MOTT MACDONALD

Riverwood Estate State Significant Precinct

Environmental Sustainability Study

March 2022

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Contents

Executive summary

Mott MacDonald has been engaged by the NSW Land and Housing Corporation to provide an Environmental Sustainability Study for the Riverwood Estate State Significant Precinct (the Study Area). The report will form part of the master planning and development controls to facilitate the renewal of existing social housing, to deliver an integrated community with a mix of social, affordable, and private housing and improved social outcomes.

This report demonstrates how the development has incorporated sustainability initiatives into the master plan. It seeks to ensure all sustainability relevant initiatives have been addressed by the proposed master plan.

This report includes a review of all applicable sustainability related strategies, guidelines, policies to gain an understanding of the contextual background necessary for consideration in theRiverwood Renewal project. The relevant requirements are broken down into national and international, state, regional and local levels.

A Green Star – Communities rating is recommended for this project to ensure all relevant guidelines and requirements are captured in the project. Green Star – Communities is considered by the industry as one of the best practice frameworks for integration of sustainability in large scale urban developments.

The report also identifies initiatives to support the development in becoming a net zero precinct by 2050 through a combination of minimising energy use, maximising energy efficiency, promoting low emission transportation and maximising onsite renewable generation.

A transition to a circular economy will require coordination from all levels of government, industry and citizens from all sectors, many beyond the control of the Riverwood Renewal project team. Therefore, a high-level waste management plan has also been presented in this report to assist with the transition to a circular economy that addresses the core principles of a circular economy as defined by the NSW Environment Protection Authority.

Other recommendations made in the report are:

1. The project should aim to achieve 5-star Green Star – Communities rating for the Riverwood Renewal.
2. The project should aim to achieve 5-star Green Star ratings for the residential towers and townhouses with the Green Star Buildings tool v1;
3. NABERS Apartment ratings should be managed by strata / building management during operation;
4. The project should achieve BASIX Energy and water scores that exceeds minimum targets;
5. The project should engage with electricity distributors to incentivise precinct wide energy distribution; and
6. The project should consider sizing electrical systems to accommodate full electrification of the precinct.

1 Introduction

Mott MacDonald has been engaged by the NSW Land and Housing Corporation (LAHC) to prepare an Environmental Sustainability Study for the Riverwood Estate State Significant Precinct. The report will form part of the master planning and development controls to facilitate the renewal of existing social housing, to deliver an integrated community with a mix of social, affordable, and private housing and improved social outcomes.

1.1 Scope of Works

LAHC has prepared a master plan to support the planning proposal for the Riverwood Estate State Significant Precinct (SSP). Mott MacDonald has been engaged to identify opportunities, constraints and risks associated with Ecologically Sustainable Development (ESD) infrastructure to support the master plan.

This report has been prepared to address the relevant State Significant Precinct requirements issued by Department of Planning, Industry and Environment (DPIE) in December 2020, as summarised in Table 1 below.

Table 1: Riverwood SSP Study Requirements

Requirement	Report Section
8 Environmental Sustainability, Climate Change and Waste Management	
8.1 Prepare an Environmental Sustainability Report for the precinct that: • Identifies the existing situations, including constraints, opportunities and key issues;	– 1.2 Project Overview
• Outlines the likely impacts of the proposal in relation to energy use, greenhouse gas emissions, air quality, noise, water use, wastewater, solid waste and climate change resilience;	– 9.1.2 Sustainability Framework – Riverwood Renewal
• Minimise land use conflict and provide a mix of uses in appropriate locations.	– N/A
• Provides detail of proposed sustainability and circular economy principles and how they will be incorporated into the proposal;	– 9.1.2 Sustainability Framework – Riverwood Renewal
• Includes an integrated water cycle management strategy supported by water sensitive urban design where it is safe and practical to do so and helps protect the environment;	– 4 Water Cycle Management Report
• Includes a principles-level waste management strategy that embraces circular economy principles;	– 7 Waste Management Strategy
• Includes measures to address the impacts of climate change including urban heat and extreme weather events;	– 6.1 Climate Change Adaptation Assessment
• Support opportunities for sustainable and efficient use of resources to minimise waste and deliver a circular economy, and water and energy from development toresult in a carbon positive precinct by 2050;	– 3 Net Zero Carbon Precinct – 7 Waste Management Strategy
• The study should include supporting air quality analysis	– 5 Air Quality
• Informs and supports the preparation of the proposed planning framework including any recommended planning controls or DCP/Design Guideline provisions that would deliver an appropriate sustainability outcome; and	– 9.1.2 Sustainability Framework – Riverwood Renewal
• Identify appropriate sustainability benchmarks for each development/building type and/or use within the precinct.	– 10 Recommendations

1.2 Project Overview

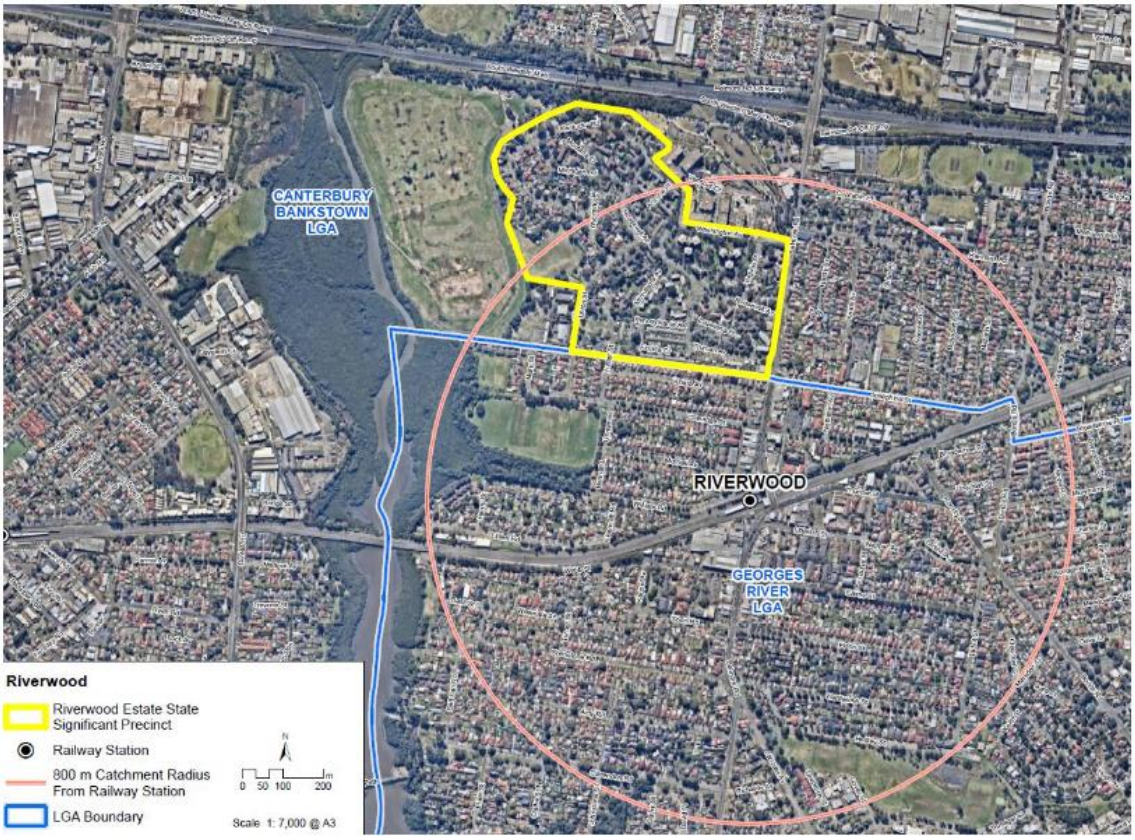
Riverwood is located 18 kilometres south west of the Sydney CBD and is split between the Georges River Council and City of Canterbury Bankstown Local Government Areas (LGA).

The Riverwood Estate State Significant Precinct (the Study Area) has an area of 30 ha, of which 16.7 ha is owned by LAHC. The Study Area comprises social housing dwellings, private dwellings and land owned by Canterbury Bankstown Council.

The Study Area is within 800 m radius of Riverwood Station on the Airport and South Line, providing direct access to the Sydney CBD and the Sydney International and Domestic Airport. The Study Area is also served by bus routes traversing through the area. To the south east of the site is the local shopping strip along Belmore Road North and further south is the Riverwood Shopping Centre.

In addition to proximity to existing public transport services, the site sits between two public schools, Riverwood Public School to the west and Hannans Road Public School to the east. High schools in the broader locality include Sir Joseph Banks High School, Punchbowl Boys High Schools, Bankstown Girls High School, East Hills Boys School and Picnic Point High School. The site is well located to access Padstow TAFE and the Milperra campus of Western Sydney University.

Figure 1: Riverwood SSP Study Area



1.2.1 Opportunities

The site has a number of existing characteristics that represent sustainability opportunities. These include:

- The site is walking distance to the following parks and sporting ovals:
  - Riverwood Park;
  - Karen St Reserve;
  - Salt Pan Reserve;
  - McLaughlin Oval;
  - Rotary Park; and
  - Lance Hutchinson Oval.
- The Riverwood Community Centre is adjacent to site and includes a community garden;
- The ‘944’ bus route passes through the site and the ‘940’ and ‘945’ bus routes operate along Belmore Road;
- The Riverwood Train Station is walking distance to the site; and
- The recent Washington Park Development to the north of site includes the creation of a market square, library and a senior citizen’s centre.

2 Sustainability Context

The following provides an overview of the key sustainability considerations within this Report. They include the wider policy and guidance relevant to this stage of the project, as well as some future drivers that will influence a more sustainable development outcome.

2.1 Green Building Council of Australia (GBCA)

Green Star is an internationally recognised sustainability rating system and Australia's largest voluntary and truly holistic sustainability rating systems. There are four Green Sar rating tools currently, each providing a mean to certify building design and construction, operation, fitouts and communities. They have been developed by the GBCA in close consultation with industry and government bodies and regularly updated to reflect the latest development in industry or regulations.

Figure 2: Current Green Star Rating Tools

2.1.1 Green Star – Communities

Green Star – Communities is considered by the industry as one of the best practice frameworks for integration of sustainability in large scale urban developments, and in this case, it has been recommended that a Green Star – Communities certification is achieved for the Riverwood Renewal project to demonstrate a practical alignment of the design with the ESD principles as defined within the Environmental Planning and Assessment Regulation (EP&A Reg) 2000.

The latest version of Green Star – Communities v1.1 was released in September 2016 and assesses the planning, design and construction of large-scale development projects at a precinct, neighbourhood and/or community scale. It is the most applicable rating system in the GBCA's suite of rating tools for Riverwood SSP.

Green Star – Communities certification lasts a maximum of five years, after which the project can recertify. This allows projects to re-assess their approach, improve on their approach, and be recognised for progress made in delivering on the ground.

The Communities framework is constructed around five core principles:

- Enhance liveability;
- Create opportunities for economic prosperity;
- Foster environmental responsibility;

- Embrace design excellence; and
- Demonstrate visionary leadership and strong governance.

The Green Star – Communities award is limited to the achievement of four, five or six star ratings as the GBCA only recognises and rewards market leaders. The Green Star rating is determined by both the total number of points achieved overall, and the achievement of a minimum points score within each individual category (except Innovation).

To achieve a Green Star – Communities rating, the minimum category score in each individual category, in addition to the minimum total score, must be achieved or exceeded for the rating as per the following table.

Table 2: Green Star Rating Scores

Rating	Minimum Total Score	Minimum Category Score				Outcome
		Governance	Liveability	Economic Prosperity	Environment	
One Star	10 – 19	-	-	-	-	Minimum Practice
Two Star	20 – 29	-	-	-	-	Average Practice
Three Star	30 – 44	-	-	-	-	Good Practice
Four Star	45 – 59	3	2	2	3	Australian Best Practice
Five Star	60 – 74	6	4	4	6	Australian Excellence
Six Star	75+	8	7	6	9	World Leadership

2.1.2 Green Star – Buildings

Green Star – Buildings v1 was released by the GBCA in October 2020. It replaces the current Design and As-built tool and all new buildings or major refurbishments aiming to achieve a rating registered after December 2021 must be certified under the new tool.

Green Star – Buildings sets out the criteria that must be met to deliver healthy, resilient, and positive places for people and nature. It aims to meet current and future demands on the built environment with aspirational benchmarks for addressing the key issues of the next decade: Climate action, resource efficiency, and health and wellbeing.

The rating tool has five key features:

1. Delivers a new definition of a sustainable building
2. Meets the Paris Agreement
3. Responds to sustainability megatrends
4. Creates clear expectations for new buildings
5. Delivers opportunities for supply chain transformation

There are eight categories representing the issues that will define the next decade of the built environment.

Figure 3: Green Star Buildings Categories

2.2 National and International

2.2.1 United Nations Sustainable Development Goals (SDGs)

In 2015, the United Nations General Assembly passed a resolution on the global agreement of 17 SDGs to form a roadmap for global development efforts to 2030 and beyond. While non-binding, for Australia, the 2030 Agenda will be highly influential, shaping commitments, development cooperation and finance flows as well as global government and private sector reporting.

Figure 4: United Nations SDGs

Table 3 outlines the SDGs that are well aligned with the redevelopment vision for Riverwood Renewal project.

Table 3: United Nations SDGs

SDGs	Description
SDG 6 – Clean Water and Sanitation	
6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity
6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.b	Support and strengthen the participation of local communities in improving water and sanitation management
SDG 7 – Affordable and Clean Energy	
7.1	By 2030, ensure universal access to affordable, reliable, and modern energy services
7.2	Increase substantially the share of renewable energy in the global energy mix by 2030
7.3	Double the global rate of improvement in energy efficiency by 2030
SDG 11 – Sustainable Cities and Communities	
11.1	By 2030, ensure access for all to adequate, safe and affordable housing and basic services, and upgrade slums
11.2	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
11.7	By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities
SDG 12 – Responsible Consumption and Production	
12.1	Implement the 10-Year Framework of Programs on sustainable consumption and production (10YFP), all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries
12.2	By 2030, achieve sustainable management and efficient use of natural resources
12.4	By 2020, achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimise their adverse impacts on human health and the environment
12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse
SDG 13 – Climate Action	
13.1	Strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries

2.2.2 National Construction Code (NCC)

The NCC is an initiative of the Council of Australian Governments (COAG) developed to incorporate all on-site construction requirements into a single code. The code provides the minimum necessary requirements for safety and health; amenity and accessibility, and sustainability in the design, construction, performance and liveability of new buildings (and new building work in existing buildings) throughout Australia. It is a uniform set of technical provisions for building work and plumbing and drainage installations throughout Australia that allows for variations in climate and geological or geographic conditions.

The NCC is comprised of the Building Code of Australia (BCA), Volumes One and Two; and the Plumbing Code of Australia (PCA), Volume Three.

- NCC Volume One primarily applies to Class 2 to 9 (multi-residential, commercial, industrial and public) buildings and structures;
- NCC Volume Two primarily applies to Class 1 (residential) and 10 (non-habitable) buildings and structures; and
- NCC Volume Three applies to plumbing and drainage for all classes of buildings.

NCC Section J is the primary section to be considered in this report, it addresses building energy efficiency requirements for non-residential buildings Class 3-9.

- Part J1 Building Fabric;
- Part J2 (Previously glazing but has since been moved to Part J1);
- Part J3 Building Sealing;
- Part J5 Air-conditioning and ventilation systems;
- Part J6 Artificial lighting and power;
- Part J7 Heated water supply and swimming pool and spa pool plant; and
- Part J8 Facilities for energy monitoring.

2.2.3 National Australian Built Environment Rating Systems (NABERS)

NABERS is a national rating system that measures the environmental performance of Australian buildings and tenancies. NABERS measures the energy efficiency, water usage, waste management and indoor environment quality of a building or tenancy and its impact on the environment. NABERS provides rating from one to six stars for buildings efficiency across:

- Energy;
- Water;
- Waste; and
- Indoor environment.

Figure 5: NABERS Star Ratings

Given the proposed redevelopment intended for the Riverwood Renewal project, NABERS for Apartment Buildings is the most applicable rating system to measure actual building

performance. The system rates the energy and water usage within the common property areas of the building including but not limited to:

- Lifts and lobby areas;
- Car Parks;
- Gyms;
- Pools; and
- Water features.

2.2.4 Nationwide House Energy Rating Systems (NatHERS)

The NatHERS provides homes with a star rating out of ten based on an estimate of a home's potential (heating and cooling) energy use. The Star ratings are based on information about the home's design, construction materials and the climate where it is being built. NatHERS primarily focuses on the potential heating and cooling energy use, centred on thermal comfort of the building's inhabitants. NatHERS is built into the BCA and for multi-residential units must:

- Collectively achieve an average energy rating of not less than six stars; and
- Individually achieve an energy rating of not less than five stars.

2.3 NSW State Controls and Guidelines

2.3.1 Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulation 2000

The redevelopment of Riverwood Estate is subject to the requirements set under the *Environmental Planning and Assessment Act* (EP&A Act) 1979 and *Environmental Planning and Assessment Regulation* (EP&A Reg) 2000. The EP&A Reg outlines the principles of ecologically sustainable development.

Table 4: Clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000

ESD Principle	Definition
6. Precautionary principle	If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
7. Inter-generational equity	The present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
8. Conservation of biological diversity and ecological integrity	Conservation of biological diversity and ecological integrity should be a fundamental consideration.
9. Improved valuation, pricing and incentive mechanisms	Environmental factors should be included in the valuation of assets and services.

2.3.2 Government Resource Efficiency Policy (GREP)

The GREP was developed in 2014 to help the government achieve its commitment to making NSW a more sustainable, liveable and resilient state. The Policy aims to reduce the NSW Government's operating costs and lead by example in increasing the efficiency of its resource use.

This policy's measures, targets and minimum standards will drive resource efficiency where significant opportunities for savings have been identified for energy, water, waste and clean air.

The measures and minimum standards within GREP relevant to the Riverwood redevelopment are provided in Table 5: GREP measures relevant to the Riverwood Renewal project.

Table 5: GREP measures relevant to the Riverwood Renewal Project

GREP Measure	Description
Energy	
E1 Target to save energy across all government sites	All agencies must: • Implement energy savings projects at each of their eligible sites; and • Achieve aggregate energy savings of at least 10 percent.
E3 Minimum standards for new electrical appliances and equipment	All new electrical equipment purchased by government must be at least 0.5 stars above the market average star rating or comply with high efficiency standards specified by this measure.
E4 Minimum standards for new buildings and fit outs	All new facilities, including office buildings, fit outs and other building types with project costs over $10 million, will achieve and maintain minimum NABERS Energy and Green Star ratings, or be designed to these standards, as specified by this measure.
E5 Whole-of-government solar target	Agencies will plan and execute the installation of solar PV on suitable sites to implement the NSW Government's solar target of 25,000 MWh per year by 2021 and 55,000 MWh per year by 2024. This target corresponds to a solar PV capacity of about 18 MW (2021) and 40 MW (2024).
E6 Purchase 6% GreenPower	Purchase a minimum of six percent GreenPower.
Water	
W1 Report on water use	All agencies will report on water use. They are strongly encouraged to set targets to reduce water use.
W3 Minimum standards for new water-using appliances	All new water-using appliances purchased by agencies must be at least 0.5 stars above the average Water Efficiency Labelling and Standards (WELS) star rating by product type, except toilets and urinals, which must be purchased at the average WELS star rating.
Waste	
P1 Report on top three waste streams	All agencies will report on their top three waste streams by both total weight and total cost. They are strongly encouraged to take measures to reduce waste.
Clean Air	
A2 Low-VOC materials	All surface coatings and other VOC emitting products will comply with the Property NSW Guidance Note on Low-VOC Emission Materials.

2.3.3 Building Sustainability Index (BASIX)

The State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 is a requirement that applies to all residential dwelling types and are part of the development application process in NSW. BASIX is one of the strongest sustainable planning measures to be undertaken in Australia.

BASIX sets sustainability targets related to energy, water and thermal comfort based on information provided about the design of the development. Table 6 and Table 7 below provides the current minimum statutory BASIX target for Riverwood Renewal project.

Table 6: BASIX Energy Targets for Postcode 2210

Building Type	BASIX Energy Target
Detached	50
Low Rise	45
Mid Rise	35

Building Type	BASIX Energy Target
High Rise	25

Table 7: BASIX Water Targets for Postcode 2210

Building Type	BASIX Energy Target
Detached	40
Low Rise	40
Mid Rise	40
High Rise	40

2.3.4 State Environmental Planning Policy No 65 (SEPP 65) and Apartment Design Guide

The SEPP 65 was developed by the NSW Government to promote better apartment designs across NSW. The policy establishes a consistent approach to the design and assessment of apartments and the way they are assessed by councils. SEPP 65 is designed to be used in conjunction with the Apartment Design Guide to give guidance and directions and provide benchmarks for designing residential apartments. Key design principles 4U Energy Efficiency and 4V Water management and conservation have been considered in the design of the Riverwood Renewal project.

2.3.5 Better Practice Guide for Waste Management in Multi-unit Dwellings

The Better Practice Guide for Waste Management in Multi-unit Dwellings was developed by the Department of Environment and Climate Change NSW in 2008 to assist design teams in incorporating better practice in design, establishment, operation and management of waste services in residential multi-unit developments. It outlines various essential points to be considered when designing a waste management system for medium or high-density residential, mixed-use and integrated housing developments.

Better practice waste management establishes and maintains services and infrastructure that enables garbage, recycling, organics and bulky waste services to be made in the best possible way in a particular situation to improve resource recovery. Better practice requires continuously searching for ways to improve infrastructure, systems and services as knowledge and experience accumulates over time.

2.3.6 Better Practice Guide for Public Place Recycling

The *Better Practice Guide for Public Place Recycling* was developed by the Department of Environment and Conservation NSW in 2005 to provide advice and minimum standards for installing recycling systems in public places such as parks, shopping centre, railway stations etc.

A well designed and managed public place waste management can increase the amount of recyclable materials collected and reduce contamination in recycling bins. The guide provides design teams with a series of steps to define, develop and implement a successful waste management system.

2.3.7 Urban Green Cover in NSW Technical Guidelines

The *Urban Green Cover in NSW Technical Guidelines* was developed by the Office of Environment and Heritage in 2015 to provide practical guidance on how to adapt the urban environment through urban green cover projects.

The guidelines offer built environment professionals working in state and local government and the private sector practical information and typical details to encourage best practice applications of green cover to minimise urban heat impacts across NSW. It was developed in consultation with urban design and engineering professionals, utilities and relevant stakeholders.

Urban green cover is a broad range of relatively low-cost strategies to integrate green, permeable and reflective surfaces into cities and towns.

- Green roofs and cool roofs – vegetated roofs and light coloured and reflective roof surfaces;
- Green walls – vegetated systems that are grown on the vertical facade of the building envelope;
- Green streets – opportunistic street tree planting with shade providing canopy combined with permeable and/or light coloured, highly reflective surfaces on roads, pavements and car parks; and
- Green open spaces – canopy trees and shade provision to parks, cycleways, footpaths, amenities and forecourts, as well as green infrastructure such as bio-swales, raingardens, soft-landscaped detention basins, de-channelisation of hard engineering (concrete culverts).

2.3.8 Future Transport 2056

Future Transport 2056 is an update of the NSW Government's Long-Term Transport Master Plan. It is a suite of strategies and plans for transport developed in concert with the Greater Sydney Commission's Sydney Region Plan, Infrastructure NSW's State Infrastructure Strategy, and the Department of Planning and Environment's regional plans, to provide an integrated vision for the state.

The *Future Transport 2026* strategy sets the 40-year vision, directions and outcomes framework for customer mobility in NSW, which will guide transport investment over the longer term. This vision is built on six outcomes:

10. Customer Focused:
    a. Moving to 'Mobility as a Service' (MaaS) and beyond.
11. Successful Places:
    a. Activating centres with a new Movement and Place framework;
    b. Encouraging active travel (walking and cycling) and using public transport; and
    c. Strengthening local partnerships.
12. A Strong Economy:
    a. A transport system that powers our future $1.3 trillion economy;
    b. Strengthening our Global Gateways and Satellite Cities; and
    c. Connecting people to jobs, goods and services in our cities and regions.
13. Safety and Performance:
    a. Safety, security and performance are interlinked; and
    b. A secure network in the 'Digital Age'.
14. Accessible Services:
    a. A fully accessible network that enables barrier-free travel for all; and
    b. Inclusive customer service and information.
15. Sustainability:

a. An affordable network that is responsive to change; and
b. Supporting more environmentally sustainable travel.

2.3.9 NSW Net Zero Plan Stage 1: 2020 - 2030

The NSW Government is committed to achieve net zero emissions by 2050 in alignment with the Paris Agreement. *The NSW Net Zero Plan Stage 1: 2020-2030* outlines the NSW Government's plan to grow the economy, create jobs and reduce emissions over the next decade. The Plan sets out how the NSW Government will support these solutions over the next decade, focused on four priority areas for action:

1. Drive uptake of proven emissions reduction technologies that grow the economy, create new jobs or reduce the cost of living;
2. Empower consumers and businesses to make sustainable choices;
3. Invest in the next wave of emissions reduction innovation to ensure economic prosperity from decarbonisation beyond 2030; and
4. Ensure the NSW Government leads by example.

2.3.10 NSW Circular Economy Policy Statement

The NSW Government has developed a Circular Economy Policy to deliver positive economic, social and environmental outcomes. A circular economy is about changing the way we produce, assemble, sell and use products to minimise waste and to reduce our environmental impact.

The transition to a circular economy will generate jobs, increase the robustness of the economy, increase the accessibility of goods, maximise the value of resources, and reduce waste.

NSW will transition to a circular economy by focusing on seven key principles:

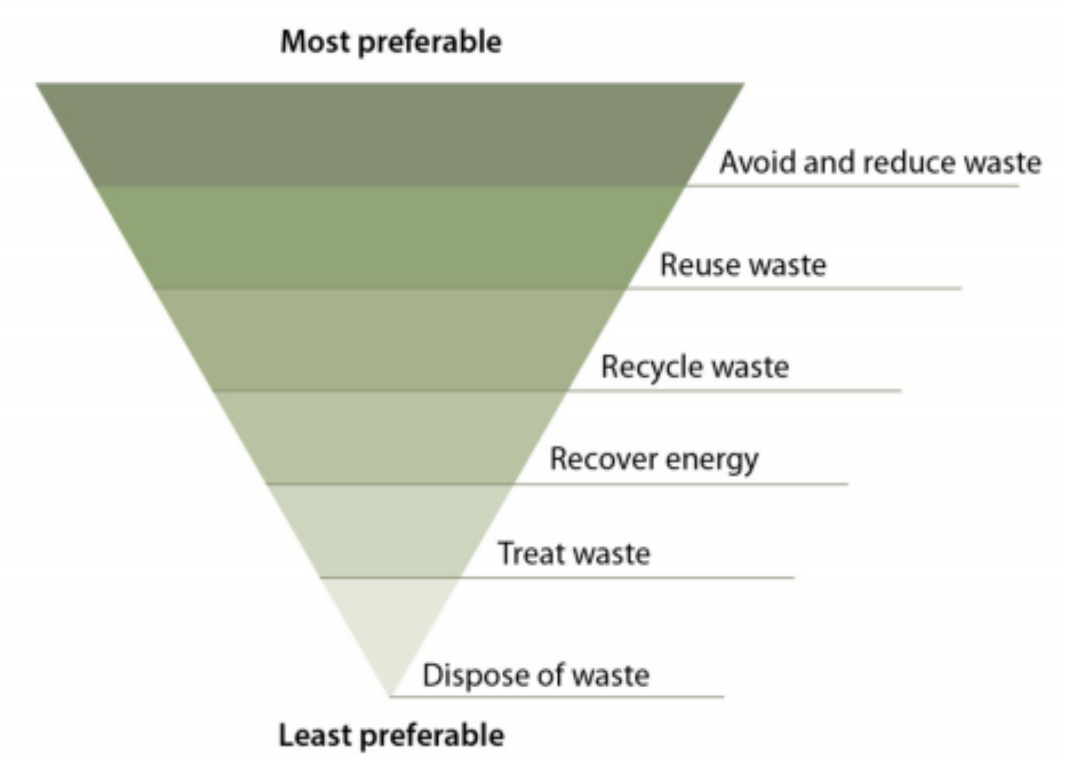
1. Sustainable management of all resources;
2. Valuing resources productivity;
3. Design out waste and pollution;
4. Maintain the value of products and materials;
5. Innovate new solutions for resource efficiency;
6. Create new circular economy jobs; and
7. Foster behaviour change through education and engagement.

2.3.11 NSW Waste Avoidance and Resource Recovery Strategy 2014 – 21 (WARR)

The NSW Environment Protection Authority (EPA) developed the *NSW Waste Avoidance and Resources Recovery Strategy 2014-21* (WARR) to reduce waste generation and keep materials circulating within the economy, this strategy is prepared every five years.

It sets clear directions for a range of priority areas over the next seven years and aligns with the NSW Government's waste reforms in NSW 2021: A plan to make NSW number one.

Figure 6: The Waste Hierarchy



The WARR Strategy is driven by the waste hierarchy in Figure 6 and it sets out six state-wide goals and targets.

Table 8: WARR Strategy Targets

Key Result Area	Target
Avoid and reduce waste generation	By 2021-2022, reduce the rate of waste generation per capita
Increase recycling	By 2021-22, increase recycling rates for: • municipal solid waste from 52% (in 2010–11) to 70%; • commercial and industrial waste from 57% (in 2010–11) to 70%; and • construction and demolition waste from 75% (in 2010–11) to 80%.
Divert more waste from landfill	By 2021-22, increase the waste diverted from landfill from 63% (in 2010–11) to 75%
Manage problem wastes better	By 2021–22, establish or upgrade 86 drop-off facilities or services for managing household problem wastes state-wide
Reduce litter	By 2016–17, reduce the number of litter items by 40% compared with 2011–12 levels and then continue to reduce litter items to 2021–22
Reduce illegal dumping	From 2013–14, implement the NSW Illegal Dumping Strategy 2014–16 to reduce the incidence of illegal dumping state-wide As part of this strategy, by 2016–17: • Reduce the incidence of illegal dumping in Sydney and the Illawarra, Hunter and Central Coast regions by 30% compared with 2010–11; and • Establish baseline data to allow target-setting in other parts of the state.

2.4 Regional Controls and Guidelines

2.4.1 Greater Sydney Commission South District Plan

The Greater Sydney Commission was established in 2015 as an independent organisation funded by the NSW Government to lead the metropolitan planning to make Greater Sydney more productive, sustainable and liveable. The vision for Greater Sydney is a Metropolis of Three Cities consisting of the Western Parkland City, the Central River City and the Eastern Harbour City and a 30-minute city. This means for residents in the South District will have quicker and easier access to a wider range of jobs, housing types and activities. The vision will improve the District's lifestyle and environmental assets.

The *South District Plan* published in 2018 is a 20-year plan to manage growth in the context of economic, social and environmental matters to achieve the 40-year vision for Greater Sydney. It is a guide for implementing the Greater Sydney Region Plan, A Metropolis of Three Cities, at a district level and is a bridge between regional and local planning.

The Plan is constructed around five Planning Directions and made up of 20 Planning Priorities.

Table 9: South District Plan Planning Priorities

Infrastructure and collaboration	
Planning Priority S1	Planning for a city supported by infrastructure
Planning Priority S2	Working through collaboration
Liveability	
Planning Priority S3	Providing services and social infrastructure to meet people's changing needs
Planning Priority S4	Fostering healthy, creative, culturally rich and socially connected communities
Planning Priority S5	Providing housing supply, choice and affordability, with access to jobs, services and public transport
Planning Priority S6	Creating and renewing great places and local centres, and respecting the District's heritage
Productivity	
Planning Priority S7	Growing and investing in the ANSTO research and innovation precinct
Planning Priority S8	Growing and investing in health and education precincts and Bankstown Airport trade gateway as economic catalysts for the District
Planning Priority S9	Growing investment, business opportunities and jobs in strategic centres
Planning Priority S10	Retaining and managing industrial and urban services land
Planning Priority S11	Supporting growth of targeted industry sectors
Planning Priority S12	Delivering integrated land use and transport planning and a 30-minute city
Sustainability	
Planning Priority S13	Protecting and improving the health and enjoyment of the District's waterways
Planning Priority S14	Protecting and enhancing bushland, biodiversity and scenic and cultural landscapes and better managing rural areas
Planning Priority S15	Increasing urban tree canopy cover and delivering Green Grid connections
Planning Priority S16	Delivering high quality open space
Planning Priority S17	Reducing carbon emissions and managing energy, water and waste efficiently
Planning Priority S18	Adapting to the impacts of urban and natural hazards and climate change
Implementation	
Planning Priority S19	Preparing local strategic planning statements informed by local strategic planning

Planning Priority S20	Monitoring and reporting on the delivery of the plan

2.4.2 Resilient Sydney Strategy 2018

The *Resilient Sydney Strategy 2018* is developed by Resilient Sydney, a member of the Resilient Cities Network (previously the 100 Resilient Cities), with the aim to help cities around the world to become more resilient to physical, social and economic challenges. The Strategy was developed in collaboration with all of Sydney's metropolitan councils with contributions with NSW Government, businesses and community organisations.

The Strategy sets out 5 Directions to strengthen the city's ability to survive, adapt and thrive in growing global uncertainty and local shocks and stresses.

1. People centred city – include communities in decision making for growth and equity;
2. Live with our climate – adapt to sustain our quality of life and our environment;
3. Connect for strength – every Sydneysider will feel they belong in our community and city;
4. Get ready – know how to prepare, respond and recover; and
5. One city – we are one city.

2.5 Local Control and Guidelines

2.5.1 Canterbury-Bankstown Connective City 2036

Connective City 2036 is the Canterbury Bankstown City's blueprint that will deliver the vision for the City in the Community Strategic Plan, CBCity 2028, and responds the NSW Government policies including the Greater Sydney Region Plan, South District Plan, Future Transport 2056 and NSW State Infrastructure Strategy.

Connective City 2036 sets a clear vision, establishes land use directions, and sets priorities – including responsibilities and timeframes - to demonstrate why and how infrastructure can be arranged and how the City relates to neighbouring LGAs and to Greater Sydney as a whole.

The plan establishes five Metropolitan Directions and five City Directions that focus on how Canterbury-Bankstown can support 500,000 people by 2036. The five Metropolitan Directions are:

1. Support Greater Sydney's evolution into a Metropolis of Three Cities;
2. Allocate metropolitan-serving roads while optimising Canterbury-Bankstown as a freight and distribution powerhouse;
3. Fulfil the aspiration for an interconnected mass transit system;
4. Connect the Cooks, Georges and Parramatta river catchments through the Greater Sydney Green and Blue Grids; and
5. Support a growing Sydney by creating a hierarchy of great places and dynamic urban centres.

The five City Directions focus on:

1. Chapel Road Precinct, Connective City's heart – from Chullora to Bankstown;
2. Eastern Lifestyle and Medical Precinct - Campsie to Kingsgrove;
3. Bankstown Aviation and Technology Precinct;
4. 34 centres and their surrounding suburbs; and
5. Canterbury-Bankstown's river systems and tributaries.

3 Net Zero Carbon Precinct

To ensure alignment with the NSW Net Zero Plan to achieve net zero emissions by 2050, the Riverwood Renewal project must focus on minimizing energy consumption, maximizing on-site renewable energy generation and ensuring the various infrastructure in the redevelopment is prepared for a full electrification.

The pathway towards net-zero carbon will occur via a combination of minimizing energy use, energy efficiency measures, low emission transportation, uptake of on-site renewable energy, and lastly, purchase of accredited carbon offsets.

The following are a list of initiatives that can be implemented into the redevelopment. These principle requirements are also addressed in the Green Star – Communities and Buildings tools and should be applied to contribute towards delivering a net zero carbon precinct.

- **Minimizing energy use** – The project should incorporate passive design principles into dwellings and common areas to reduce the need for heating, cooling, and lighting through a combination of block orientation, optimized glazing and shading devices, sufficient continuous insulation, and an airtight building envelope;
- **Maximize energy efficiency** – Energy efficiency measures across the Riverwood Renewal should be pursued before considering renewable energy. This can be attained through providing high efficiency appliances, centralized hot water, heating and cooling systems and optimizing the use of vertical transports in buildings;
- **Low emission transportation** – To achieve a net-zero carbon precinct, the design must prioritize active transport for pedestrians, cyclists, and public transports over private vehicles. The precinct should consider minimizing car parking and improving accessibility to public transports to reduce private vehicle use, design cycle and pedestrian links to key destinations, encourage car share schemes, and provide infrastructure capacity to accommodate EV charging stations to accommodate projected EV uptake; and
- **Onsite renewable energy** – Both rooftop PV systems and building-integrated photovoltaics (BIPV) must be maximized to achieve a net zero carbon precinct for the Riverwood Renewal and combined with an appropriate battery system to better make use of the generated energy. And as a precinct wide redevelopment, the site can take advantage of its scale and implement a microgrid system by connecting the various PV arrays installed across the Riverwood Renewal. This allows the community as a whole to reduce the cost of electricity and improve energy resilience.

4 Water Cycle Management Strategy

4.1 Stormwater Detention Strategy

A large portion of Sydney's suburban areas are now undergoing redevelopment as a result of Sydney's growing population, particularly in areas around major centres and transport nodes. Within these areas considerable changes in development typology are being observed with low density housing being intensified to incorporate higher density land uses. These medium and high density developments can lead to more intensive site usage and less efficient stormwater drainage systems. Without compensatory measures, the cumulative impacts of the increased stormwater runoff and loss of flood storage across development sites would increase the flooding risk to downstream properties.

In order to manage the intensified land uses, On-Site Detention (OSD) must be provided for all new developments. OSD is the temporary storage of stormwater, traditionally within a development footprint, to ensure that peak runoff from a development site does not incur adverse impacts to downstream properties.

Canterbury Bankstown Council requires all multi dwelling housing and residential flat building developments to provide OSD regardless of the impervious area before and after the development, and regardless of whether the site falls toward or away from the street. A minimum of 75 percent of the site area must drain to the detention basin. The OSD must be designed to ensure stormwater flows do not exceed a permissible site discharge (PSD) of 150 L/s per hectare.

4.1.1 Stormwater Modelling

A hydrological model of the catchment was formulated using the DRAINS software package and was analysed to assess the performance of the site stormwater network. The DRAINS program typically performs design and analysis calculations for urban stormwater systems and models the flood behaviour on both rural and urban catchments.

The user data inputs required by DRAINS include catchment areas, flow path lengths, time of concentration, pervious and impervious areas, IFD rainfall intensities and flow path roughness. Modelling is performed through the development of a network of pipes, pits and nodes to represent both the proposed and existing scenarios on site.

Refer to Water Cycle Management Report for detailed inputs and modelling methodology.

4.1.2 Salt Pan Creek Reserve

The updated 2019 master plan for the Salt Pan Creek Reserve (SPC Reserve) has been developed to coincide with the closure and capping of the existing tip. As a holistic approach, interactive wetlands have been considered as part of the reserve master plan. Therefore, there is potential for LAHC to incorporate the OSD and water quality treatment devices in this report to then discharge treated water to the Salt Pan Creek Reserve sites.

The water re-use rates in the recreation areas have not yet been confirmed, and the water quantity and quality treatment measures for the Riverwood Renewal project have been limited to the confines of the Study Area. However, consideration has been given to the intent for the SPC Reserve and should the project proceed, the proposed measures for Riverwood can integrate with the SPC Reserve concept strategy.

4.2 Water Quality Management

The Riverwood Renewal Project is situated within the Saltpan Creek Catchment and similarly with many other urbanised areas in Sydney, the Study Area at times can result in poor water quality from roads and open spaces, particularly after heavy rain. This untreated runoff in the localised catchment also contributes to the overall water quality in Saltpan Creek. As part of the master plan, Water Sensitive Urban Design (WSUD) procedures have been incorporated to improve water quality in local waterways.

4.2.1 Water Quality Modelling

Modelling of the master plan was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software. The software was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amounts of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

Refer to Water Cycle Management Report for detailed inputs and modelling methodology.

4.2.2 Water Quality Objectives

Through discussions with Council, it was determined that the removal targets used for the Washington Park development would be adopted for the Riverwood Renewal project:

Table 10: Stormwater Quality Removal Targets

Pollutant	Performance Target Reduction Loads
Total Suspended Solids	85%
Total Phosphorus	65%
Total Nitrogen	45%
Gross Pollutants	95%

Source: Civil, Drainage, Water and Sewerage Infrastructure Report, Warren Smith & Partners (2011)

4.2.3 Water Quality Treatment Train

The following treatment train has been proposed for the site:

- Gross pollutant traps (GPTs) are to be used to capture larger pollutants and sediments before discharging into bioretention, local piped network and subsequent watercourses;
- Bioretention raingardens are to be used for effective pollutant removal of finer sediments and nutrients. A raingarden will be incorporated into the regional detention basin located within sub-catchment M2. Runoff from private residential lots within sub-catchment M4 will bypass the proposed basin and discharge directly to the downstream waterway as per the existing scenario.; and

It should be noted that the current proposal for a regional detention basin was incorporated following recommendations by Council/LAHC consultant team to tie in with the Salt Pan Creek Masterplan (SPCM). However, there are three options that should continue to be investigated as possible solutions for stormwater storage and treatment. Those the options are:

1. **Current proposal.** Continue with the current basin design and adjust at a later stage when the SPCM is constructed, noting that there could be a loss of open space if not delivered in tandem with the SCPM.

2. **Interim solution.** The treatment of runoff from the development doesn't require a wetland, rather a 'dry' basin which temporarily stores water during more intense storms. An adapted layout of the 'dry' filtration treatment areas is possible that allows the current use of the KRR to be maintained. This interim scenario would locate biofiltration areas outside the footprint of the playing field. The potential future reconfiguration as wetland providing the full benefit to SPCM would then follow, when the full SPCM is implemented. The inclusion of this interim solution is the current preferred option subject to further consultation with Council.
3. **Alternate proposal.** On-lot treatment for all stages avoiding the construction of a regional basin. This results in the development of the catchment being limited to the use of lot based detention as opposed to a regional facility. This is the proposed strategy in other catchments which do not benefit from the KRR opportunity, and has a lower ESD value, using proprietary water quality treatment and tanks instead of vegetated basin treatment.

4.2.4 Additional WSUD Measures and Long Term Integrated Aspirational Goals

The proposed treatment train is a regional, end of line network which aims to provide a holistic approach, limiting disaggregation of treatment devices to reduce maintenance requirements and maximise efficiency.

It is acknowledge this approach is more regional in nature and does not include potential at source treatments. However, in the interest of providing a more environmentally friendly and sustainable development, it is encouraged that at source treatments be implemented, this is typically provided on lot as part of the development footprint which are generally through standard Basix requirements. These could also include tree bays or swales located within road reserves or parks. It is also noted that at source treatment devices can be difficult to practically implement due to road grades, future parking requirements and existing trees to be retained. At the detailed design stage, opportunities can be sought to incorporate these devices where possible, reducing the end of line treatment provision.

There may be an opportunity to reassess and reduce the impervious fraction of the road reserve (90%) based on the amount of landscape within the reserve. Given the large percentage of impervious area that the road reserve holds, a reduction in the impervious fraction will reduce the overall water detention and treatment requirements.

There potential for LAHC and CBC to co locate water retention systems and ponds within Salt Pan Creek Reserve (SPC) Reserve to reduce stormwater runoff and reuse water for irrigation of parks/open space and community gardens in the form of a stormwater harvesting and water quality wetland.

4.3 Recommended Planning Controls

The results of the above assessment show that the proposed development will have minimal impact on local and regional flooding. It is therefore not expected that additional planning controls will need to be created. The following sections detail how the development complies with the existing controls outlined in both Council's DCP and the NSW Floodplain Development Manual (FDM).

4.3.1 Flood Planning Level

Per Council's DCP, all habitable floor levels of residential buildings are to be located a minimum 0.5 m above the 100-year flood level. However, in the interest of a climate resilient development Mott MacDonald recommend adopting that the Flood Planning Level be set at 0.5 m above the

15 percent climate change level. For the buildings within the Washington Park frontage this is approximately RL 13.68.

Council also require development to not increase the flood hazard or flood damage to other properties or adversely affect them in any way during times of flooding. As the proposed development lies outside the flood area and it should not be expected that flood worsening will occur as a result of the development.

4.3.2 Flood Management

All physical works are proposed outside the 100-year flood extents. Therefore, there is no loss of flood storage or flood worsening as a result of earthworks and filling of land. As such, no cumulative flood impacts are expected as a result of the development.

No flood management measures will be required for the development as there is no adverse impact on flooding. Should future developments seek to encroach on the 100-year flood extent further flood studies and subsequent mitigation measures may be required.

4.3.3 Precinct Flood Evacuation Strategy and Time to Peak

One critical aspect of flood evacuation is the time it takes to mobilise and evacuate in conjunction with the time it takes for floodwaters to rise. The time it takes for the flood waters to reach their maximum height for any given storm event is referred to as the ‘Time to Peak’. The following assessment has been made to assess the Time to Peak for the PMF event.

There are generally two types of flooding, Flash Flooding (usually quick short intense events, predominately in small, highly developed catchments) and mainstream flooding (typically slower longer flood events associated with large catchments, creeks, streams and rivers). This analysis only applies to the Salt Pan Creek Tributary as flooding from the Salt Pan Creek in the PMF does not affect the site.

The Salt Pan Creek Tributary Catchment is comparatively smaller than that of the overall Salt Pan Creek and is subject to flash flooding. As a result, the time to peak is relatively short at approximately 35 minutes from the start of the storm to the peak of the storm in a PMF event. In accordance with the FDM, properties along the Washington Park frontage that are impacted by the PMF event are advised to evacuate the site to higher ground via the rising road access towards the south. Once the storm event is over the SES will provide guidance to tenants and building managers when it is safe to return to the site.

Future detailed design of the buildings will need to include an appropriate flood evacuation management plan to address the time to peak, this will need to include adequate quick response warning systems. Proposed properties on the fringe of the PMF will be able to evacuate via rising road access to the south.

5 Air Quality

Although the proximity of the development does not trigger the expectation of mitigation measures and design consideration, it is considered prudent to list measures that may be included in the design of the development to minimise the potential for air quality impacts. When design features cannot eliminate an impact sufficiently, certain measures can be employed to mitigate many impacts. For buildings this primarily consists of internal ventilation options such as:

- Natural Ventilation through open windows to ensure pollution does not accumulate within a building. This presents the simplest and cheapest option to provide air flow throughout a building as it relies on natural pressure and temperature differences between the inside and outside of the building. However, when windows must be kept closed other ventilation systems can be utilised;
- Passive Acoustic ventilation is an option where ventilators are installed to maintain external airflow without the impact of external noise sources;
- Mechanical Ventilation may be considered where windows need to be kept closed and involves circulation of fresh air into the building using ducts and fans. This is an option to be considered as a means to 'treat' air through filtration (e.g. carbon filters) as it enters the building. Mechanical ventilation air inlet ports should be positioned as far from the source of pollution as is practical i.e. in this case to the south of the buildings; and
- Any adopted ventilation systems must meet the requirements of the Building Code of Australia and Australian Standard 1668 – The use of ventilation and air conditioning in buildings.

Reference should be made to *Air Quality Study Requirements - Riverwood LAHC* (April 2021) for more information.

6 Climate Change

The effects of a changing climate present complex challenges to the built environment and infrastructure due to projected changes in intensity and frequency of severe weather events. Climate change can increase the exposure of transport and property infrastructure to risks, including:

- Structural asset damage;
- Service interruption;
- Productivity losses;
- Reduced customer satisfaction;
- Death, injury and ill health; and
- Interruption of access to critical services such as electricity, water and emergency services.

6.1 Climate Change Adaptation Assessment

Mott MacDonald acknowledges that delivering effective CCA initiatives in public areas is less challenging than enforcing development controls on private developments. This presents a good opportunity to highlight Government leadership and therefore, where possible initiatives have focused on items in the public realm to increase the likelihood of CCA outcomes being delivered.

Public realm initiatives are implemented by effective master planning as opposed to private built form initiatives that are generally implemented by planning controls or design guidelines. Therefore, where possible, focus has been placed on including initiatives in the master plan.

Where inclusion in the master plan is not practical or appropriate, a planning control has been nominated and where design innovation should be explored a possible procurement condition has been included to encourage developers to explore additional CCA measures that could be feasibly delivered at this early stage of the project (these would need to be assessed for commercial feasibility at the tender stage of the project but also drives the industry to explore innovative solutions).

In instances where implementation of the initiative is deemed outside the scope of the Riverwood Renewal project or is not considered viable at this stage, initiatives have been nominated as aspirational for future consideration.

Table 11: Summary of Implemented CCA Initiatives

POSSIBLE CCA INITIATIVE	MASTER PLAN ALLOWANCE	SUGGESTED PLANNING CONTROL/OBJECTIVE	POSSIBLE PROCUREMENT CONDITION
Consider more insulated roofing, and green roofing and/or white painted roofing. Additionally, enhanced glazing treatment, shutters to control solar gain.	The master plan documentation includes the provision of light coloured roofing and interspersed green roofing where achievable to reduce heat absorption and improve thermal efficiency. Future building design could include	This initiative could be reflected in a proposed planning control which aims to provide a more sustainable development. Draft planning controls could include: **Sustainable materials** Controls	

POSSIBLE CCA INITIATIVE	MASTER PLAN ALLOWANCE	SUGGESTED PLANNING CONTROL/OBJECTIVE	POSSIBLE PROCUREMENT CONDITION
	enhanced glazing treatment and additional shutters to limit solar gain above current standards.	• External walls and roofs should be non-heat absorbing and light in colour; and • Insulated roofing should be provided for all buildings.	
Developments should consider more hard-wearing materials that can withstand temperature extremes which may cause warping, bending, blistering, fading or melting. Consider extra structural reinforcements and more hardwearing materials that can withstand strong winds and excessive precipitation. Consider use of fire retardant materials / linings in buildings.		These initiatives could be reflected in proposed planning controls which aim to provide a more sustainable development which is resilient to changes in climate. Draft planning controls could include: **Sustainable materials** Controls • Materials that are more resilient than traditional materials should be used for construction where appropriate; and • Fire-retardant materials that are more effective that traditional materials should be incorporated in buildings.	
Consider lighter coloured paving of roads/sidewalks, as well and lighter coloured roofs and/or walls to reduce the heat island effect.		This initiative could be included as a proposed planning control which outlines requirements for public open spaces. Draft planning controls could include: **Public Open Space** Controls • Light coloured pavements and road surfaces should be used to avoid heat absorption and retention.	This initiative could include part of an overarching procurement condition to mitigate the urban heat island effect.
Consider passive cooling and through air flow and explore innovative and renewable sources of heating and cooling.	The master plan documentation includes passive cooling and through air flow as a provision.	This initiative could be included as a proposed planning control which will outline sustainability in design requirements. Draft planning controls could include: **Sustainable materials** Controls • More insulation than standard practice is to be demonstrated for all buildings; and • Living environments are to incorporate natural ventilation and passive cooling	This initiative could include a procurement condition as follows: Sustainability Outline measures to promote improved building insulation and natural ventilation. As a minimum, demonstrate that more insulation will be used on buildings than is standard practice.
Increase tree canopy for shading and cooling ambient temperatures with native species that have lower fire risks and are drought tolerant.	The master plan documentation includes this as a provision. The master plan and landscape report shows a proposed net increase in trees/tree canopy. A	This initiative could be included as a proposed planning controls which aim to promote planting of native plants and retain and maximise tree coverage across the site. Draft planning controls could include:	

POSSIBLE CCA INITIATIVE	MASTER PLAN ALLOWANCE	SUGGESTED PLANNING CONTROL/OBJECTIVE	POSSIBLE PROCUREMENT CONDITION
Select more drought resistant plants where irrigation is not to be undertaken.	minimum coverage of 30% has been proposed by the landscape architects - higher than the 15% average for Sydney.	**Public Open Space** Controls • Native plants which are drought tolerant and pose a low fire risk should be used in public open space areas. **Street Trees and Landscaping** Controls • Provide a minimum tree canopy coverage of 30%.	
Consider deeper ponds / water bodies and storage of grey water for landscaping/re-wetting paved areas during drought periods.	The master plan documentation and planning Control includes this as a provision.		This initiative could include a procurement condition as follows: Sustainability Outline how additional WSUD initiatives could be implemented to promote healthy waterways and reduce potable water consumption. Explore opportunities to include rainwater capture and re-use for irrigation purposes. As a minimum, implement the WSUD strategy as outlined in Attachment I of the master plan.
Consider adopting a higher flood planning level based on an increased rainfall event and sea level rise over and above standard practice.	The master plan documentation includes this as a provision.	This initiative could be included as a proposed planning control for flooding which aims to allow for increased storm intensity resulting from climate change. Draft planning controls could include: **Stormwater and Water Sensitive Urban Design** Controls • The applicable flood planning level for residential, mixed use, and commercial developments shall be the 100 year ARI +15% climate change flood event with 0.5m freeboard.	
Consider green roofing to absorb heavy precipitation and reduce the amount and rate going into drains.	The master plan documentation includes this as a provision. The master plan shows light coloured roofing interspersed with proposed green roofs.	This initiative could be included as a proposed planning control which aims to provide green roofs to 30% of all buildings within the Riverwood Renewal project where possible. Draft planning controls could include: **Communal Open Space** Controls	

POSSIBLE CCA INITIATIVE	MASTER PLAN ALLOWANCE	SUGGESTED PLANNING CONTROL/OBJECTIVE	POSSIBLE PROCUREMENT CONDITION
		• Green roof spaces should be provided where practical in accordance with the master plan; and • All green roof designs should address roof maintenance and servicing, security, visual and acoustic privacy and wind impacts.	
Consider increasing on site attenuation for improved flood neutrality (linked to this could be WSUD considerations, attenuated parking lots, etc).	The master plan documentation includes this as a provision. Stormwater retention opportunities are denoted in the landscape plan and tree plantings/new open spaces in general are noted.		This initiative could include a procurement condition as follows: <u>Sustainability</u> Outline how the development will consider more intense storm events as a result of climate change. As a minimum, design all buildings for a 15% increase in rainfall intensity.
Consider planting hardy, native tree and plant species that can withstand violent winds and/or root inundation (and ideally drought conditions too). Linked to this, plan adequate setbacks from critical structures in case of trees falling.	The master plan documentation includes this as a provision. The tree palette is native and setbacks are apparent in the master plan.	This initiative could be included as a proposed planning control which aims to provide native plants throughout the Riverwood Renewal project. Draft planning controls could include: **Street Trees and Landscaping** <u>Controls</u> • Native plants should be provided on all north-south streets in accordance with the Indicative Plant Schedule.	
Consider rainwater harvesting for increased water 'independence' for users.		This initiative could be included as a proposed planning control which aims to reduce stormwater runoff generated by the development. Draft planning controls could include: **Stormwater and Water Sensitive Urban Design** <u>Controls</u> • Rainwater harvesting should be included for buildings without a green roof, to minimise stormwater runoff generated by the development and achieve BASIX requirements.	
Increasing development densities to allow for the	The master plan documentation includes	This initiative could be included as several proposed planning controls which would provide more open	This initiative could include part of an overarching

POSSIBLE CCA INITIATIVE	MASTER PLAN ALLOWANCE	SUGGESTED PLANNING CONTROL/OBJECTIVE	POSSIBLE PROCUREMENT CONDITION
presence of more open space (thus cooling the immediate environment) and less hardened surface area coverage/sprawl (thus reducing runoff).	this as a provision. The master plan configuration shows a densification of the site with 3-12 storey buildings with a notable increase in open spaces from the present situation. The master plan calculations show an increase of approximately 2,900 dwellings whilst increasing open space area and tree coverage.	space and tree coverage across the Riverwood Renewal project. Draft planning controls could include: **Street Trees and Landscaping** Controls • Provide a minimum tree canopy coverage of 30%. **Site Coverage** Objectives • To provide adequate setbacks for landscaping, deep soil planting and communal open space. Controls • Building footprints must not exceed 60% of the total combined precinct site area.	procurement condition which would require public domain strengths be demonstrated in a master plan (planning proposal).

7 Waste Management Strategy

Waste is a key aspect of sustainability that is critical to the Riverwood Renewal project and the NSW Government, transition to a circular economy requires cooperation across different sectors, all levels of government and citizens.

The seven key circular economy principles outlined by the NSW EPA are:

4. Sustainable management of all resources;
5. Valuing resources productivity;
6. Design out waste and pollution;
7. Maintain the value of products and materials;
8. Innovate new solutions for resource efficiency;
9. Create new circular economy jobs; and
10. Foster behaviour change through education and engagement.

The project team can respond to these principles by adopting the waste hierarchy principles presented by the *Waste Avoidance and Resources Recovery Strategy*:

- Avoid and reduce the generation of waste;
- Reuse waste materials;
- Recycle waste materials;
- Recover energy from waste materials; and
- Disposal of waste when there is no reuse or recycling potential.

Both the Green Star – Communities and Green Star – Buildings tool sets out specific requirements that addresses both construction and operation waste, achieving these credits will ensure the project is well positioned to transition to a circular economy.

Any waste management strategies and waste related design initiatives should be developed in accordance with *Better Practice Guide for Waste Management in Multi-unit Dwellings*. Some relevant initiatives are outlined below.

To reduce the rate of municipal solid waste generation, separate recycling chutes should be co-located with regular waste chutes within apartment buildings. The recycling chutes should be easily accessible with clear signage and posters to educate residents on recyclable materials. The chutes could feed into carousels with compactors located in the waste disposal rooms located at ground level.

Individual compost bins can be provided for residents to compost their own food scraps to reduce waste sent to landfill. A precinct wide composting scheme should also be considered, where food scraps and other compostable waste material can be collected and used in various garden areas throughout the development.

Given the large volume of dwellings planned for the Riverwood Renewal project, the current biannual free bulky goods pick up service offered by the City of Canterbury Bankstown would be insufficient and may lead to illegal dumping on footpaths and common areas. Consideration should be given to provide dedicated spaces within each building for residence to dispose of unwanted bulky goods, and residence should be educated on the availability of such spaces to encourage the use of these areas.

A ‘pay-as-you-throw’ system can be implemented on a precinct or building level to place a financial incentive on reducing waste and increasing recycling. A reduction in strata fees in correspondence to the waste generated can be an incentive for the whole community to reduce their waste generation. This option will require much further investigation and consideration into issues such as preventing illegal dumping, the baseline costs for waste management services and coordination with council waste and recycling schemes.

An automated waste collection system made up of underground pipes that transport waste from above-ground disposal locations can be considered on a precinct scale. The waste is collected from a centralised location to be compacted and then transported to a treatment facility. Whilst the initial costs are high, savings can be found in eliminating a dedicated waste storage room, reduced greenhouse gas emissions and air and noise pollution from reduced garbage truck movements and reduced odour and vermin. Further investigation is required to articulate ownership structures, maintenance and collection location.

The detailed design plan should also consider the provision of ‘Return and Earn’ container collection points within the redevelopment to service the community and promote recycling rates for glass bottles, plastic bottles and aluminium cans.

8 Preliminary BASIX Assessment

Building Sustainability Index (BASIX) assessments measure a proposed residential development's sustainability against NSW BASIX targets which are based on the NSW home benchmark average. This requires a building architectural design to be known, which has not been undertaken as part of the master plan stage.

Developers should consider the following items in building design to increase their BASIX scores:

- Central on-site recycled/alternative water supply (i.e. water tanks using roof water);
- Selection of four or greater star rated fixtures for showerheads, toilets, kitchen taps and bathroom taps;
- A hot water recirculation or diversion system;
- Selection of four or greater star rated appliances such as clothes washers, dryers, and dishwashers;
- Install a gas instantaneous hot water system;
- Install energy efficient lighting;
- Provide internal clothes lines, efficient appliances; and
- Include carpark ventilation controls.

9 Sustainable Design Integration

9.1.1 Framework Development

After considerations of the various sustainability context surrounding the Riverwood Renewal project, we suggest that achieving a Communities rating can ensure that Riverwood Renewal project complies with all sustainability related regulations. Table 12 demonstrates how each one of the Green Star – Communities five core principles can be mapped against the guideline and regulation outlined in Section 2 above.

Table 12: Riverwood Renewal Sustainability Framework Alignment

	EP&A ESD Principles				Study Requirements					Other Policies																	
	Precautionary principle	Inter-generational equity	Conservation of biological diversity	Improved valuation, pricing and incentive mechanisms	8.1 Energy use	8.1 GHG Emissions	8.1 Water use and wastewater	8.1 Solid waste	8.1 Integrated water cycle management	United Nations SDGs	NCC	NABERS	NatHERS	GREP	BASIX	SEPP 65	Better Practice Guide for Waste Management in Multi-unit Dwellings	Better Practice Guide for Public Place Recycling	Urban Green Cover in NSW Technical Guidelines	Future Transport 2056	NSW Net Zero Plan Stage 1: 2020-2030	GSC South District Plan	Resilient Sydney Strategy 2018	Canterbury Development Control Plan 2012	Canterbury-Bankstown Connective City 2036	NSW Circular Economy Policy	WARR Strategy
Enhance Liveability																											
Diverse and affordable living	✓	✓								✓						✓						✓	✓	✓	✓		
Healthy, safe and secure communities		✓								✓						✓			✓			✓	✓				
Inclusiveness and cohesiveness		✓								✓						✓				✓		✓	✓				
Community adaptability		✓								✓										✓		✓	✓				

Create Opportunities for Economic Prosperity																											
Education and learning		✓		✓																	✓						
Enhancing employment opportunities				✓						✓											✓	✓				✓	
Investment				✓						✓											✓	✓					
Encouraging innovation				✓						✓									✓		✓	✓				✓	✓
Efficiency and effectiveness	✓			✓						✓	✓			✓	✓	✓	✓	✓	✓		✓			✓		✓	✓
Foster Environmental Responsibility																											
Enhancing our natural environment	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓
Reducing ecological footprint	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓
Embrace Design Excellence																											
Adopting effective planning practices				✓							✓					✓			✓			✓	✓		✓		
Encouraging integrated design			✓								✓	✓	✓	✓	✓	✓			✓			✓	✓				
Maintaining flexible and adaptable approaches	✓	✓		✓							✓											✓					
Desirable places												✓	✓		✓	✓			✓			✓			✓		
Promoting accessibility	✓	✓														✓				✓		✓	✓		✓		
Demonstrate Visionary Leadership and Strong Governance																											
Coordinated and transparent approaches											✓	✓		✓	✓	✓							✓				
Commitment to implementation										✓		✓	✓		✓												
Stakeholder engagement																				✓		✓	✓		✓		

Sustainable cultures and behaviours	✓	✓								✓				✓	✓				✓			✓			✓		
Encouraging and rewarding innovation				✓							✓	✓	✓			✓											

9.1.2 Sustainability Framework – Riverwood Renewal Project

Table 13 demonstrates how the master plan responds to the Green Star – Communities five core principles and proposes future considerations to ensure alignment.

Table 13: Sustainability Framework – Riverwood Renewal Project

Green Star – Communities core principles	Master Plan Response	Suggested Actions to Ensure Integration With ESD Principles
Enhance Liveability		
Providing diverse and affordable living	• Five key housing typologies have been developed specifically to reinforce the desired future character of each residential precinct on the site; and • The building types proposed have been developed to cater for a culturally diverse population with differing lifestyles and include generous provisions for a range of communal open spaces.	• Maintain master plan development requirement.
Creating healthy, safe and secure communities	• Communal open space will provide residential with safe, accessibility, and high quality landscaped open space within the perimeter of the development lot; and • Facilities within the communal spaces can range from informal seating areas to barbeque and dining amenity.	• Maintain master plan development requirement.
Fostering inclusiveness and cohesiveness	• A diverse range of open spaces and housing typologies have been developed to cater for the community.	• Maintain master plan development requirements.
Building community adaptability		• Include building accessibility in detailed design for people with disabilities.
Create Opportunities for Economic Prosperity		
Promoting education and learning	• The master plan provides for a childcare centres. Increase in population will also trigger improvements to the Riverwood public school.	• Identify mechanisms to create community led organisations to program community spaces to maintain inclusive community engagement.
Enhancing employment opportunities	• Riverwood being strategically located within 30 minutes of existing employment, health, education and recreational facilities, in Bankstown, Hurstville, Sydney Airport and the City, can build on this vision, delivering increased housing within easy access of jobs and services.	• Maintain master plan development requirements.
Attracting investment	• A re-shaped streets network will create a more robust road network to support the increased density and a diverse range of dwelling types and building uses; and • Removal of dead-end streets and adding new streets will allow for better traffic flow and community mobility.	• Maintain master plan development requirements.

Green Star – Communities core principles	Master Plan Response	Suggested Actions to Ensure Integration With ESD Principles
Encouraging innovation	• New retail areas will facilitate new business opportunities to enhance competitiveness and innovation.	• Consider GBCA Innovation Challenges. (e.g. Incorporation of Indigenous Design, Smart Precincts, Reconciliation Action Plan).
Promoting efficiency and effectiveness		• Consider full electrification of the development. (i.e., eliminating the use of natural gas and require developers to design buildings with heat pumps and install electric stovetops). • Consider implementing precinct wide energy efficient street lighting. • Embed circular economy principles and investigate possible initiatives outlined in Section 4 into corresponding waste management strategy to be developed.
Foster Environmental Responsibility		
Enhancing our natural environment	• The draft master plan identifies new open space to support the future population, including a new central park close to the Riverwood Local Centre.	• Maintain master plan development requirements.
Reducing ecological footprint	• New network of connected open spaces promotes active walking; and • Master plan extends road cycle paths to encourage active transport.	• Consider electrical services sizing to facilitate transition away from fossil fuels-based energy sources; and • Incorporate Passivhaus design principles into building designs.
Embrace Design Excellence		
Adopting effective planning practices		• Maintain master plan development requirements
Encouraging integrated design	• The master plan creates multiple corridors to enable easier access to key site to encourage community connectedness.	• Consider implementing precinct scale solutions such as embedded networks, precinct wide water recycling systems to reduce operating cost and promote a sense of place.
Maintaining flexible and adaptable approaches	• The master plan allocates part of the site for mixed use zoning to allow for a range of residential, retail or commercial uses.	• Maintain master plan requirements.
Creating desirable places	• Proposed new open space, including Play Street, will provide 2.4 ha of new high quality public open space for residents, the Riverwood community and visitors to enjoy.	• Maintain master plan requirements.
Promoting accessibility	• Existing streets are widened to facilitate better traffic flow; • The site is located 5-15 minutes' walk from Riverwood Train Station and provides direct access to Central station within 30 minutes; and • The site is serviced by several local bus routes, with the 944 service that runs through the site.	• Maintain master plan requirements.
Demonstrate Visionary Leadership and Strong Governance		
Establish coordinated and transparent approaches	• The DPIE and local Council will review the Study to confirm all requirements are addressed; and	• Maintain master plan requirements.

Green Star – Communities core principles	Master Plan Response	Suggested Actions to Ensure Integration With ESD Principles
	• As part of the State Significant Precinct process, the proposal will be placed on public exhibition for community feedback and consultation.	
Build a commitment to implementation		• Consider embedding Green Star Buildings and NABERS for Apartments into requirements to ensure continual sustainability outcomes are achieved in design and construction and operation.
Engaging with stakeholders	• The development will undertake a program of consultation with government agencies and the public; and • The Study will be exhibited to the public for community feedback and consultation.	• Maintain master plan requirements.
Fostering sustainable cultures and behaviours		• Provide sustainability workshops to showcase and educate the community and stakeholders on the development's sustainability.
Encouraging and rewarding innovation	• New network of connected open spaces promotes walking; and • Master plan extends road cycle paths to encourage active transport.	• Maintain master plan requirements.

10 Recommendations

From the assessment in Sustainability Framework – Riverwood Renewal Project and in consideration of the sustainability context around Riverwood Renewal project outlined in Section 2, we recommend the following at this planning stage for best alignment with and ensure future sustainability related targets are met.

10.1 Aim to Achieve a 5-star Green Star – Communities v1.1

Green Star – Communities is considered by the industry as one of the best practice frameworks for integration of sustainability in large scale urban developments. In consideration of the range of sustainability related regulations and initiatives in Section 2 Sustainability Context, we recommend Riverwood Renewal aim to achieve a 5-star rating under the Green Star – Communities v1.1 tool. We believe it is the most holistic approach to the redevelopment and provides a framework to address key issues such as energy use, greenhouse gas emissions, water use, wastewater, solid waste and climate change resilience.

10.2 Aim to Achieve 5-star Green Star – Buildings v1

Green Star – Buildings is the latest rating system released by the GBCA to certify new buildings and major refurbishments. We recommend residential towers and townhouses in the redevelopment aim to achieve a 5-star rating under the Green Star – Buildings v1. The new tool not only addresses key issues such as energy use, greenhouse gas emissions, water use, wastewater, solid waste and climate change resilience, but it also provides a pathway for buildings to achieve net zero carbon in operations, steering the redevelopment towards a net zero carbon precinct outcome.

10.3 NABERS for Apartment Buildings

NABERS for Apartment Buildings measures a building's energy and water performance based on the energy use of shared service such as reception areas, car parks, lobbies and heating and cooling services. We recommend NABERS for Apartment ratings to be managed by strata or building management for all eligible buildings in the redevelopment to drive energy and water savings during building operation.

10.4 BASIX Energy and Water

BASIX sets sustainability targets related to energy, water and thermal comfort based on information provided about the design of the development. Through installation of energy and water efficient appliances, optimised common area and apartment designs, onsite renewable energy generation, we believe exceeding the statutory BASIX energy and water score is reasonable and achievable, and recommend dwellings to aim to achieve scores beyond this.

10.5 Precinct Wide Energy Distribution

A precinct wide energy distribution network by connecting multiple buildings PV system can improve energy resilience, load balancing and reduce energy bills. For Riverwood Renewal project, we recommend investigating the option to connect these systems and early engagement with utilities companies to discuss the feasibility of these options.

10.6 Electrical Infrastructure

To support the transition to a net zero carbon precinct for Riverwood Renewal project, we recommend investigating the option of removing gas boilers and stovetops and install electric heat pumps and induction cooktops as an alternative. This will ensure the precinct will be well positioned to become net zero carbon once the electricity grid is decarbonised.

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