3.5	3.0
7.2	Mulit-functional water system infrastructure	3.0	2.5
7.3	Integration and intelligent control	3.5	2.5
7.4	Robust infrastructure	3.0	3.0
7.5	Infrastructure and ownership at multiple scales	3.0	2.5
7.6	Adequate maintenance	3.0	3.0

Table 2: WSC Index scores (goals and indicators) for Ku-ring-gai and Greater Sydney (for comparison)

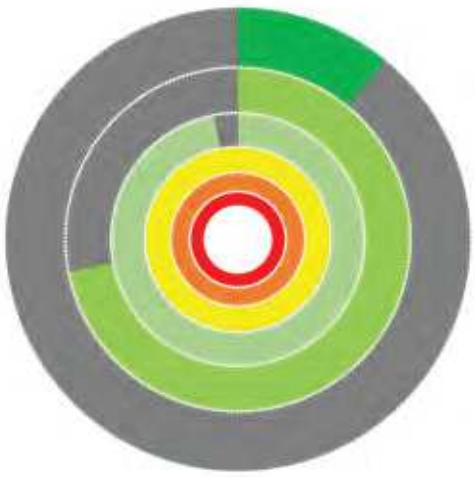
6.2 Benchmarked city-states

The results indicate that Ku-ring-gai is one of the most water sensitive cities in Australia (based on 2018 data). By aggregating the results of the 34 indicators a percentage score can attributed to where Ku-ring-gai is in its journey towards becoming water sensitive city.

Whilst Ku-ring-gai has achieved 100% in its respective journey to becoming a water supply; sewered; and a drained city, it has not quite completed its journey to becoming a waterway, water cycle or indeed a water sensitive city. The 2018 index process indicates that Council is 97%, 72%, and 11% of the way to each of those respective city-state goals. It should be noted that the 'water-sensitive city' is seen as an aspirational target that is not necessarily achievable but rather a state that should be continually aspired towards.

It should be noted that a result of 100% against any of the benchmarked city states such as a 'Drained City' does not indicate perfect drainage everywhere, all of the time.

WSC Index 2018 Benchmarking Results



Key		
	Water supply city	100%
	Sewered city	100%
	Drained city	100%
	Waterway city	97%
	Water cycle city	72%
	Water sensitive city	11%

Figure 15: Ku-ring-gai's performance with respect to the water benchmarked city-states.

100% Water Supply City and Sewered City

Ku-ring-gai scored 100% as a Water Supply City and Sewered City. The performance assessment demonstrated that the community in the Council LGA has equitable and safe access to water supply and wastewater services. These services are provided by Sydney Water who operate under an operating license to maintain services to all customers.

While access and quality of these services were scored highly, it was noted that residents of Ku-ring-gai are some of the highest water users in Sydney.

100% Drained City

Ku-ring-gai scored 100% as a Drained City. Much of Ku-ring-gai is located relatively high in the catchment, resulting in a lower flood risk than other lower lying communities in Sydney.

Drainage infrastructure is generally in a good condition; however, Council is only just currently undertaking a comprehensive CCTV inspection and condition assessment. Council receives only a small number of community complaints. In large storm events, nuisance flooding can cause temporary disturbance for local residents.

Significant proactive effort is currently being directed toward flood mapping and flood management planning. Stormwater detention in some locations also assists in managing localised runoff.

97 % Waterway City

Ku-ring-gai scored 97% as a Waterway City. Internally, the Council has a high level of water literacy across the organisation.

Citizens that lived adjacent to local parks, drainage lines and waterways were considered to have the highest water literacy. While the broader community is generally well educated and has a strong connection to the 'green' image of Ku-ring-gai, the local population is growing and the demographic slowly changing presenting new challenges for Council. There are relatively low levels of knowledge in regard to different aspects of the water cycle, as well as low citizen understanding of some of the newer water sensitive urban design features and initiatives being undertaken.

The Environmental Levy established approximately 16 years ago, has played a major role in Council undertaking on-ground projects and education programs with the community, for example by participating in community-based catchment care activities.

Local residents and the business community are reported to be gradually recognising the wider value of water and the benefits provided by the landscape, including cooling and liveability, however these actual benefits have not been quantified or regularly included in business case development.

Ku-ring-gai has amongst the highest water consumption per dwelling for LGAs in the Greater Sydney region. External water used in gardens on large blocks and pools has a big influence on the high-water use, with single residential dwellings making up 85% of the land area in Ku-ring-gai.

State agencies and Sydney Water acknowledge that there is generally a lack of collaboration, with the majority of interactions with the Council being ad hoc and, on a case,-by-case basis. One exception to this is local disaster planning where very strong and collaborative relationship exist across a diverse number of regional stakeholders.

Working with private development industry stakeholders continues to be a challenge especially with regards to ensuring the intent of Council's DCP requirements around WSUD elements are met with private certification. Greater involvement in state government led district level planning, and the planning of state infrastructure projects such as schools, would drive enhanced collaboration and ownership. The relationships with adjacent councils are also positive, but ad hoc.

Local waterways are in relatively good condition. Approximately 20% of the catchments in the LGA are treated with some form of stormwater quality improvement device (SQIDs). There are 78 SQIDs on the asset schedule and 46 raingardens. Ku-ring-gai has had various stormwater policies in place, which are supported by technical guidance (such as deemed to comply solutions), and Council's compliance officers actively enforce erosion and sediment control measures. Groundwater is not a significant resource or feature in the area, however further investigation into the importance of perched groundwater tables and sub-surface flow is important for a number of vegetation communities.

72% Water Cycle City

Ku-ring-gai scored 72% as a Water Cycle City. Water is seen as a high priority for the area, with strong policy and development controls in place (within Council's control). Water-related plans, a constantly evolving knowledge and understanding of the water system, and the Environmental Levy provide strategic guidance and resources to ensure the continual maintenance of Ku-ring-gai's stormwater system, and for implementing innovative projects to help reduce flooding and prevent pollutants entering local waterways.

The community has relatively high levels of trust and communication with Council. Council invests heavily in understanding the perspectives of the community to inform decision making, including for local public projects. There are some established community reference groups, for example for flood management. Not all of the community feels empowered to engage in key projects or issues unless there is a direct and generally negative impact on the individual. An ageing population see many interactions with the community focussing on short-term goals rather than longer term vision.

Council has actively undertaken a range of stormwater harvesting and sewer mining projects which have contributed to building local and regional knowledge and capacity. There are two golf courses using sewer mining to provide reused water for irrigation and 14 stormwater harvesting schemes are in place. Many projects are now utilising solar or low energy sources to reduce greenhouse gas emissions. There has also been widespread adoption of rainwater tanks in new residential developments, in part driven through BASIX.

Green infrastructure solutions have also been implemented by Council, despite the local steep topography in many locations constraining opportunities and public access. Asset management audits are currently underway to inform future management planning and maintenance schedules. Many of the newer projects have had associated monitoring programs put in place, however further work is required to ensure reliability of data and efficient maintenance.

Ku-ring-gai has a high quality and functioning stream network with mostly intact corridors. These corridors are protected through geography and planning which precludes development in steep riparian / bushland areas. There continues to be a high level of investment into catchment planning and habitat and biodiversity management with local residents and adjacent councils.

The diverse network of green and blue corridors provide for a wide range of primarily passive recreational opportunities which are also recognised for their role in providing areas of cool respite in times of extreme heat.

The topography and large number of private landholders located adjacent to these corridors present ongoing challenges for Council in terms of managing pest and invasive species, and in enabling public access and connection.

11% Water Sensitive City

Ku-ring-gai scored 11% as a Water Sensitive City. Council has a strong organisational culture underpinning their commitment to water sensitive cities. Council has proactively sought to use science to inform the planning and management of its natural resources. There is strong collaboration across Council, for example, between architects, scientists and engineers, on a wide range of public realm projects. Water sensitive urban design and broadly liveability and resilience initiatives are considered common place across the organisation.

Ku-ring-gai proudly recognises themselves as the 'green heart' of Greater Sydney, with more than 150 bushland reserves covering 1,150 hectares. The community has a very strong affiliative with the vegetation in the region which constantly rates highly in terms of value in local community surveys.

This high community value and a common view that 'trees are sacred' has helped to drive a large number of policies to ensure their protection, including regularly updated Development Control Plans and strong tree management and tree preservation policies.

Population growth and urban intensification continues to place pressure on regulatory controls to ensure the long-term protection of the vegetation communities and their role in providing urban cooling and liveability.

6.3 Pathways to support the transition

The process resulted in six high-level paths aimed at improving Ku-ring-gai's performance with respect to goals and indicators where room for improvement was identified and therefore furthering Ku-ring-gai's journey towards becoming a water sensitive city.

- Integrating the 'new' with the 'old'
- Targeting high water users
- A shared vision
- Investing in knowledge to inform business case development
- Growing the network of champions – internally
- Growing the network of champions – externally

7. Targets

To guide annual work programs and progress towards a water sensitive city, the following targets are proposed to be reported on annually through IP&R to help drive this transition to a water sensitive city.

The focus on community engagement, action, and also water supply metrics are deliberate as they capture key issues that Council have control over, can influence the outcomes of, and will be influenced by the range of goals and outcomes as outlined in the above sections of this strategy. In several areas, Council is already delivering well above the 2020 target (as reported in the 2019/20 annual report) and is well placed to continue to deliver these programs and meet these targets.

All targets can be delivered within existing funding, with further details outlined in the sections below.

In Figure 11 it notes that 11.7 GL of potable water is consumed on average by all residents, business and Council. Council's potable use is approximately 100 ML/yr , so approximately 0.8% of the total amount of potable water consumed. By engaging with the community and highlighting the potential for water savings, there are potentially gigalitres of water to be saved, in comparison to the 10-year target of 75 ML/yr[31] consumption across all Council operations. Also related to these potable reduction targets are a focus on reviewing and updating the DCP and LEP and working with developers to explore options to go beyond BASIX.

The potable reduction target, and community engagement targets, are complimented by a target to increase the use of alternative water. The potable reduction target is equivalent to the increase in use of alternative water uses.

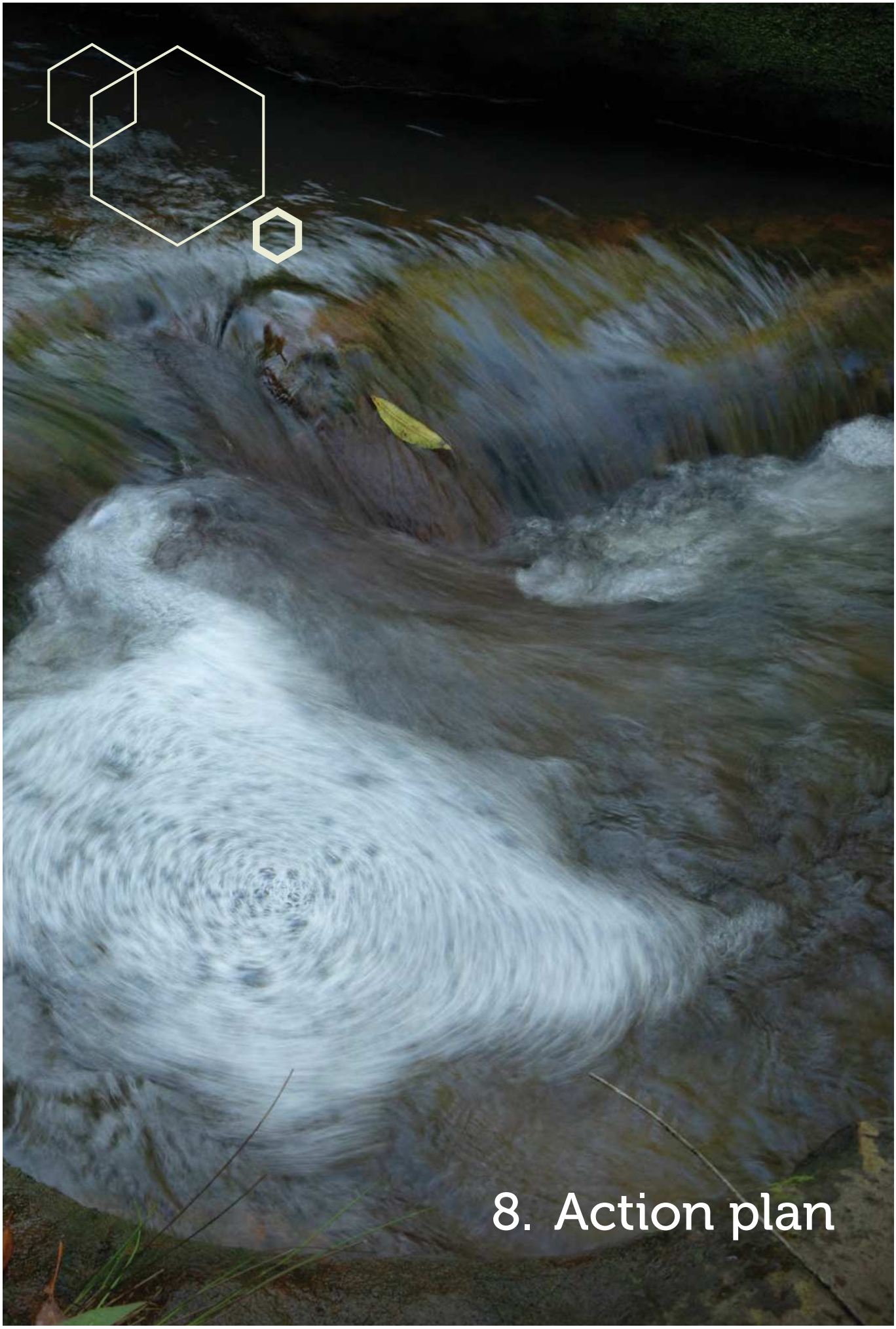
Council has a long history in maintaining drainage infrastructure and in light of the high degree of trees and vegetation in the LGA, have an extensive program to ensure gross pollutants and leaves do not clog the drainage infrastructure. With an increased adoption of more water sensitive infrastructure, the target to remove 5,000 tonnes of rubbish diverted from waterways is important to ensure that these assets work as intended and the waterways can continue to improve in condition and may require more street sweeping.

The trajectory that each target will follow year to year will be varied, due to the natural variability of water and the staged nature of investing in infrastructure upgrades.

31. KRG. 2020. Annual report. p. 188.

ID	Target	2019/20 reported performance	2020/21 reported performance (Baseline target 2016/17)	2030 target	Relevant WSC Index goal
1	Increase the number of residents involved in community environmental programs.	10,374	5,836 (5,348)	10,000	Increase community capital
2	Increase the number of residents at a household or individual level who carried out actions to benefit the environment.	2,465	2,764 (2,843)	5,000	Increase community capital
3	Increase the number of residents involved in climate change adaptation activities.	671	731 (294)	2,000	Increase community capital
4	Maintain the percentage of creeks tested that maintain or improve their stream health score.	100%	100% (100%)	100%	Improve ecological health
5	Increase the tonnes of rubbish diverted from our waterways.	1,306 tonnes	2,616 tonnes (2,295 tonnes)	5,000 tonnes	Improve productivity and resource efficiency
6	Increase the percentage of harvested/reused water of total irrigation demand utilised at harvested/reuse sites.	91%	93% (86%)	90%	Improve productivity and resource efficiency
7	Decrease the household potable water consumption per capita.	73.74 kL/capita	77.74 kL/capita (79.38 kL/capita)	60 kL/capita	Ensure good water sensitive governance
8	Decrease the potable water consumption from Council facilities	100.45 ML/yr	86.84 ML/yr (183.57 ML/yr)	75 ML/yr	Ensure good water sensitive governance
9	Increase the total volume of water sourced from re-use and recycling systems	120.46 ML/yr	120.93 ML/yr (134.56 ML/yr)	170 ML/yr	Improve productivity and resource efficiency

Table 3: Council water sensitive city targets.



8. Action plan

The action plan was developed in consultation with key staff and is presented below to illustrate how each of the goals and indicators will change and provide confidence that Council will continually move closer to the 'water sensitive city' state.

The involvement of all parts of Council, external stakeholders and the community are critical in this evolution and movement towards a water sensitive city. The roles and responsibilities are further expanded upon in Section 9.

The funding and benefits are also expanded upon in Sections 5 and 10.

Table 4: Actions to achieve a water sensitive city

Action No.	Action	Council responsibility	Funding	Monitoring mechanism
Goal 1 – ENSURE GOOD WATER SENSITIVE GOVERNANCE				
1.1	Ensure WSC is integral to all Council projects, supported by a cross Council Working Group, and led by management.	Environment and Sustainability (E&S)	Existing	No of projects considered, and Council Water Working Group meetings held.
1.2	Ensure organisations and key groups from outside of Council, including indigenous representatives are engaged, to deliver on the WSC strategy and targets. Looking for opportunities to engage with indigenous groups and representatives is a high priority.	E&S Community	Existing	Working group with key stakeholders (including externals) to be held quarterly
1.3	Annually review funding sources and available external grants to ensure there is adequate planning, budgets, and clear objectives with strategy and targets.	E&S Technical Services Infrastructure Services	Existing	Requirement of end of financial year duties from E&S and for Operations (annual meeting between departments) Incorporation of forward budget meeting into Water working group schedule.
1.4	Prominently integrate promotion and education of the WSC concept into existing sustainability education and engagement initiatives to connect all parts of our community to specific actions they can do and incentives they can benefit from. Promote a sustainability and climate water story through the projects and people in Ku-ring-gai.	E&S Community	Existing (environmental levy)	Community perceptions / evaluation surveys.
1.5	Seek increased representation of different voices across water issues and across community groups and social demographics. Seek increased representation of different voices across water issues and across community groups and social demographics.	E&S Community	Existing (environmental levy)	No. of invited and attended external stakeholders at water working group meetings.

Action No.	Action	Council responsibility	Funding	Monitoring mechanism
Goal 2 – INCREASE COMMUNITY CAPITAL				
2.1	Create a Council branded WSC campaign to use on all assets, waterways, creeks, lakes, and events.	E&S	New budget. Funding source to be identified.	No. of WSC related promotional materials produced
2.2	Continue and extend community engagement programs, by reviewing how, and where the community can participate in environmental protection, advocacy, clean up and celebration, and act on climate change, extreme events, resilient and cool neighbourhoods.	E&S Community	Existing (environmental levy)	No. of members of active community groups (such as Council's Care program).
2.3	Promote a community incentive program to increase water sensitive outcomes at local and property scale - as measured through use of rainwater tanks, increased planting and additional canopy cover, potable saving, stormwater reductions, and flood mitigation. Promote a community incentive program to increase water sensitive outcomes at local and property scale - as measured through use of rainwater tanks, increased planting and additional canopy cover, potable saving, stormwater reductions, and flood mitigation.	E&S	Potential new budget required in addition to WaterSmart and Climate Wise Communities Program.	Direct measure of program uptake (i.e., no of rainwater tanks installed) data can be gathered directly through engagement in program.
2.4	Collaborate with Sydney Water to reduce sewer overflows at ecologically sensitive locations.	E&S Bushland Services Regulation	Existing	No. of catchment / city wide meetings attended.
2.5	Collaborate with surrounding councils, Sydney Water and State Government to improve access and connectivity, maintenance and strategic planning for waterways, natural assets and water infrastructure.	E&S Technical Services Infrastructure Services	Existing	No. of catchment / city wide meetings attended.
Goal 3 – ENSURE EQUITY OF ESSENTIAL SERVICES				
3.1	Continue implementing and applying the actions from the Flood Risk Management program.	E&S Technical Services Development and Regulation	Existing + grants	No of actions delivered from Flood Risk Management program.
3.2	Continue maintaining WSUD assets and other water assets.	E&S Waste & Cleaning Services Infrastructure services	Existing with additional funding required to ensure assets maintained to best practise standard.	Asset condition reports and quantity of maintenance visits completed.
3.3	Review the actions in the Green Grid Strategy and Urban Forest Strategy to ensure Council has an ongoing program to increase access to waterways and green spaces, and the value of water in these strategies is paramount.	Strategy and Environment Operations	Existing	No of access points, tracking increase in access.
3.4	Keep up to date stormwater models for the LGA, including DRAINS, MUSIC and the LGA wide water balance.	E&S Technical services	Existing	No of staff with appropriate IWM skills, and number of training days completed.

Action No.	Action	Council responsibility	Funding	Monitoring mechanism
Goal 4 – IMPROVE PRODUCTIVITY AND RESOURCE EFFICIENCY				
4.1	Review current water assets and infrastructure to maximise energy efficiency, and integrate smart monitoring systems to avoid leaks, waste, and energy use.	E&S Infrastructure Services	Existing (environmental levy)	Before and after audits
4.2	Investigate opportunities for water focused 'industrial ecology' through the expansion of Council water projects, or other support and incentive programs with commercial and private organisations to decrease potable water use.	E&S	New budget required	Subcatchment IWM analysis – showing change to water balance.
4.3	1. Continue measuring 'rubbish diverted from our waterways'	E&S Waste & Cleaning Services	Existing (environmental levy) however no current funding for reuse/recovery of material.	Kgs of rubbish diverted.
4.4	2. While a new target is developed to measure maintenance undertaken and increasing catchment areas treated.	E&S Waste & Cleaning Services Infrastructure Services	Existing (environmental levy) however no current funding for reuse/recovery of material.	Catchment area with WSUD.
4.5	3. Investigate opportunities to reuse waste from WSUD assets through a regional or inter-council approach.	E&S Waste & Cleaning Services	Existing (environmental levy) however no current funding for reuse/ recovery of material.	Kg of waste reused.
4.6	Identify and deliver up to 10 priority best practice water projects at Council sites and ensure all projects consider best practice water management options.	E&S Technical Services	Capital works funded by Levy	No. of best practice priority projects delivered.
Goal 5 – IMPROVE ECOLOGICAL HEALTH				
5.1	Review DCP and LEP regulations to maximise water retention in all new developments and maximises potable water savings, with view to working with developers to go beyond BASIX.	Strategy and Environment Development and Regulation	Existing	Review complete.
5.2	Review how maintenance of streets and drains can be proactively maintained for the purposes of ecological health.	E&S Waste & Cleaning	Existing	% of streets upstream of each catchment, with clear allocation of where street sweeping will enable greater ecological health outcomes.

Action No.	Action	Council responsibility	Funding	Monitoring mechanism
5.3	Continue to improve the condition of local waterways, continuing to focus on protecting pristine areas, improving ecological richness and bank stability.	E&S Bushland Services	Existing (environmental levy)	Condition of waterways, using existing monitoring program.
5.4	Ensure there is appropriate monitoring and mapping of ecological systems to inform development controls, maintenance, and priority works.	E&S Land Information	Existing (environmental levy)	Monitoring reports.
5.5	Better understand groundwater and subsurface flows and the link between upstream catchments, development and the ecological impact downstream.	E&S Bushland Services	Existing (environmental levy)	Groundwater/surface water mapping complete.
5.6	Identify and manage sensitive aquatic ecosystems.	E&S Bushland Services	New budget required	Ecological mapping, including primary threats to ecology, by subcatchment.
Goal 6 – ENSURE QUALITY URBAN SPACE				
6.1	Review the LEP & DCP to ensure all developments mitigate urban heat island impacts. Where practical, incorporate water play and WSUD features into playgrounds with the aim to support Ku-ring-gai's nature play strategy to build community knowledge around water issues and improve integration of water in the design and planning of play spaces.	Strategic Planning Development and Regulation	Existing	No. of plans submitted with WSUD and microclimate strategies included.
Goal 7 – PROMOTE ADAPTIVE INFRASTRUCTURE				
7.1	Engage with infrastructure service providers regarding asset management, ecological health, shared use of land, support for water sensitive infrastructure, and support for climate adaptation projects.	E&S	Existing	No. of meetings with infrastructure service providers.
7.2	Investigate capital upgrades for intelligent control options of Council WSUD assets and implement upgrades, where it is feasible and beneficial from a whole of life cost perspective, that enables more proactive maintenance.	E&S Infrastructure Services Information Management	New budget required	No. of upgrades implemented and maintenance condition reports where upgrades have been implemented.
7.3	Review desired maintenance budgets each year as the asset base for water sensitive infrastructure increases, and report annually on the actual and desired maintenance budget.	Operations E&S	New budget required	Annual report on actual and ideal budget gaps, by water asset type.
7.4	Maintain infrastructure to specified standards, with accompanying reporting, asset tracking, to deliver better performance and increase the longevity of assets.	Infrastructure Services Waste & Cleaning Services	New budget required	No. of and results of asset condition reports.

9. Governance and responsibilities

To successfully deliver this strategy there must be clear responsibilities and governance structures to facilitate the transition to a water sensitive city.

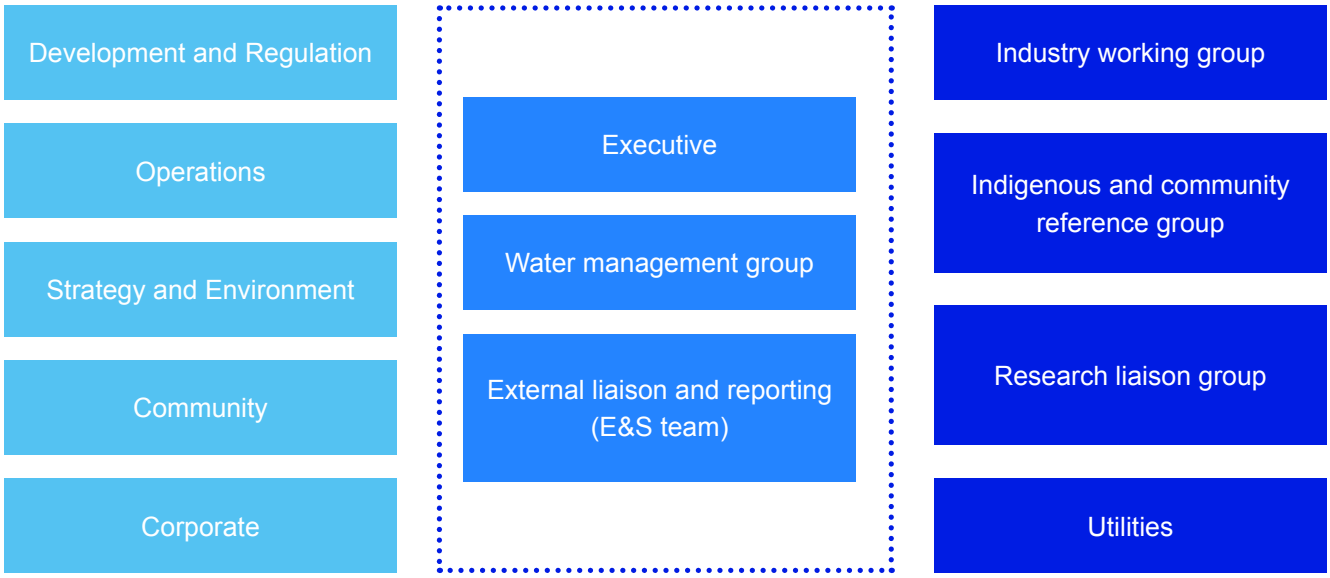


Figure 16: Proposed governance structure and roles

There are a range of internal and external governance structures and roles that will ensure that all agencies and teams are clear in regard to their respective roles and responsibilities (see Figure 16 below). Note that Table 4 in Section 8 above outlines which team is responsible for leading each of the actions, and this section discusses the roles and responsibilities more broadly with reference to external agencies and working groups.

The Strategy and Environment team within Council will oversee and coordinate the delivery of the strategy and convene the various internal and external working groups. Council's Manager of Environment and Sustainability has overall responsibility for overseeing delivery of the strategy, coordinating budgets and reporting.

Within Council, the list below outlines the respective responsibilities for the relevant departments:

- **Strategy and Environment.** Within this department the Environment and Sustainability team is responsible for leading the implementation of this strategy and key actions including planning and implementation of the Environmental Levy, ecological monitoring, design of water sensitive infrastructure and community engagement activities. The Strategic Planning team is responsible for incorporation of key issues into the strategic planning framework and consideration of how state government planning policies relate to local planning decisions and master planning around urban growth.
- **Development and Regulation**. This department is responsible for statutory planning, including the review of development applications for compliance with WSC measures. Regulation activities such as building compliance and environmental health are also undertaken by this department.
- **Operations.** Operations is responsible for the maintenance of drainage and water infrastructure and management of the Stormwater Charge, as well as providing advice to the Strategy and Environment team on the scale and design of assets, and options to reduce the cost and improve the multiple benefits of infrastructure. The Operations group will lead the move towards smarter monitoring and intelligent network solutions and ensure these future proactive monitoring systems are compatible with current systems.
- **Community.** This department is largely responsible for assisting the Environment and Sustainability Team in the delivery of community engagement programs promoting environment and sustainability initiatives such as the Climate Wise Communities and Better Business Program.
- **Corporate.** This department is responsible for financial reporting and will liaise with all other groups of Council to ensure that assets values are tracked and budgeted for appropriately. Information Management is also within the department and this team will be essential in assisting with monitoring, mapping and data management.

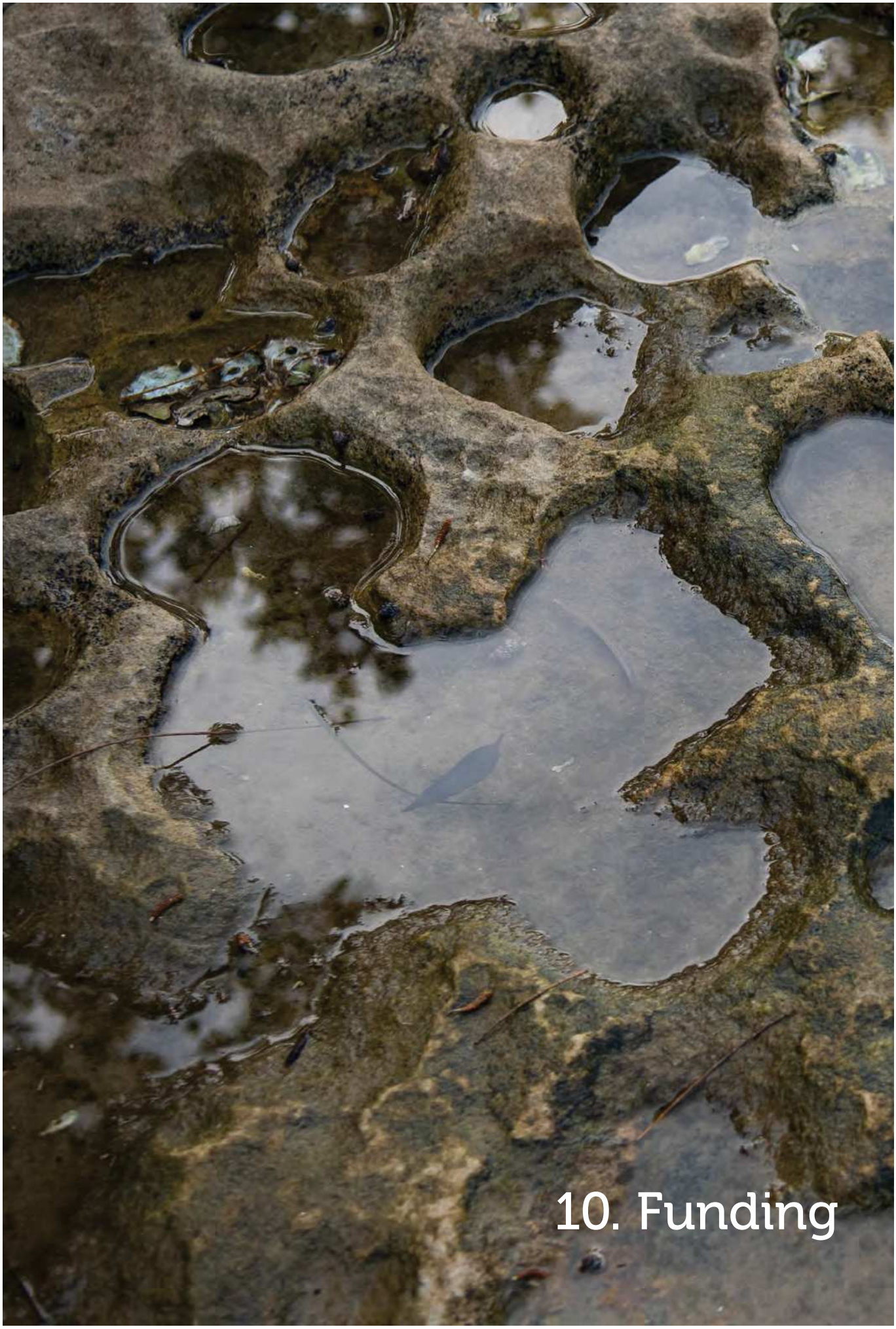
Civic. This department supports the needs of the General Manager, Mayor and Councillors and provides key assistance in liaison with staff. The external groups that will be important in the delivery of this strategy have the following roles:

Industry working group. This proposed group is made up of the main state government agencies, such as DPE, TfNSW, Sydney Water, neighbouring local councils (Hornsby, Northern Beaches, Ryde, Parramatta and Willoughby) and consulting companies and industry groups. Existing networks and groups may meet this purpose, as long as it is made up of the main state government agencies, such as DPE, TfNSW, Sydney Water, neighbouring local councils (Hornsby, Northern Beaches, Ryde, Parramatta and Willoughby), and consulting companies and industry groups. DPE in particular is important to be closely involved in this working group. DPE is responsible for ensuring sustainable, secure and healthy water resources and services for NSW. They manage the surface and groundwater in the state, develop and implement plans for water security in NSW, and manage regional and metropolitan water supply and usage. DPE are developing 'an integrated water strategy for NSW that addresses water security and supply for both metropolitan and regional areas. As part of this, we plan and deliver major water infrastructure projects'. This group would meet quarterly.

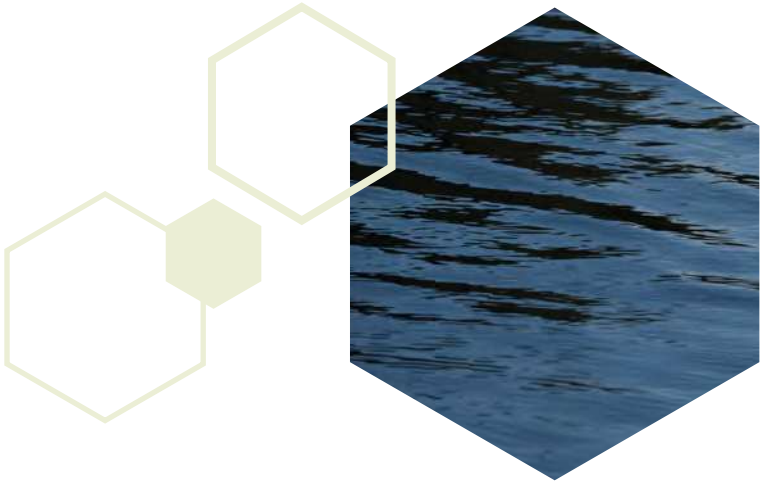
Indigenous and community group. Existing networks and groups may meet this purpose, and ideally this group would meet regularly/quarterly (or as determined by existing arrangements) and represent the local community and ensure that the community stories, needs and issues are incorporated into all water sensitive city projects.

Research liaison group. This group is made up of Council and researchers and would meet twice a year to review the latest science associated with water sensitive cities and advise on current and future research projects that will support and accelerate this transition.

Utilities. As outlined in Section 6, several indicators of a water sensitive city relate to the role and operations of the city's water authority. It is important to ensure that both at an operational level and strategic level Sydney Water is closely involved in managing water and seeking water sensitive city solutions.



10. Funding



There are three main sources of funding to support the delivery of this strategy.

Environmental Levy. The Environmental Levy is a funding mechanism to 'secure permanent funding to deliver a mix of capital works and operational programs that protect and enhance Ku-ring-gai's environment and help the community to live more sustainably; and to deliver a range of essential service functions to ensure best practice environmental management'[32]. The approved application in 2019 for a permanent levy was for a total of $34.5 million over ten years. There are four main themes to the works that the Environment Levy supports: water and catchments, energy, community engagement and sustainable transport. An in-depth breakdown of this proposed allocation of funds for water projects can be found in Appendix B.

Stormwater Management Charge. The Stormwater Management Charge is levied under Section 496A of the Local Government Act, 1993. The charge is dedicated to projects such as:[33]

- Constructing more stormwater inlets and grates
- Retrofitting pipes to carry more water
- More frequent inspections
- Cleaning pollutant traps

In the 2019/2020, the charge was:

- $25 per residential dwelling
- $12.50 per strata residential unit
- a minimum of $5.00 or the relevant portion of the maximum annual charge that would apply to the land subject to the strata scheme if it were a parcel of land subject to the Business rateable property charge
- $25 per 350m2 for business properties (maximum charge $1,500)

Approximately $996,000 will be raised by this charge each year.

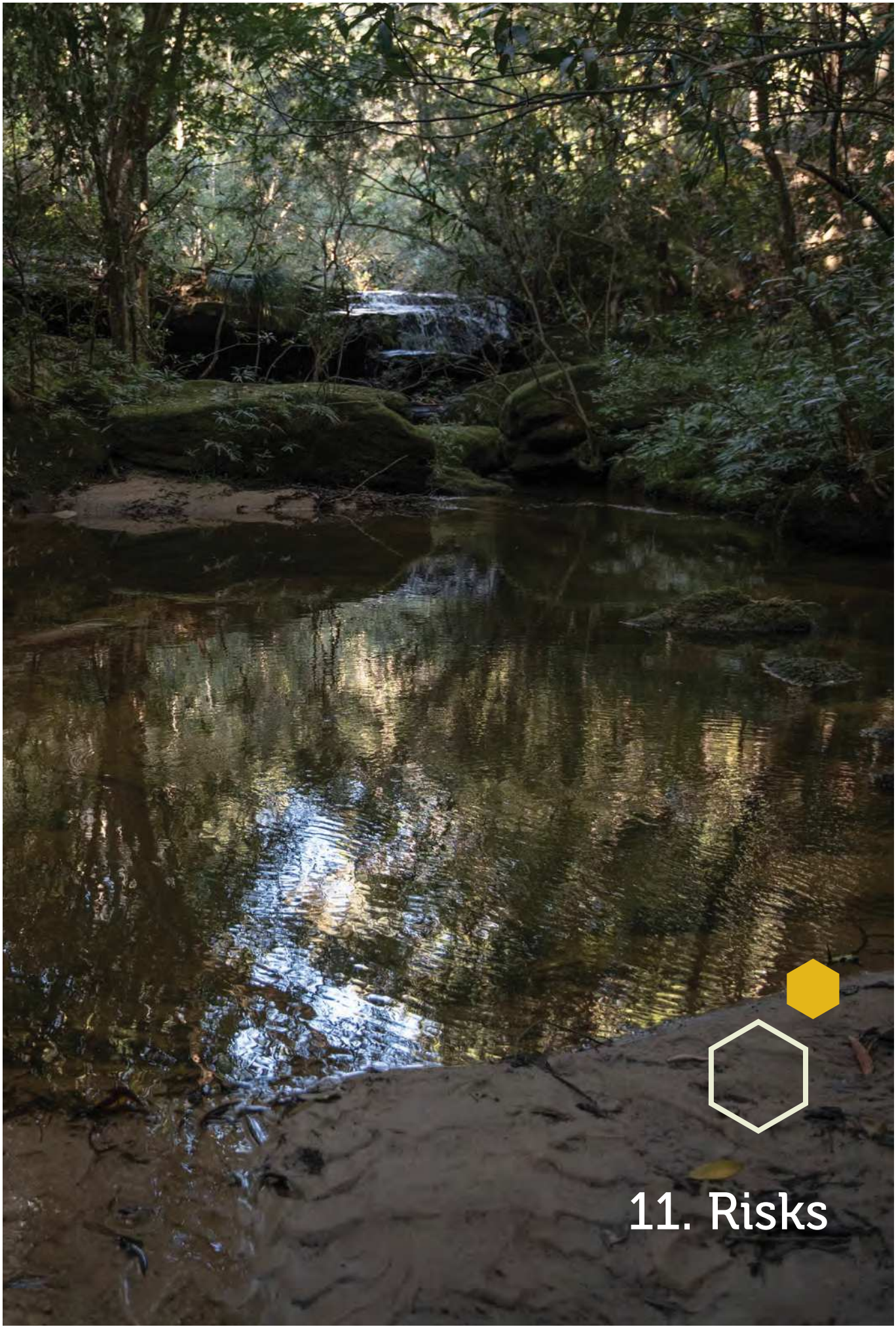
General Revenue. General revenue is also used for a variety of projects related to water management, from flood studies, to monitoring, to purchasing loggers for monitoring, to licences for specific software to assess developments and plan and design future works.

Additional funds maybe be generated through cost recovery programs (i.e., selling of native plants and water efficient appliances, and penalties for pollution incidents).

There is the additional option for external grant funding, and the opportunity to reinvest funds saved through reductions in operational budgets (e.g., saving potable water will save money, that can be reinvested in other projects related to the delivery of this strategy).

In 2019 the Council application for a permanent levy noted that in the past an additional $12 million had been granted from external sources, as a result of leveraging the funding from the levy, a significant benefit from the use of levy, charge and general revenue to assist in the transition to a water sensitive city.

32. IPART, 2019. Special Variation Application Form – Part B. Accessed at https://www.ipart.nsw.gov.au/Home/Industries/Local-Government/Reviews/Special-Variations-Minimum-Rates/Special-Variations-Minimum-Rates-2019-20?qDh=2&cid=52d5d723-84f3-413f-ab76-10f8f2cbc779
33. KRG, 2021. Stormwater Management Charge website. Accessed at https://www.krg.nsw.gov.au/Council/Rates-and-fees/Fees-and-charges/Stormwater-management-charge



11. Risks

There are several risks to delivering this strategy, which are discussed below alongside mitigation strategies.

Resourcing. A significant problem for all organisations is the capacity and retention of staff, particularly with the specific expertise associated with water sensitive cities and water sensitive urban design. A mitigation strategy that will help address this is an ongoing capacity building program to increase the knowledge base of all staff, the use of celebration and evaluation sessions, and clear professional development plans to ensure staff continue to learn and grow in all positions that are important to the delivery of the strategy.

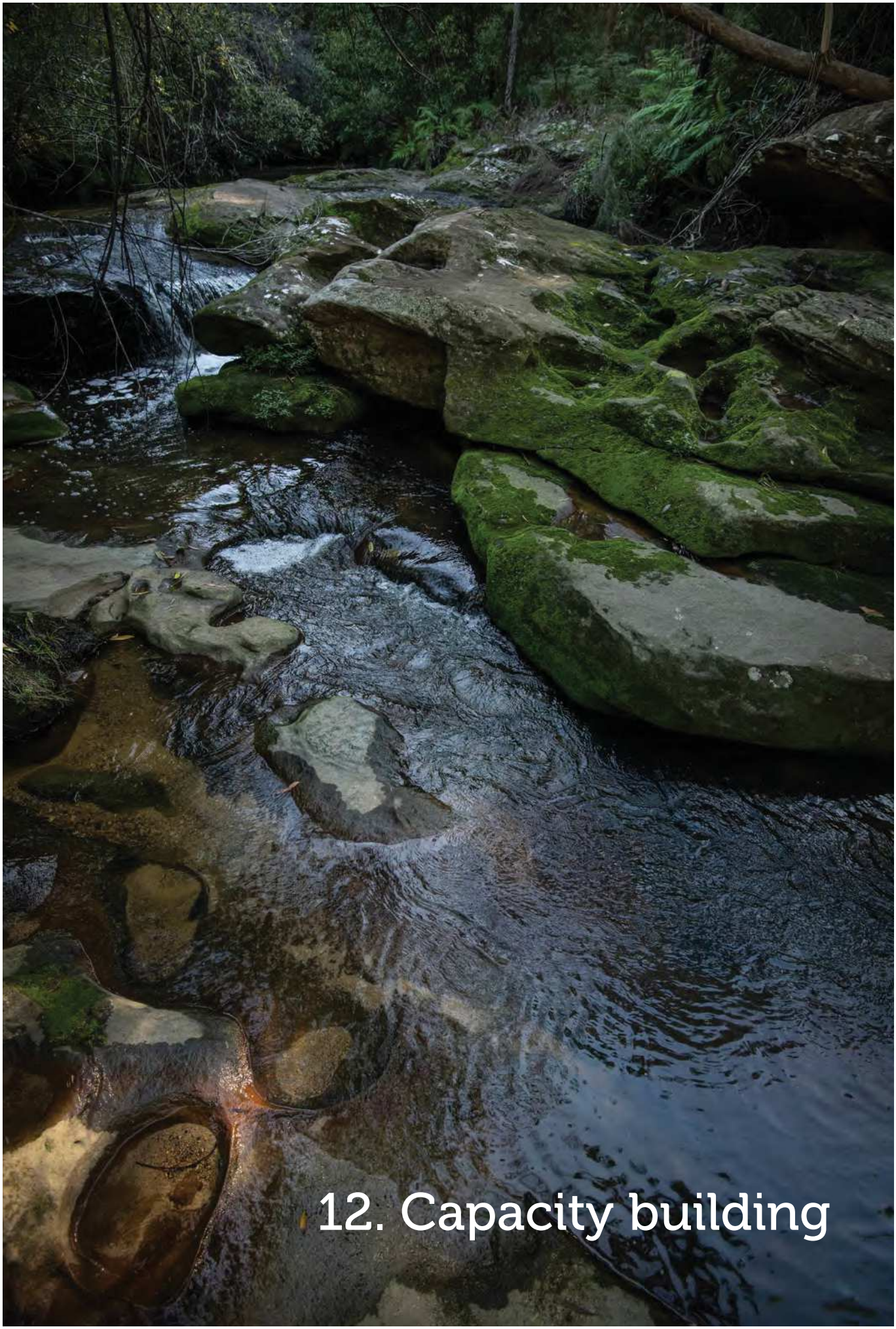
Climate change and extreme events. While the strategy acknowledges climate change as a driver, any extreme event (floods, droughts, storms, bushfires, or extreme heat) will highlight the value of water, and the resilience of infrastructure in different parts of the LGA. A mitigation strategy for this is to ensure that all future works factor in climate change, and that the risks and mitigation strategies to tackle climate change are discussed and communicated frequently.

Community expectations. Managing community expectations in terms of the costs and benefits of delivering on this strategy, and the rate at which projects are delivered, will be an important risk to manage. It should be noted that the community do not have only one view, with demographic, economic and spatial variations all having a significant impact on community perceptions and expectations for water in Ku-ring-gai.

Funding. Any changes to the funding mechanisms, as well a lack of indexing to ensure the budgets do not decline in real terms, will have a large impact on the ability to meet the vision, targets and deliver on all of the actions. Council's ability to continually demonstrate the value of this strategy and communicate the cost benefit ratio of investments, and link this work with other strategic goals will reduce the risk of a decline in funding into the future

Policy and planning rules. Changes to local and state government policy and regulation, particularly in relation to requirements for water efficiency and rainwater / stormwater retention, reuse, and filtering, have the potential to impact on the ability to deliver this strategy. A key mitigation strategy is the governance systems that will encourage Council to engage frequently with the state government and discuss the costs and benefits of planning rules on this transition to a water sensitive city.

Evidence and science. Lastly there is a strong possibility that new evidence and science will be published in the coming decade, and that in all likelihood this will increase the drive to deliver these actions and transition to a water sensitive city. Mitigation strategies that address this include the development of strong relationships between Council and academic institutions, and membership of state and national research bodies that ensure Council is aware of upcoming research and its implications.



12. Capacity building

Capacity building within the council, and with the community and key stakeholders is a critical issue to support the delivery of the strategy.

Capacity building for WSUD is "a process used to improve the ability of urban water practitioners to plan, design, implement and maintain WSUD assets, within the context of smarter and more efficient city building, and the associated institutions and disciplines that play a role in city building"[34].

Some of the main methods to build capacity in the water sector and specifically on the subject of water sensitive cities include:

- Site tours
- Seminars
- Guidelines
- Case studies
- Peer review of designs
- Mentoring
- Training courses (online and in person)

Evaluation of past capacity building programs has highlighted that practitioners (generally made up of engineers, scientists, planners and ecologists) prefer case studies and site tours to see how things work and they also prefer online tools and guidelines that ensure all parts of the industry are working with the same methods and process.

For Council a capacity building program can be directed by the Water Management Group and targeted to ensure that the increase in skills and capacity is linked with the ability of the whole organisation to deliver the targets set out in Section 7.

The benefit of a focus on capacity building is that it should reduce the financial risk of designing and operating assets, as well as ensure there is a clear method to account for the latest research and evidence and evaluate the impact of these assets and transition to a water sensitive city over the course of the strategy. Clearwater reported that the cost of 10 years of their capacity building program was equivalent to ½ the capital cost of one constructed wetland[35].

It may be more cost effective to consider how to deliver capacity building for staff within Council through a regional delivery model (i.e., if six councils fund the development of guidelines the cost is shared, and training budgets will be reduced if more attendees are involved).

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14. Appendix A: Monitoring methods

The key 'Regional Environmental Health Values (REHVs)' measures that are recorded throughout this program and their associated grades can be seen in the table below.

Physical/Chemical water quality indicators	Grade A	Grade B	Grade C	Grade D	Grade F
pH	5.11 – 6.86	4.8 – 5.1, 6.87-7.4	4 – 4.79, 7.41 - 8		0 - 3.99, 8.01 - 12
Electrical Conductivity (µs/cm)	156 - 350	144 – 155, 351 - 404	128 – 143, 405 - 457	112 – 127, 458 - 510	0 – 111, > 511
Turbidity (NTU)	< 7.79	8.79 – 11.02	11.03 – 13.36	13.37 - 25	> 25.01
Dissolved Oxygen (%)	> 76	67 - 75	57 - 66	21 - 56	< 20
Ammonium Nitrogen (NHx) (mg/L)	< 0.0200	0.0201 – 0.0370	0.0371 – 0.0385	0.0386 – 0.0400	> 0.0401
Oxidised Nitrogen (NOx)(mg/L)	< 0.05	0.06 – 0.11	0.12 – 0.15	0.16 – 0.18	> 0.19
Total Nitrogen (mg/L)	< 0.40	0.41 – 0.50	0.51 – 0.60	0.61 – 0.70	> 0.71
Total Phosphorus (mg/L)	< 0.010	0.011 – 0.025	0.026 – 0.060	0.061 – 0.080	> 0.081
Faecal Coliforms (CFU/100ml)	< 150	151 - 600	601 - 1000	1001 - 4000	> 4001
SIGNAL 2 Score	> 5.44	4.68 – 5.43	4.17 – 4.67	3.16- 4.16	< 3.15

Table 5: REHVs and grades for key water quality indicators developed for Ku-ring-gai (Source: KRG, 2016. Ku-ring-gai Council Water Quality and Aquatic Macroinvertebrate Sampling: Background Report 2016).

These grades provide an overall indication of the health of the aquatic ecosystem at that location, the general condition of the waterway the monitoring site is located in, and any probable adverse impacts to the living organisms that depend on that waterway.

Health grade	Ecological health description	Cleanliness of stream	Probable adverse impact on biota
A	Excellent	Clean	None
B	Good	Slightly degraded	Mild impairment
C	Fair	Moderately degraded	Moderate impairment
D	Poor	Seriously degraded	Serious impairment
F	Very Poor	Severely degraded	Severe impairment

Table 6: Water quality and aquatic ecosystem health as reflected by the associated indicator grade, (Source: KRG, 2016. Ku-ring-gai Council Water Quality and Aquatic Macroinvertebrate Sampling: Background Report 2016. Adapted from Hornsby Shire Council; HSC 2012).

15. Appendix B: Environmental levy

Water and Catchment Management

Project Description	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	TOTAL	National Climate Resilience and Adaptation Strategy	National greenhouse gas emission reduction target	Australia's Biodiversity Conservation Strategy	National Water Initiative	Living Sustainably: National Action Plan for Education for Sustainability	National Sport and Active Recreation Policy Framework	NSW Climate Change Policy Framework	Securing our water: NSW Government Water Reform Action Plan	Greater Sydney Services and Infrastructure Plan	North District Plan
Stormwater harvesting / water reuse projects		131,891	134,827		145,000		145,000		150,000		**706,718**	✓			✓				✓		✓
Water Sensitive Urban Design (WSUD) projects	281,100	68,878	154,828	157,000	150,000	145,000	140,000	150,000	150,000	150,000	**1,546,806**	✓			✓				✓		✓
Asset condition review of WSUD systems	40,900					50,000					**90,900**				✓				✓		✓
Maintenance of Water Sensitive Urban Design (WSUD) projects	61,300	68,878	66,919	70,000	70,000	70,000	70,000	70,000	70,000	70,000	**687,097**				✓				✓		✓
Bio filter systems and tree pits	61,300	60,900	62,865	64,000	60,000	60,000	60,000	60,000	60,000	60,000	**609,065**				✓				✓		✓
Buildings and facilities – water projects	30,700	30,450	31,432	35,000	35,000	35,000	35,000	35,000	35,000	35,000	**337,582**				✓				✓		
Buildings and facilities – water monitoring	30,700	30,450	31,432	32,218	30,000	33,500	34,000	34,500	35,000	35,500	**327,300**				✓				✓		
	506,000	**391,447**	**482,303**	**358,218**	**490,000**	**393,500**	**484,000**	**349,500**	**500,000**	**350,500**	**4,305,468**				✓				✓		

16. Appendix C: Water Sensitive City Strategy – Water related funding sources

Water Sensitive City Strategy – Water related funding sources

Summary of water related council funding by Council Department. The figures are indicative averages of annual expenditure based on the last few years and will change year to year.

Reporting requirements for funding sources:

Special rate variation environmental levy (water and catchment management) – Council reports on the program of expenditure funded by the Levy and outcomes achieved through its Annual Report.

Stormwater management charge – The Local Government (General) Regulation requires a statement detailing the stormwater management services provided by the council during that year. This can include information on services proposed to be implemented compared to services provided, with an explanation of any differences between them.

General Rates (recurrent funds) – Reporting through Council's Annual Report and Council's adopted annual financial statements

Environment and Sustainability – Manager Environment & Sustainability – Strategy and Environment

	Council water related activities & projects	Funding Sources
1	**Water and catchment management:** including the installation of stormwater harvesting systems, sediment and filter basins, biofilter systems and gross pollutant traps; creek stabilisation and scour protection works; and water quality and macroinvertebrate sampling across the LGA.	
1.1	Contribute to new rainwater and stormwater harvesting (SWH) and Sewer Mining Projects	• Special Rate Variation Environmental Levy (water and catchment management) • General Rates (recurrent funds) • Federal & State grants when available
1.2	Contribute to new WSUD and Stormwater Treatment Measures for upgrades to existing Council assets	• Special Rate Variation Environmental Levy (water and catchment management)
1.3	Condition audits and maintenance of Environmental Levy funded WSUD systems	• Special Rate Variation Environmental Levy (water and catchment management)
1.4	Water use and quality monitoring and efficiency upgrades for council buildings and facilities	• Special Rate Variation Environmental Levy (water and catchment management)

	Council water related activities & projects	Funding Sources
1.5	Creek rehabilitation/stabilisation projects	• Special Rate Variation Environmental Levy (water and catchment management)
2	Loving Living Ku-ring-gai community engagement program including: Water Smart, Smart Units & Better Business Partnerships programs	
2.1	**Water Smart,** offering water rebates on raingardens, rainwater tanks and water sensitive gardens and regular information sessions on water management in the home;	• Special Rate Variation Environmental Levy (water and catchment management)
2.2	**Smart Units -** providing Ku-ring-gai unit blocks with energy, water and waste audits, tailored action plans and sustainability rebates;	• Special Rate Variation Environmental Levy (water and catchment management)
2.3	**Better Business Partnership (BBP) –** providing a sustainability advice service and tailored action plans to small and medium businesses;(including water efficiency program advice)	• Special Rate Variation Environmental Levy (water and catchment management)
3	Catchment Management Operations	
3.1	Waterway health assessments	• General Rates (recurrent funds)
3.2	Stormwater and rainwater harvesting system water quality monitoring	• General Rates (recurrent funds)
3.3	Stormwater and rainwater harvesting system maintenance (note: responsibility shared with Infrastructure Services Item 2.1)	• General Rates (recurrent funds)
3.4	50% contribution to Flood Studies	• General Rates (recurrent funds)
3.5	Catchment Studies	• General Rates (recurrent funds)
3.6	Operational licences and memberships (MUSIC; DRAINS, Stormwater NSW Association etc.)	• General Rates (recurrent funds)
3.7	Miscellaneous catchment maintenance and monitoring equipment (new loggers, water quality analysis etc.)	• General Rates (recurrent funds)

Estimated indicative average annual budgets (water related) **$500,000**

Waste and Cleansing Services - Manager Waste & Cleaning Services – Operations

	Council water related activities & projects	Funding Sources
1	Waste management	
1.1	Cleaning and maintenance of gross pollutant traps (GPTs)	• General Rates (recurrent funds)
1.2	Disposal of GPT waste to a registered tip facility	• General Rates (recurrent funds)
1.3	Street sweeping of roads and gutters	• General Rates (recurrent funds)
1.4	Disposal of street sweeper waste to a registered tip facility	• General Rates (recurrent funds)

Estimated indicative average annual budgets (water related) **$1,149,000**

Technical Services – Manager Technical Services – Operations

	Council water related activities & projects	Funding Sources
1	Major & minor drainage management	
1.1	Constructing more stormwater inlets and grates	• General Rates (recurrent funds)
1.2	Stormwater drainage upgrades	• General Rates (recurrent funds)
1.3	More frequent stormwater inspections	• General Rates (recurrent funds)
1.4	50% contribution to Flood Studies	• General Rates (recurrent funds)

Estimated indicative average annual budgets (water related) **$926,000**

Note: The operations budget includes funds collected from the Annual Stormwater Management Charge

Infrastructure Services – Manager Infrastructure Services – Operations

	Council water related activities & projects	Funding Sources
1	Stormwater drainage maintenance	
1.1	Cleaning of stormwater drainage pipes and pits including maintenance and repairs	• General Rates (recurrent funds)
2	Open space maintenance	
2.1	Stormwater and rainwater harvesting system maintenance (note: responsibility shared with Environment & Sustainability Item No. 3.3)	• General Rates (recurrent funds)
2.2	Maintenance of Council sporting fields irrigation systems	• General Rates (recurrent funds)

Estimated indicative average annual budgets (water related) **$780,000**

Development Assessment Services - Manager Development Assessment Services – Development and Regulation

	Council water related activities & projects	Funding Sources
1	Development Assessment Services	
1.1	Assessment of WSUD devices and BASIX water management regulations	• Negligible Fees collected
1.2	Compliance of DA conditions of consent for WSUD related works including on-going maintenance	• Negligible Fees collected

Estimated indicative average annual budgets (water related) **$0**

Further information

Development assessment plays an active role in applying the provisions which seek WSUD outcomes via the assessment of development and related applications. WSUD provisions contained under state and local planning controls such as SEPPs and Council's LEPs and DCPs. Some examples of specific provisions relate to the reduction of stormwater run-off from residential sites (water retention & detention). This can also include re-use of stormwater for irrigation or toilet flushing purposes. The Building Sustainability Index (BASIX) helps reduce water use in homes by setting targets to reduce water consumption with initiatives like installation of rainwater tanks and water saving shower heads, and low water use plantings.

Another example of WSUD relates to the protection of riparian areas that seek the restoration of these areas within more natural environment with less built form. Compliance with the provisions are also supported through conditions of consent including on-going maintenance in some circumstances. These provisions, where applicable to the development, apply to all applications regardless of whether they are managed under delegated authority, by a local or regional panel or via the NSW Land and Environment Court in an appeal.

Regulation and Compliance - Manager Regulation and Compliance – Development and Regulation

	Council water related activities & projects	Funding Sources
1	Compliance Inspections	
1.1	Investigate stormwater pollution complaints	• Negligible Fees collected
1.2	Monitor private septic tanks and onsite wastewater management systems	• Negligible Fees collected
1.3	Monitor Service Station UPSS	• Negligible Fees collected

Estimated indicative average annual budgets (water related) **$0**

Further information

Council's Environmental Health Officers are responsible for investigation and compliance of a number of water related areas including; private septic tanks and onsite wastewater management systems and Service Station UPSS groundwater compliance.

Council's Rangers are responsible for investigation and compliance of stormwater pollution incidents.

Urban Planning, Urban Design, Development Contributions Planning – Manager Urban & Heritage Planning – Strategy and Environment

	Council water related activities & projects	Funding Sources
1	Development Contributions Planning	
1.1	Stormwater quality treatment and major projects	• Negligible 7.11 developer contributions

Estimated indicative average annual budgets (water related) **$0**

Further information

The only projects that can have contributions at present are the very few Gross Pollutant Traps in the current s7.11 Contributions Plan.

There is limited potential for future works to be funded from s7.11 and we currently require all stormwater detention on-site for new developments.

Ku-ring-gai LGA rarely has large land releases as it is not a greenfield area. Future WSUD requirements would be via the DCP should any further releases occur.

17. Appendix D: Ku-ring-gai's CSP & LSPS and North District Plan Links

Table 1 Links with the Ku-ring-gai's CSP & LSPS and North District Plan

North District Plan Theme - Infrastructure and collaboration			
North District Plan Direction – A city supported by infrastructure			
North District Plan Priorities	Ku-ring-gai Community Strategic Plan Themes and Objectives	Ku-ring-gai LSPS Priorities	Water Sensitive Cities Strategy Objectives
N1. Planning for a city supported by infrastructure	T1. Integrated and accessible transport T1.1 A range of integrated transport choices are available to enable effective movement to, from and around Ku-ring-gai T3. Regional Transport Network T3.1 An accessible public transport and regional road network that meets the diverse and changing needs of the community P6. Enhancing recreation, sporting and leisure facilities P6.1 Recreation, sporting and leisure facilities are available to meet the community's diverse and changing needs P7. Enhancing community buildings and facilities P7.1 Multipurpose community buildings and facilities are available to meet the community's diverse and changing needs P8. Improving the standard of our infrastructure P8.1 An improved standard of infrastructure that meets the community's service level standards and Council's obligations as the custodian of our community assets.	K1. Providing well-planned and sustainable infrastructure to support growth and change.	1.1 Ensure WSC is integral to all Council projects, supported by a cross Council Working Group, and led by management.
North District Plan Direction – A collaborative city			
N2. Working through collaboration	L1. Leadership L1.1 A shared long term vision for Ku-ring-gai underpins strategic collaboration, policy development and community engagement.	K2. Collaborating with State Government Agencies, and the community to deliver infrastructure projects	7.1 Engage with infrastructure service providers regarding asset management, ecological health, shared use of land, support for water sensitive infrastructure, and support for climate adaptation projects.

North District Plan Theme - Liveability			
North District Plan Direction – A city for people			
North District Plan Priorities	Ku-ring-gai Community Strategic Plan Themes and Objectives	Ku-ring-gai LSPS Priorities	Water Sensitive Cities Strategy Objectives
N3. Providing services and social infrastructure to meet people's changing needs	C1. Community health and wellbeing C1.1 A equitable and inclusive community that cares and provides for its members P6. Enhancing recreation, sporting and leisure facilities P6.1 Recreation, sporting and leisure facilities are available to meet the community's diverse and changing needs P7. Enhancing community buildings and facilities P7.1 Multipurpose community buildings and facilities are available to meet the community's diverse and changing needs	K14. Providing a range of cultural, community and leisure facilities to foster a healthy, creative, culturally rich and socially connected Ku-ring-gai K17. Providing a broad range of open spaces, sporting and leisure facilities to meet the community's diverse and changing needs K18. Ensuring recreational activities in natural areas are conducted within ecological limits and in harmony with no net impact on endangered ecological communities and endangered species or their habitats K19. Providing well maintained, connected, accessible and highly valued trail networks and recreational infrastructure where locals and visitors can enjoy and connect with nature	1.1 Ensure WSC is integral to all Council projects, supported by a cross Council Working Group, and led by management. 1.2 Ensure organisations and key groups from outside of Council, including indigenous representatives are engaged, to deliver on the WSC strategy and targets. Looking for opportunities to engage with indigenous groups and representatives is a high priority. 1.5 Seek increased representation of different voices across water issues and across community groups and social demographics.
N4. Fostering healthy, creative, culturally rich and socially connected communities	C2. Cultural diversity and creativity C2.1 A harmonious community that respects, appreciates, celebrates and learns from each other and values our evolving cultural identity C3. Community connectedness C3.1 A community where opportunities are provided for all voices to be heard and where community stewardship, participation and engagement is supported and promoted C4. Healthier lifestyles C4.1 A community that embraces healthier lifestyle choices and practices P6. Enhancing recreation, sporting and leisure facilities P6.1 Recreation, sporting and leisure facilities are available to meet the community's diverse and changing need	K14.Providing a range of cultural, community and leisure facilities to foster a healthy, creative, culturally rich and socially connected Ku-ring-gai K15. Strengthening recognition and support for Aboriginal communities and cultural heritage K17. Providing a broad range of open spaces, sporting and leisure facilities to meet the community's diverse and changing needs K18. Ensuring recreational activities in natural areas are conducted within ecological limits and in harmony with no net impact on endangered ecological communities and endangered species or their habitats K19. Providing well maintained, connected, accessible and highly valued trail networks and recreational infrastructure where locals and visitors can enjoy and connect with nature	1.2 Ensure organisations and key groups from outside of Council, including indigenous representatives are engaged, to deliver on the WSC strategy and targets. Looking for opportunities to engage with indigenous groups and representatives is a high priority. 1.5 Seek increased representation of different voices across water issues and across community groups and social demographics.

North District Plan Direction – A city of great places			
N6. Creating and renewing great places and local centres, and respecting the District's heritage	P1. Preserving the unique visual character of Ku-ring-gai P1.1 Ku-ring-gai's unique visual character and identity is maintained P2. Managing urban change P2.1 A robust planning framework is in place to deliver quality design outcomes and maintain the identity and character of Ku-ring-gai P3. Quality urban design and development P3.1 The built environment delivers attractive, interactive and sustainable living and working environments P4. Revitalisation of our centres P4.1 Our centres offer a broad range of shops and services and contain lively urban village spaces and places where people can live, work, shop, meet, and spend leisure time P5. Heritage that is protected and responsibly managed P5.1 Ku-ring-gai's heritage is protected promoted and responsibly managed	K12. Managing change and growth in a way that conserves and enhances Ku-ring-gai's unique visual and landscape character K13. Identifying and conserving Ku-ring-gai's environmental heritage K16. Protecting, conserving and managing Ku-ring-gai's Aboriginal heritage objects, items and significant places K6. Revitalising and growing a network of centres that offer a unique character and lifestyle for local residents K7. Facilitating mixed-use developments within centres that achieve urban design excellence K8. Promoting Gordon as the centre for business and civic functions and as the cultural heart of Ku-ring-gai K11. Promoting Lindfield as a thriving and diverse centre K10. Promoting Turramurra as a family focused urban village K9. Promoting St Ives Local Centre as an active green lifestyle and shopping destination	1.2 Ensure organisations and key groups from outside of Council, including indigenous representatives are engaged, to deliver on the WSC strategy and targets. Looking for opportunities to engage with indigenous groups and representatives is a high priority.

North District Plan Theme - Sustainability			
District Plan Direction – A city in it's landscape			
North District Plan Priorities	Ku-ring-gai Community Strategic Plan Themes and Objectives	Ku-ring-gai LSPS Priorities	Water Sensitive Cities Strategy Objectives
N15. Protecting and improving the health and enjoyment of Sydney Harbour and the District's waterways	N3. Natural Waterways N3.1 Our natural waterways and riparian areas are enhanced and protected	K35. Protecting and improving the health of waterways and riparian areas K36. Enhancing the liveability of Ku-ring-gai's urban environment through integrated water infrastructure and landscaping solutions K37. Enabling water resource recovery through the capture, storage and reuse of water; alternative water supplies; and increased water efficiency	2.4 Collaborate with Sydney Water to reduce sewer overflows at ecologically sensitive locations. 2.5 Collaborate with surrounding councils, Sydney Water and State Government to improve access and connectivity, maintenance and strategic planning for waterways, natural assets and water infrastructure. 4.1 Review current water assets and infrastructure to maximise energy efficiency, and integrate smart monitoring systems to avoid leaks, waste, and energy use. 4.2 Investigate opportunities for water focused 'industrial ecology' through the expansion of Council water projects, or other support and incentive programs with commercial and private organisations to decrease potable water use. 4.3 (1) Continue measuring 'rubbish diverted from our waterways' 4.4 (2) While a new target is developed to measure maintenance undertaken and increasing catchment areas treated. 5.1 Review DCP and LEP regulations to maximise water retention in all new developments and maximises potable water savings, with view to working with developers to go beyond BASIX. 5.2 Review how maintenance of streets and drains can be proactively maintained for the purposes of ecological health. 5.3Continue to improve the condition of local waterways, continuing to focus on protecting pristine areas, improving ecological richness and bank stability. 5.5 Better understand groundwater and subsurface flows and the link between upstream catchments, development and the ecological impact downstream. 5.6 Identify and manage sensitive aquatic ecosystems.

N16. Protecting and enhancing bushland and biodiversity	N2. Natural Areas N2.1 Our bushland is rich with native flora and fauna	K28. Improving the condition of Ku-ring-gai's bushland and protecting native terrestrial and aquatic flora and fauna and their habitats K29. Enhancing the biodiversity values and ecosystem function services of Ku-ring-gai's natural assets	2.4 Collaborate with Sydney Water to reduce sewer overflows at ecologically sensitive locations. 2.5 Collaborate with surrounding councils, Sydney Water and State Government to improve access and connectivity, maintenance and strategic planning for waterways, natural assets and water infrastructure. 5.2 Review how maintenance of streets and drains can be proactively maintained for the purposes of ecological health. 5.6 Identify and manage sensitive aquatic ecosystems.
N17 Protecting and enhancing scenic and cultural landscapes	P1. Preserving the unique visual character of Ku-ring-gai P1.1 Ku-ring-gai's unique visual character and identity is maintained	K12. Managing change and growth in a way that conserves and enhances Ku-ring-gai's unique visual and landscape character K16. Protecting, conserving and managing Ku-ring-gai's Aboriginal heritage objective, items and significant places	1.2 Ensure organisations and key groups from outside of Council, including indigenous representatives are engaged, to deliver on the WSC strategy and targets. Looking for opportunities to engage with indigenous groups and representatives is a high priority.
N19. Increasing urban tree canopy cover and delivering Green Grid connections	P1. Preserving the unique visual character of Ku-ring-gai P1.1 Ku-ring-gai's unique visual character and identity is maintained	K30. Improving the quality and diversity of Ku-ring-gai's urban forest K31. Increasing, managing and protecting Ku-ring-gai's urban tree canopy K32. Protecting and improving Green Grid connections K33. Providing a network of walking and cycling links for leisure and recreation K34. Improving connections with natural areas including river and creek corridors, bushland reserves and National Parks	3.3 Review the actions in the Green Grid Strategy and Urban Forest Strategy to ensure Council has an ongoing program to increase access to waterways and green spaces, and the value of water in these strategies is paramount
N20. Delivering high quality open space	P6. Enhancing recreation, sporting and leisure facilities P6.1 Recreation, sporting and leisure facilities are available to meet the community's diverse and changing needs	K27. Ensuring the provision of sufficient open space to meet the needs of a growing and changing community	1.1 Ensure WSC is integral to all Council projects, supported by a cross Council Working Group, and led by management.

District Plan Direction – An efficient city			
N21. Reducing carbon emissions and managing energy, water and waste efficiently	N5. Sustainable Resource Management N5.1 A community progressively reducing its consumption of resources and leading in recycling and reuse	K38. Reducing greenhouse gas emissions by Council and the Ku-ring-gai community to achieve net zero emissions by 2045 or earlier K41. Reducing the generation of waste K42. Managing waste outcomes that are safe, efficient, cost effective, maximise recycling, and that contribute to the built form and liveability of the community	4.1 Review current water assets and infrastructure to maximise energy efficiency, and integrate smart monitoring systems to avoid leaks, waste, and energy use. 4.2 Investigate opportunities for water focused 'industrial ecology' through the expansion of Council water projects, or other support and incentive programs with commercial and private organisations to decrease potable water use. 4.3 (1) Continue measuring 'rubbish diverted from our waterways' 4.4 (2) While a new target is developed to measure maintenance undertaken and increasing catchment areas treated. 4.5 (3) Investigate opportunities to reuse waste from WSUD assets through a regional or inter-council approach. 4.6 Identify and deliver up to 10 priority best practice water projects at Council sites and ensure all projects consider best practice water management options. 5.1 Review DCP and LEP regulations to maximise water retention in all new developments and maximises potable water savings, with view to working with developers to go beyond BASIX. 7.1 Engage with infrastructure service providers regarding asset management, ecological health, shared use of land, support for water sensitive infrastructure, and support for climate adaptation projects. 7.2 Investigate capital upgrades for intelligent control options of Council WSUD assets and implement upgrades, where it is feasible and beneficial from a whole of life cost perspective, that enables more proactive maintenance. 7.4 Maintain infrastructure to specified standards, with accompanying reporting, asset tracking, to deliver better performance and increase the longevity of assets.

North District Plan Direction – A resilient city			
N22. Adapting to the impacts of urban and natural hazards and climate change	C7. Emergency Management C7.1 An aware community able to prepare and respond to the risk to life and property from emergency events N4. Climate change N4.1 A community addressing and responding to the impacts of climate change and extreme weather events	K39. Reducing the vulnerability, and increasing the resilience, to the impacts of climate change on Council, the community and the natural and built environment K40. Increasing urban tree canopy and water in the landscape to mitigate the urban heat island effect and create greener, cooler places K43. Mitigating the impacts of urban and natural hazards	2.2 Continue and extend community engagement programs, by reviewing how, and where the community can participate in environmental protection, advocacy, clean up and celebration, and act on climate change, extreme events, resilient and cool neighbourhoods. 3.1 Continue implementing and applying the actions from the Flood Risk Management program 6.1 Review the LEP & DCP to ensure all developments mitigate urban heat island impacts. 7.1 Engage with infrastructure service providers regarding asset management, ecological health, shared use of land, support for water sensitive infrastructure, and support for climate adaptation projects. 7.2 Investigate capital upgrades for intelligent control options of Council WSUD assets and implement upgrades, where it is feasible and beneficial from a whole of life cost perspective, that enables more proactive maintenance.