ARUP

Transport for New South Wales

Redfern North Eveleigh Precinct Renewal Project

Environmental Sustainability Report

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Document verification

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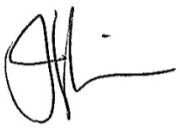
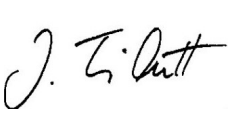
		Signature			

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Contents

Historic Paint Shop Interior

Executive Summary

The Redfern North Eveleigh Paint Shop sub-precinct (the Precinct) is being investigated for rezoning through the State Significant Precinct (SSP) process. The Minister for Planning has issued, through the Department of Planning and Environment, a set of SSP Study Requirements identifying specific actions and elements to be studied as part of the rezoning process. These requirements are detailed in Section 8 *Environmental Sustainability, Climate Change and Waste Management* of the SSP Study Requirements report. This Environmental Sustainability report responds to the relevant Study Requirements.

The Precinct is part of the broader Redfern North Eveleigh Precinct, which is adjacent to Redfern Station, one of the busiest train stations in NSW. The precinct comprises three sub-precincts: the Paint Shop sub-precinct; the Carriageworks sub-precinct; and the Clothing store sub-precinct. This Environmental Sustainability report is specific only to the Paint Shop sub-Precinct.

The SSP study requirements outline a number of requirements, and initiatives and outcomes for consideration in relation to four key sustainability themes:

1. Energy & Greenhouse Gas Emissions
2. Water
3. Solid Waste
4. Climate Change and Microclimate

The report describes the principles and objectives for these sustainability themes, in line with relevant global, national, and local policies and guidelines. These principles and objectives have also been informed by recent industry trends and drivers and the existing site's opportunities and constraints.

In consideration of the Precinct's early development stage, the report outlines potential scenarios that would achieve the desired sustainability outcomes through a number of different design, technology, construction, or management initiatives throughout the Precinct's next development stages. A number of initiatives have already been integrated as part of this proposal. Where initiatives require a greater level of design resolution and certainty about the Precinct's future governance and ownership structures, these have been noted as options for future consideration.

As a result, the report outlines the development's impact in relation to the four key sustainability themes noted above. It recommends respective performance benchmarks and design guidelines in line with current best practice industry standards. These benchmarks and guidelines exceed the previous Concept Plan approval from 2008 and in summary commit to formal future certification under the following sustainability rating schemes and performance outcomes:

- Green Star Communities – 5 Star rating
- Green Star Buildings – 5 Star rating
- BASIX targets – exceed by 10%
- NABERS Energy – 5.5 Star rating
- NAERS Water – 4 Star rating

A more detailed list of proposed benchmarks in relation to the key sustainability themes and their applicability to different building and development typologies is provided in Section 7 *Implementation Plan* of this report.

1 Introduction

The NSW Government is investing in the renewal of the Redfern North Eveleigh Precinct to create a unique mixed-use development, located within the important heritage fabric of North Eveleigh. The strategic underpinning of this proposal arises from the Greater Sydney Region Plan and District Plan. These Plans focus on the integration of transport and land use planning, supporting the creation of jobs, housing and services to grow a strong and competitive Sydney.

The Redfern North Eveleigh Precinct is one of the most connected areas in Sydney, and will be a key location for Tech Central, planned to be Australia's biggest technology and innovation hub. Following the upgrading of Redfern station currently underway, the Precinct's renewal is aimed at creating a connected destination for living and working, and an inclusive, active and sustainable place around the clock.

- The Redfern North Eveleigh Precinct comprises three Sub-Precincts, each with its own distinct character:
- The Paint Shop Sub-Precinct which is the subject of this rezoning proposal;
- The Carriageworks Sub-Precinct, reflecting the cultural heart of the Precinct where current uses will be retained; and
- The Clothing Store Sub-Precinct which is not subject to this rezoning proposal.

This State Significant Precinct (SSP) Study proposes amendments to the planning controls applicable to the Paint Shop Sub-Precinct to reflect changes in the strategic direction for the Sub-Precinct. The amendment is being undertaken as a State-led rezoning process, reflecting its status as part of a State Significant Precinct located within the *State Environmental Planning Policy (Precincts - Eastern Harbour City) 2021*.

The amended development controls will be located within the City of Sydney Local Environmental Plan. Study Requirements were issued by NSW Department of Planning and Environment (DPE) in December 2020 to guide the investigations to support the proposed new planning controls.

1.1 Purpose of this report

The purpose of this report is to provide a detailed Environmental Sustainability assessment of the proposed changes and consider any potential impacts that may result within and surrounding the Paint Shop sub-precinct. This report addresses study requirement Number 8 *Environmental Sustainability, Climate Change and Waste Management.* The relevant study requirements, considerations and consultation requirements, and location of where these have been responded to is outlined in Table 1 below.

Table 1 - Study requirements, considerations, and consultation requirements

Ref.	Study requirement	Section (and page number) of this report
8. Environmental Sustainability, Climate Change and Waste Management		
Study requirements		
1	Identifies the existing situation, including constraints, opportunities, and key issues	Sections 3-5 (Pages 12-24)
2	Outlines the likely impacts of the proposal in relation to energy use, greenhouse gas emissions, water use, wastewater, solid waste, and climate change resilience	Sections 8.3, 9.2, 10.2 and 11.2, Appendix 3 and 4, and

Ref.	Study requirement	Section (and page number) of this report
		Table 12
3	Provides detail of proposed sustainability principles and how they will be incorporated into the proposal	Section 6.1 (Identification) and 7 (Incorporation)
4	Includes an integrated water cycle management strategy	Section 9.3
5	Includes an integrated waste management strategy that maximises resource recovery	Section 10.3
6	Includes measures to address the impact of climate change including urban heat and extreme weather events	Section 11.3
7	Identify appropriate sustainability benchmarks for each development type within the precinct	Section 7.3
8	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	Section 7.4
Considerations		
1	The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings	Section 8.4
2	Strategies to achieve 100% renewable energy supply for the precinct including maximising on-site generation and securing a supply of off-site renewable electricity	Section 8.4.1-8.4.5
3	How sustainability principles will be incorporated into the design, construction, and ongoing operation phases of the redevelopment to achieve sustainability best practise initiatives	Section 7
4	High benchmark sustainability performance targets for the precinct	Section 7
5	Compliance with BASIX and opportunities to deliver beyond BASIX scores	Section 8.4.3, 8.4.4 and 9.3
6	The incorporation of Green Roofs, Cool Roofs and Green Walls into the design of any future buildings	Section 7 and 11.3
7	Climate change, including the urban heat island effect, changing temperatures and rainfall patterns	Section 11.3
8	Taking a whole-of-life- approach to sustainability through planning design, construction, and ongoing precinct management	Section 7 and 8.4.6
9	Maximising resource efficiency to contribute to net zero emissions by 2050	Section 7, 8.4.7, and 8.4.8
10	Water, wastewater, and stormwater plus options for potential alternative water supply including potential to achieve a water positive precinct	Section 9.3

Ref.	Study requirement	Section (and page number) of this report
11	Opportunities for and assessment of the feasibility of a precinct-scale recycled water scheme including the possibility	Section 9.3
12	Precinct scale measures to ensure effective operational waste management	Section 10.3
Consultation		
1	Consultation with the City of Sydney (5th October 2021)	Appendix 7
2	Consultation with the Department of Planning and Environment (25th October 2021)	Appendix 8

1.2 Redfern North Eveleigh Precinct

The Redfern North Eveleigh Precinct is located approximately 3km south-west of the Sydney CBD in the suburb of Eveleigh (refer to **Figure 1**). It is located entirely within the City of Sydney local government area (LGA) on government-owned land. The Precinct has an approximate gross site area of 10.95 hectares and comprises land bounded by Wilson Street and residential uses to the north, an active railway corridor to the south, residential uses and Macdonaldtown station to the west, and Redfern station located immediately to the east of the Precinct. The Precinct is also centrally located close to well-known destinations including Sydney University, Victoria Park, Royal Prince Alfred Hospital, the University of Technology Sydney, and South Eveleigh, forming part of the broader Tech Central District.

The Precinct is located within the State Heritage-listed curtilage of Eveleigh Railway Workshops and currently comprises the Platform Apartments with 88 private dwellings, Sydney Trains infrastructure and key state heritage buildings including the Paint Shop, Chief Mechanical Engineer's Building, and the Carriageworks and Blacksmith Shop which provide shared community spaces for events including the Carriageworks Farmers Markets.

A map of the Precinct and relevant boundaries is illustrated in **Figure 2**.

Figure 1 Location plan of Redfern North Eveleigh precinct (Source: Ethos Urban)

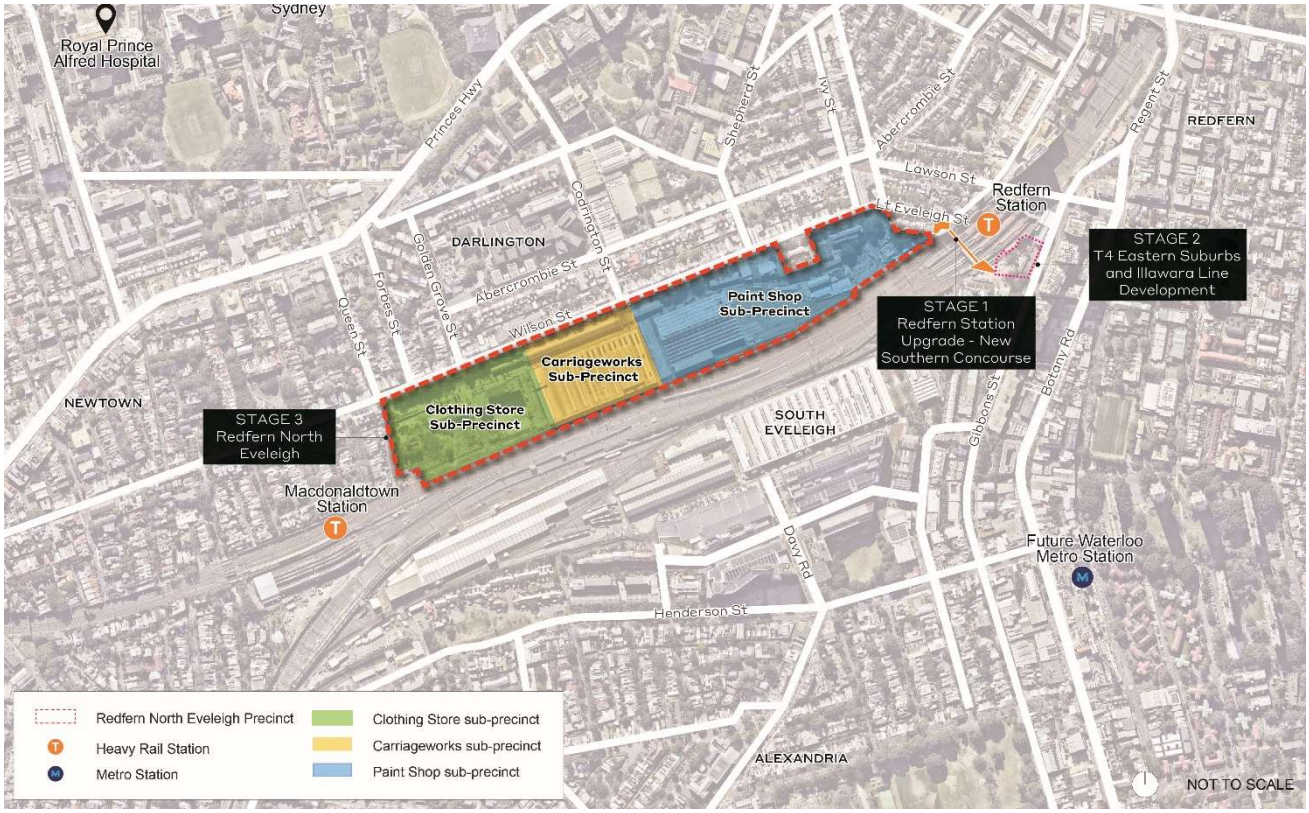


Figure 2 Redfern North Eveleigh and sub-precincts (Source: Ethos Urban)

1.3 Redfern North Eveleigh Paint Shop Sub-Precinct

The Redfern North Eveleigh Paint Shop Sub-Precinct is approximately 5.15 hectares and is bounded by Wilson Street to the north, residential terraces and Redfern station to the east, the Western Line rail corridor to the south and the Carriageworks Sub-Precinct to the west. The Sub-Precinct has a significant level change from a Reduced Level (RL) height of RL25 metres to RL29 metres on Wilson Street.

The Paint Shop Sub-Precinct currently hosts a number of items of heritage significance, including the Paint Shop Building, Fan of Tracks, Science Lab Building, Telecommunications Building, and Chief Mechanical Engineer's Building. The Sub-Precinct has a number of disused spaces adjacent to the rail corridor as well as functioning Sydney Trains' infrastructure, offices and operational space. Vehicle and pedestrian access to this area is used by Sydney Trains. The site has a clear visual relationship to South Eveleigh and the Eveleigh Locomotive Workshops across the active rail corridor.

A map of the Paint Shop Sub-Precinct and relevant boundaries is illustrated in **Figure 2**.

1.4 Renewal Vision

The Redfern North Eveleigh Paint Shop Sub-Precinct will be a connected centre for living, creativity and employment opportunities that support the jobs of the future, as well as providing an inclusive, active and sustainable place for everyone, where communities gather.

Next to one of the busiest train stations in NSW, the Sub-Precinct will comprise a dynamic mix of uses including housing, creative and office spaces, retail, local business, social enterprise and open space. Renewal will draw on the past, adaptively re-using heritage buildings in the Sub-Precinct and will acknowledge Redfern's existing character and particular significance to Aboriginal peoples, culture and communities across Australia. The Sub-Precinct will evolve as a local place contributing to a global context.

2 Proposal

2.1 Project description

An Urban Design and Public Domain Study has been prepared to establish the urban design framework for the Redfern North Eveleigh Paint Shop Sub-Precinct. The Urban Design and Public Domain Study provides a comprehensive urban design vision and strategy to guide future development of the Sub-Precinct and has informed the proposed planning framework of the SSP Study.

The Urban Design Framework for the Paint Shop Sub-Precinct comprises:

- Approximately 1.4 hectares of publicly accessible open space, comprising:
  - A public square – a 7,910 square metre public square fronting Wilson Street;
  - An eastern park – a 3,871 square metre park located adjacent to the Chief Mechanical Engineer's Building and the new eastern entry from Platform 1 of the Redfern station; and
  - Traverser No1 - a 2,525 square metre public square edged by Carriageworks and the Paint Shop.
- Retention of over 90% of existing high value trees.
- An overall greening coverage of 40% of the Sub-Precinct.
- A maximum of 142,650 square metre gross floor area (GFA), comprising:
  - between 103,700 - 109,550 square metres of gross floor area (GFA) for employment and community facility floor space (minimum 2,500 square metres). This will support approximately 6,200 direct jobs on the site across numerous industries including the innovation, commercial and creative sectors.
  - between 33,100 - 38,950 square metres of GFA for residential accommodation, providing for between 381 and 449 new homes (including 15% for the purposes of affordable housing).
- New active transport infrastructure and routes to better connect the Paint Shop Sub-Precinct with other parts of Tech Central and the surrounding localities.
- Direct pedestrian connections to the new Southern Concourse at Redfern station.
- Residential parking rates, comprising:
  - Studio at 0.1 per dwelling
  - 1 Bed at 0.3 per dwelling
  - 2 Bed at 0.7 per dwelling
  - 3 Bed at 1.0 per dwelling
- Non-residential car parking spaces (including disabled and car share) are to be provided at a rate of 1 space per 700 square metres of GFA.
- 66 car spaces are designated for Sydney Trains maintenance and operational use.

The key features of the Urban Design Framework, include:

- The creation of a new public square with direct pedestrian access from Wilson Street to provide a new social and urban hub to promote outdoor gatherings that will accommodate break out spaces and a pavilion structure.
- An eastern park with direct access from Redfern station and Little Eveleigh Street, which will provide a high amenity public space with good sunlight access, comfortable wind conditions and community character.

- Upgraded spatial quality of the Traverser No1 yard, retaining the heritage setting, and incorporating complementary uses and good access along Wilson Street to serve as a cultural linkage between Carriageworks and the Paint Shop Building.
- The establishment of an east-west pedestrian thoroughfare with new public domain and pedestrian links.
- A range of Water Sensitive Urban Design (WSUD) features.
- Activated ground level frontages with commercial, retail, food and beverage and community and cultural uses.
- Adaptive reuse of heritage buildings for employment, cultural and community uses.
- New buildings for the Sub-Precinct, including:
    - Commercial buildings along the rail corridor that range between 3 and 26 occupied storeys;
    - Mixed use buildings along the rail corridor, comprising a three-storey non-residential podium with residential towers ranging between 18 to 28 occupied storeys;
    - Mixed use buildings (commercial and residential uses) along Wilson Street with a four-storey street wall fronting Wilson Street and upper levels at a maximum of 9 occupied storeys that are set back from the street wall alignment;
    - A commercial building on the corner of Wilson Street and Traverser No.1 with a four-storey street wall fronting Wilson Street and upper levels at a maximum of 8 occupied storeys that are set back from the street wall alignment. There is flexibility to allow this building to transition to a mixed-use building with active uses at ground level and residential uses above; and
    - Potential options for an addition to the Paint Shop Building comprising of commercial uses. These options (all providing for the same GFA) include:
        - A 5-storey commercial addition to the Paint Shop Building with a 3m vertical clearance, with the adjacent development site to the east comprising a standalone 3-storey commercial building (represented in Figure 3);
        - A 3-storey commercial addition to the Paint Shop Building with a 3m vertical clearance which extends and connects to the commercial building on the adjacent development site to the east; and
        - No addition to the Paint Shop Building, with the adjacent development site to the east comprising a standalone 12-storey commercial building.
- Commitment to a 5 Star Green Star Communities rating, with minimum 5 Star Green Star Buildings rating.
- All proposed buildings are below the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) to ensure Sydney Airport operations remain unaffected.

The proposed land allocation for the Paint Shop sub-precinct is described in Table 2 below.

Table 2 - Breakdown of allocation of land within the Paint Shop sub-precinct

Land allocation	Existing	Proposed
Developed area	15,723 sqm / 30% of total site area	20,824 sqm / 40% of total site area
Public open space	Area not publicly accessible	14,306 sqm / 28% of total site area

Land allocation	Existing	Proposed
Other public domain areas (including streets, shared zones, pedestrian paths and vehicular zones)	Area not publicly accessible	15,149 sqm / 29% of total site area (Excludes privately accessible public links and private spaces ~ 3% of total site area)

The Indicative Concept Proposal for the Paint Shop sub-precinct is illustrated in **Figure 3** below.

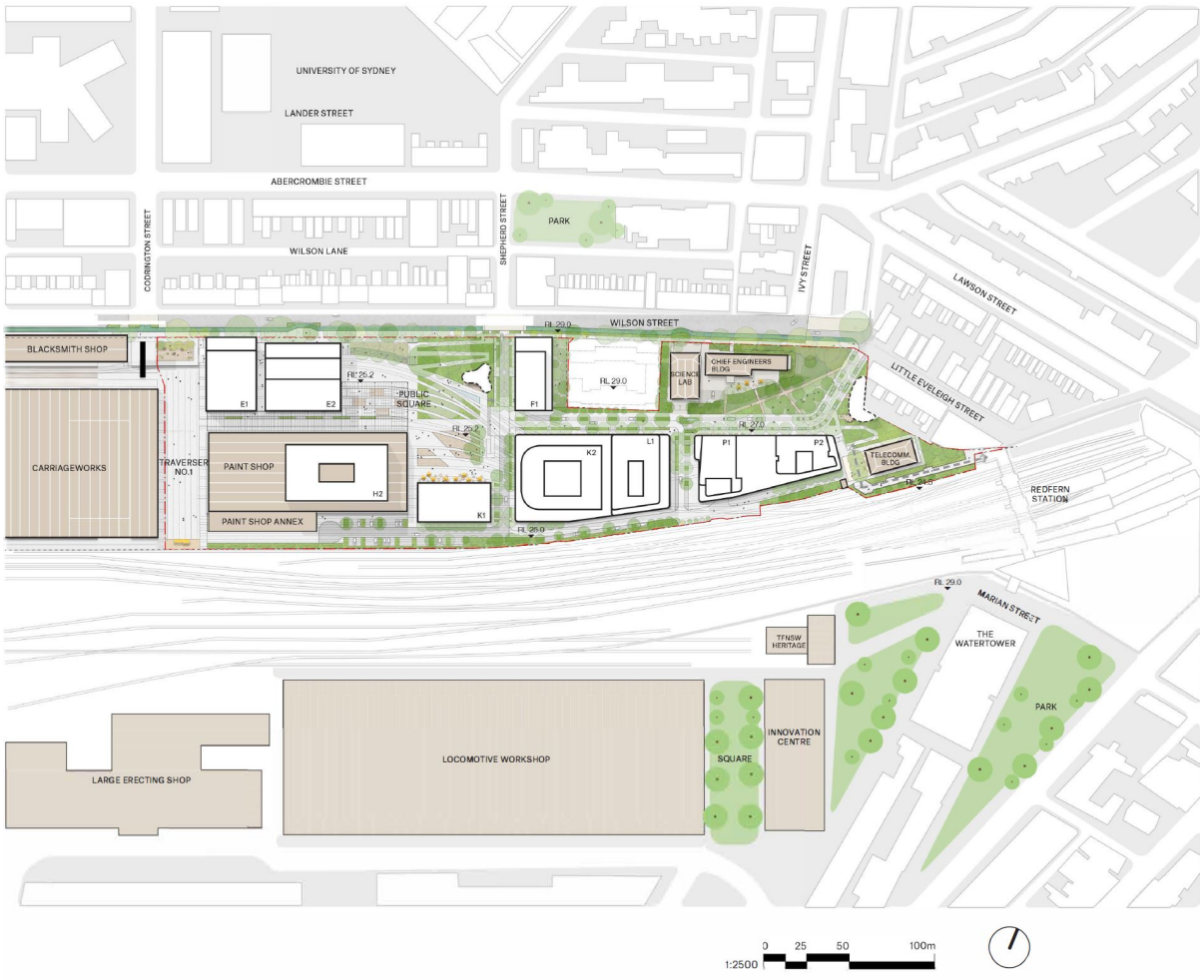


Figure 3 - Indicative Concept Proposal (Source: Bates Smart and Turf)

3 Site History

This section details the site history including existing approvals, constraints, opportunities, key issues, and strategic vision. The following SSP study requirements are being addressed as part of this section:

Requirement:

- *"Identifies the existing situation, including constraints, opportunities, and key issues;"*

The Precinct is located on Gadigal Country within the wider Redfern -Waterloo Authority (RWA) Sites State Significant Precinct in the City of Sydney Council. RWA's operational area includes the suburbs of Darlington, Redfern, Waterloo, and Eveleigh, with Redfern being 'one of the most significant sites of contemporary Aboriginal Australia'[1]. The Precinct is 10 hectares of government-owned land located at the southern edge of Redfern Station, between the rail corridor and Wilson Street.

Formerly known as the Eveleigh Carriage Workshops, the site functioned as a carriage workshop for almost 100 years and was integral to the development of the surrounding suburbs. In 1989, railway carriage production ceased and since that time the site has been used for the storage of railway carriages, machinery, and a range of moveable items[2]. Since 2002, the Carriageworks has been a multi-arts urban cultural precinct and showcases contemporary art and performing arts, as well as being used for filming, festivals, fairs, and commercial exhibitions.

Arup understands that the NSW Government is investing in the renewal of the Precinct to create a unique mixed-use development within the important heritage fabric of North Eveleigh. The Precinct will be opened up to create homes for new residents including affordable housing, spaces for the jobs of the future, opportunities for local business and retail, and enrich existing communities through social and cultural spaces.

Development of this Precinct has been under consideration since 1971 when strategic plans identified Central to Eveleigh for an expansion of the Sydney CBD. In 2005, the NSW Government established the Redfern-Waterloo Authority (RWA) and the RWA Built Environment Plan (Stage One) was subsequently developed in 2006. The Built Environment Plan included considerations of ecologically sustainable design (ESD) principles including:

- Energy efficiency, conservation, and reduction of greenhouse gas
- Applying passive design principles in the orientation and design of development to minimise the need for mechanical heating and cooling and artificial lighting
- Water conservation and grey water reuse
- Efficient waste management, including minimisation and recycling in the demolition, construction, and operational phases of development
- Reduced car dependence; promoting public transport use, cycling, and walking through improved access to public transport; minimising car parking provision and providing facilities for cyclists
- Compliance with BASIX for residential development and SEDA Building Greenhouse Ratings for non-residential buildings

[1] Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework, Balarinji (5/11/2021), pg 13.
[2] (Carriageworks, 2021)

3.1 Concept Plan Approval

In 2008, a Concept Plan for the Precinct was approved by the then Minister for Planning.

The Concept Plan forms the current set of development controls across the Precinct, detailing the future assessment requirements and the proponents Statement of Commitments. These requirements are detailed below.

Schedule 2 – Part C Future Assessment Requirements

C8 ESD and Sustainable Design

(1) The future projects applications for residential development are to demonstrate compliance with the provisions of the State Environmental Planning Policy (Building Sustainability Index: BASXI) 2004
(2) Future project applications are to consider the Water Management Plan of the Environmental Assessment and are to investigate options for reducing potable water consumptions, provision of alternative water supply for non-potable uses, and the use of recycled water.
(3) Future project applications for commercial development are to demonstrate that they achieve a minimum of 4.5 Star ABGR or equivalent Green Star rating

Schedule 3 – Proponent's Statement of Commitments

Sustainability (To be addressed at Project Application Stage)

The proponent commits to:

1. *The achievement of the following sustainability targets, or equivalent minimum:*
   - *Commercial Buildings*
     - *4 Star Green Star (Office Design)*
     - *4.5 Star NABERS Office Energy (Base Building)*
   - *Residential Buildings*
     - *BASIX water consumption benchmark*
     - *BASIX energy consumption benchmark*

   In accordance with the Regulation.
2. *The proponent commits to investigating the achievement of higher targets.*
3. *Non-Potable Water*
   Further assessment will be undertaken into the viability of obtaining an external non-potable water supply.
4. *Further investigate the opportunity for including the following Ecologically Sustainable Development principles:*
   - *Design internal apartment layouts to maximise natural ventilation and to capture prevailing winds;*
   - *Utilise roof forms to capture natural light and ventilation;*
   - *Re-use and recycle stormwater;*
   - *Use of high thermal mass materials within apartments;*
   - *Promote the use of alternative energy sources for common areas;*
   - *Ensure natural light and ventilation is provided to common areas to minimise energy consumption;*
   - *Divide the layout of the apartments into zones to reduce heat and cooling energy consumption;*
   - *Reuse of roof water and rainwater run off;*
   - *Utilise low water flow fixtures and tap ware;*
   - *Reuse rainwater for spray irrigation with rain and moisture detector controls; and*
   - *Recycling grey wastewater.*

The development of the Concept Plan also involved:

- Briefings of key stakeholders including the Aboriginal Housing Company, NSW Council of Social Service, Coalition of Aboriginal Agencies under the auspices of the Redfern Aboriginal Authority, The Department of Aboriginal Affairs, and the Aboriginal Housing Office.

- Six interviews with individual local Aboriginal people.

- A preliminary Aboriginal Heritage Assessment undertaken by Paul Irish, Consultant Archaeologist, of two parcels of land adjacent to Wilson Street within the north-eastern corner of Part Lot 4 DP 862514.

The Concept Plan recommended the preparation of an Aboriginal impact assessment for the small areas of land adjacent to Wilson Street.

3.2 Central to Eveleigh Sustainability Strategy Report

In 2015, UrbanGrowth NSW (now Sydney Metropolitan Development Authority) released the Central to Eveleigh Sustainability Strategy Report. The report provides an assessment of the potential of the Central to Eveleigh Framework Plan (May 2015) and identifies key sustainability and infrastructure interventions that will deliver the Central to Eveleigh corridor as a world class urban renewal. The four key themes explored were:

- Accessible and connected
- Environmentally sustainable and responsive
- Affordable housing and living
- Resilient community

3.3 Central to Eveleigh Urban Transformation Study

In 2016, UrbanGrowth NSW prepared the Central to Eveleigh Urban Transformation Study, which included the development of the Precinct, outlining 10 key actions including greening Sydney, creating centres of activity around stations, and strengthening connectivity for people and places. The strategy particularly noted the opportunity for adaptive re-use of historic buildings the Clothing Store and the Chief Mechanical Engineer's Office as future centres of community activity.

3.4 Existing site opportunities and constraints

Considering the physical, social, and economic factors on the site from a sustainability perspective, there are a number of opportunities where sustainability considerations could enhance value or decrease risks associated with the project.

Table 3: Consideration and potential response to existing physical site opportunities and constraints

Theme	Considerations	Potential response
Country-centered	• Proximity to the heart of 'one of the most significant sites of contemporary Aboriginal Australia' • Five different pathways for connecting with Country across the different stages of the project lifecycle. • The benefits to the local Aboriginal community of a shift from a human-centred to a Country-centred approach in the context of energy and greenhouse gas emissions, water, solid waste and climate change and microclimate.	• Work with the Aboriginal community during future stages to guide the further development of the sustainability principles for the Precinct in line with the recommendations of the Final Connecting With Country Framework [3]. • Leverage the different pathways for connecting with Country during Precinct design, delivery and maintenance to maximise energy efficiency, minimise GHG emissions, integrate water, maximise resource efficiency, and increase resilience to extreme weather. • Consider working with the Aboriginal community during future stages to improve the health of Country[4].

[3] Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework, Balarinji (5/11/2021), pg 30.
[4] Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework, Balarinji (5/11/2021), pg 39.

Theme	Considerations	Potential response
		• Consider working with the Aboriginal community during future stages on shared ways to regenerate Country[5].
Public Transport	• Good proximity to public transport and cycle infrastructure. • Potential constraints on the local vehicle network.	• Optimisation of parking and integration with local public transport and cycling infrastructure. • Prioritisation of pedestrians, cyclists, and other low carbon modes of transport and movement.
Private Transport	• Significant potential uptake of EVs (reflected by NSW Electric Vehicle (EV) Strategy).	• Responding to the future demand for EVs. • Accommodate adequate charging infrastructure for future occupants, staff, and visitors.
Heritage	• The site contains extensive existing heritage assets which provides the potential for reuse, adaptation, and repurposing.	• Use the existing building fabric and infrastructure to reduce material use and embodied carbon emissions. • Retention of heritage can also place constraints on sustainability outcomes; both need to be carefully weighed up.
Existing Trees	• Existing trees across the site require space. • Existing levels to be maintained.	• Retain a significant number of mature trees across the Precinct, contributing to the Precinct's overarching green infrastructure strategy.
Acoustic Comfort	• High levels of potential noise and vibration due to proximity to a major rail corridor. • There are longer term plans to replace diesel trains which may have an effect on acoustic comfort and air quality.	• Physical mitigation measures could include physical barriers, such as sounds walls, or high levels of acoustic insulation/separation paired with mechanical ventilation to all residences.
Outdoor Comfort – Heat and Wind	• Climate changes, particularly extended heat periods and increased wind, could reduce comfort levels of outdoor areas and discourage use.	• Integration of green and blue infrastructure, shading structures, and design initiatives to improve outdoor comfort. • Design built form design to avoid adverse wind impacts.
Flooding and on-site detention requirements	• High risk of flooding due to the low levels of site permeability • Risk that flooding could affect the adjacent rail corridor.	• Opportunities to increase site permeability through Precinct design. • Incorporate Water Sensitive Urban Design (WSUD) initiatives e.g. on-site stormwater detention and use.
Utilities	• There is a limitation to the extent of utility lead-ins.	• Reduce utility demand (energy, water, waste) across the Precinct through a combination of design and operational efficiency initiatives.

[5] Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework, Balarinji (5/11/2021), pgs 40 and 41.

Table 4: Consideration and potential response to of social needs and issues

Theme	Considerations	Potential response
Stakeholder Diversity	• Recognition of the strong Aboriginal history, present and future for the site. • A rich blend of stakeholders occupying and visiting the Precinct, accompanied by different values and needs. • A changing demographic over time.	• Designing with country in line with the connecting with country framework developed for the site. • Recognise the legacy and expectations within the community consultations have occurred over many years. • Recognise and nurture the diversity across the Precinct. • Accommodates for a lively community with a strong identity. • Large heritage spaces at street level to provide community spaces and spaces for indoor recreation.
Country-centred	• Proximity to the heart of 'one of the most significant sites of contemporary Aboriginal Australia' • An approach that supports the right of Country to be cared for. • An approach that prioritises Aboriginal people's relationship to Country, financial and economic benefits to the Country, and the local, place-specific cultural identity of the Country. • An approach that shares tangible and intangible benefits with the Country and the Traditional Custodians of that Country, including current and future generations. • An approach that prioritises recognition and responsibility of Aboriginal people. • An approach that supports Aboriginal people continue their practices of managing land, water, and air.	• Leverage the different pathways for connecting with Country during future stages of the development of the Precinct as set out in the Final Connecting With Country Framework[6].
Public Safety and Security	• Ensure public safety and security needs will be met.	• The provision of high quality, comfortable, and resilient outdoor spaces that enhance public safety and security.
Increased Traffic Congestion	• Increased density leading to more traffic congestion across the site and adjacent neighbourhoods.	• Promote alternative transport modes, such as walking, cycling, and the use of public transport. • Design initiatives that prioritise the use of these different transport modes.
Affordable Housing	• The regional need for affordable housing.	• Sustainable design and development that reduces energy and water consumption. • Enhanced access to low-cost transport. • Consider the benefits to Country, culture and language, family and community due to the provision of affordable housing on Country during future stages of the Precinct development.
Limited Open Spaces	• The limited potential for large open space within the precinct daws careful consideration of the quality and adaptability for the places defined.	• Balance existing heritage with new open spaces. • Consider the benefits of the reinstatement of cultural landscapes to Country, culture and language, family and community during future stages of the Precinct development. • Design for high quality and adaptable public domain to meet multigenerational and multicultural needs through days and years.

[6] Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework, Balarinji (5/11/2021).

Table 5: Consideration and potential response to policy requirements

Theme	Considerations	Potential response
Heritage	• The NSW Heritage Act guides the development of the Precinct, including the extent of heritage fabric to be retained.	• Improve the efficiency of building envelopes where possible. • Utilising heritage fabric to reduce the embodied emissions associated with building new structures.
Development objectives	• Achieving an appropriate balance between development and the availability of open spaces and tree canopy coverage.	• Provide green infrastructure through greening of roofs and walls. • Enable public accessibility to these spaces.
Car Parking	• Market expectations and policy ambitions for low to no on-site parking provisions.	• Offer and promote alternative transport modes. • Leverage the location next to Redfern station. Easy access to public transport. • Provide safe and pleasant cycling infrastructure. • Promote walking across and beyond the Precinct.
100% Renewable Energy	• Demonstrating 100% renewable energy supply at the rezoning stage.	• Locking in a sensible built form (e.g. orientation and overshadowing). • Commitments to future energy efficiency targets. • Commit to an all-electric precinct so all energy demand to be met by renewable sources. • Dedication of roof spaces to photovoltaics.

3.5 Transport for NSW Strategic Vision

In March 2021 Transport for NSW (Transport) released a Strategic Vision to guide the renewal of the Precinct. Arup agrees with the vision for the project, which is to create *a connected centre for living, creativity and employment opportunities that support the jobs of the future. An inclusive, active, and sustainable place for everyone, where communities gather. The Precinct will comprise a dynamic mix of uses including housing, creative and office spaces, retail, local business, social enterprise, and open space.* The principles guiding the renewal include:

- Great place for community
- Jobs for the future
- Creative
- Aboriginal past, present, and future
- Culture and history
- Connected people and places

4 Policy Context

This section covers the global, national, state, and local policy context as it relates to the Study Requirement. The following SSP study requirements are being addressed as part of this section:

Requirement:

- *"Identifies the existing situation, including constraints, opportunities, and key issues;"*

To ensure alignment with government and community objectives and expectations, the following section lists the international, national, state, and local policy drivers. This informs and influences the sustainability benchmarks, design strategies, and sustainable outcomes identified for Redfern North Eveleigh Paint Shop sub-precinct. For a more detailed review of these policies and their relevance to the Precinct refer to Appendix 1.

National and International Context

- United Nation Sustainable Development Goals
- Paris Agreement
- Climate Active Carbon Neutral Standard
- Sustainability Ratings: NABERS, NatHERS, Green Star (Buildings & Communities)
- United Nations Declaration on the Rights of Indigenous Persons[7]
- National Partnership Agreement on Closing the Gap (2019-2029)[8]

NSW State Context and Guidelines

- Transport for NSW Environment and Sustainability Policy
- Environmental Planning & Assessment Act and Regulation
- Net Zero Plan Stage 1 2020-2030
- NSW Electric Vehicle Strategy
- NSW Circular Economy Policy Statement
- NSW Waste and Sustainable Materials Strategy 2041
- Building Sustainability Index (BASIX)
- SEPP 65 and the Residential Apartment Design Guide
- Future Transport Strategy 2056
- Better Practice Guide for Resource Recovery in Residential Development
- NSW Climate Change Framework
- NSW and ACT Regional Climate Modelling
- The Australian Guidelines for Water Recycling: Managing Health and Environmental Risks

[7] Refer to Appendix 1 – Policy Context for rationale for inclusion.

[8] Refer to Appendix 1 – Policy Context for rationale for inclusion.

- Government Resource Efficiency Plan
- Better Placed: Draft Connecting With Country Framework[9],
- NSW Aboriginal Land Rights Act (ALRA) 1983
- Transport for NSW Reconciliation Action Plan (RAP) July 2019- July 2021

Regional Controls and Guidelines

- Greater Sydney Region Plan and Eastern District Plan

Local Plans

- City of Sydney Sustainable Sydney 2030
- City of Sydney City Plan 2036
- Planning for Net Zero Energy Buildings
- City of Sydney Policy for Waste Minimisation in New Developments
- City of Sydney Leave nothing to waste – Managing resources in the City of Sydney Area. Waste strategy and action plan 2017-2030
- City of Sydney Development Control Plans

[9] Better Placed: Draft Connecting With Country Framework, Government Architect New South Wales, Issue no. 01-2020 – Draft for Discussion

5 Industry Trends and Drivers of Change

This section outlines some key trends and market and industry drivers. The following SSP study requirements are being addressed as part of this section:

Requirement:

- *"Identifies the existing situation, including constraints, opportunities, and key issues;"*

There are a number of market and industry drivers that will influence and act upon the overall outcome of the Precinct from an energy, water, waste and Country-centred perspective. These come from emerging market innovation, pricing trends, supply constraints, climate change or policy changes, and a shift from human- to Country-centred approaches to sustainability that present either potential opportunities or emerging risks for the Precinct. If considered early, these can be managed to improve the medium- and long-term future for the Precinct and the city from an environmental, social, and economic sustainability perspective. These trends have been considered in setting the strategy and relevant initiatives for the Precinct.

5.1 Energy Prices

Coupled with the NSW Net Zero by 2050 commitment, the Precinct should be considering the risks of gas and, investigate and explore opportunities to transition from gas and towards electrification of the Precinct.

5.2 Grid Electricity Carbon Emissions

Peaking in 2009, emissions in electricity have been falling since 2016, driven by large amounts of renewable generation entering the market and the closure of high emissions intensity power plants such as Hazelwood in Victoria. Over the projections period, emissions are projected to decline from 2020 by 60 Mt CO2-e, reaching 111 Mt CO2-e in 2030. These declines are driven by the projected continued decarbonisation of electricity generation across the country, including the country's largest market, the National Energy Market (NEM). Large deployment of renewables, in particular rooftop solar, form a growing share of generation in the NEM. By 2030, decentralised rooftop solar forms the largest capacity type in Australia, making up around a third of all grid-connected capacity in the country. This sees the emissions intensity of electricity decline over the decade to 2030.

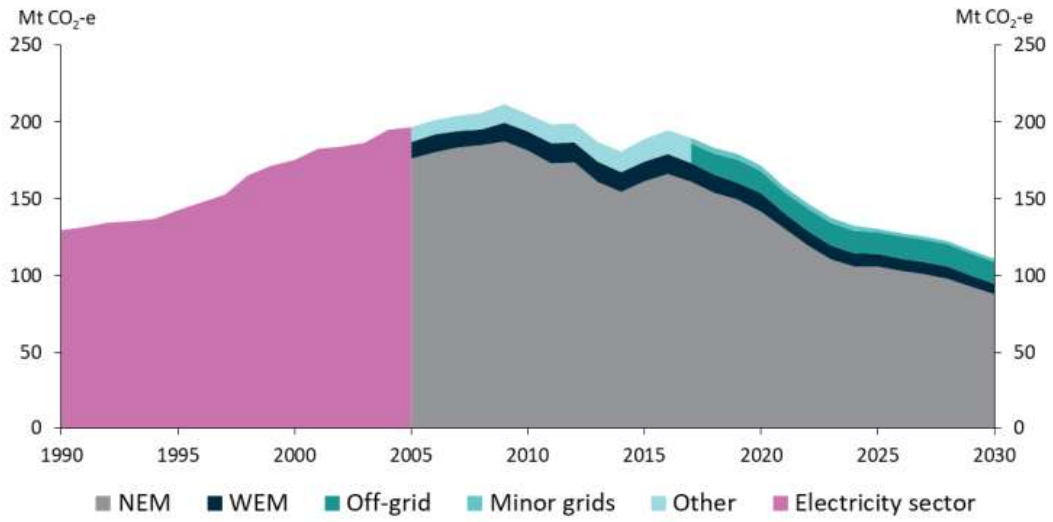


Figure 4: Electricity emissions from 1990 to 2030

With the Paris Agreement setting Australia on a net zero carbon trajectory by 2050, continued reliance on grid electricity under the current projections will leave the wider Precinct exposed to carbon liability. However, there is the opportunity to set the Redfern North Eveleigh Precinct onto an appropriate trajectory to become carbon neutral by 2050 during the early planning stages. See Section 8 of this report for further details.

5.3 Building Codes and Standards

Driven by the Government's commitment to reduce its emissions by 26-28% on 2005 levels by 2030 and the National Energy Productivity Plan, the National Construction Code is expected to increase design stringency under Section J of the Building Code of Australia. The proposed changes are projected to reduce energy consumption of new buildings in the order of 40% for commercial buildings initially. There are a number of changes including new constraints on the allowable window-to-wall ratios, glazing, thermal insulation, and thermal bridging properties. Though currently these are focussed on commercial buildings, these standards are likely to be changed to include other building types and continue driving more stringent standards for buildings in the future.

The proposed update of the National Construction Code (NCC) in 2022 is looking to further increase the energy efficiency which will need to be considered in the development. Early action in the design considerations may enhance the ease of compliance with the new codes.

5.4 Climate Change

The effects of climate change will vary for different regions in both the near (2030) and far future (2070). The predicted changes in extremes for the Precinct (as a part of the Greater Sydney area) include:[10]

- **Average temperature:** Average annual temperatures are expected to increase. In 1995, the average temperature in Sydney was 18.0°C. This is projected to increase to between 19.6°C and 21.1°C in 2070.
- **Heatwaves:** Extreme heat days are expected to increase. This means that heatwaves will become hotter, last longer and be more frequent. In 2015, 3.7 days exceeded temperatures of 35°C. In 2030, this is expected to exceed to 5.8 days and 15 days in 2070.
- **Rainfall:** Natural variability in annual rainfall will continue which includes dry spells, droughts, and wet periods. The number of dry spells are expected to increase, as well as increased rainfall intensities. Heavy rainfall events are likely to increase in frequency. Current 1 in 50-year events will likely become 1 in 20-year events.
- **Air pollution:** Air particulates and ozone are expected to increase. Hospital admissions in Greater Sydney, not just the City of Sydney LGA, due to air pollution are projected to rise by over 200% by 2051 compared to the 1996–2005 baseline.
- **Bushfire condition**s: Bushfire conditions are expected to increase as the climate becomes hotter and drier with the duration of very high fire danger periods expected to increase 10–50%. An increase in bushfires in the areas surrounding Sydney is likely to place strain on essential services and will impact air quality in the city

Consideration of climate change and its impact on the development are part of the study requirements for the Precinct and are discussed further in Section 11 of this report.

5.5 Water Consumption

For Sydney Water, there are a number of potential future consumption scenarios being considered. The chart below presents some of the future water consumption scenarios forecast to 2022 based on existing consumption and projected future consumption. It is important to note that average weather has a significant impact on potable water consumption with dryer weather leading to increased reliance on potable supply as water tanks run out and irrigation increases. Hot weather also has an impact on water consumption. As we move into warmer and more intermittent wet/dry periods this is likely to impact water consumption. The integrated water cycle management stagey will need to consider future changes in water consumption patterns and the design of the water and

[10] Adapting for Climate Change - A long term strategy for the City of Sydney (30.03.2021)

wastewater infrastructure in the Precinct will need to accommodate for these changes. See Section 9 of this report for further information.

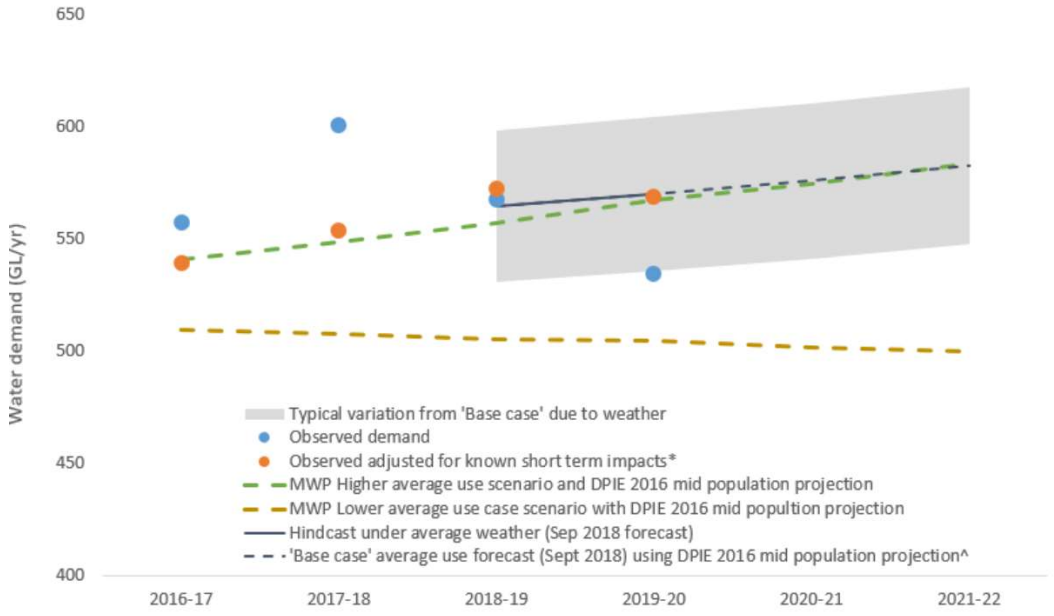


Figure 5: Water consumption future scenarios

5.6 Waste Generation

In 2018-19, Australia generated per capita, the equivalent of 499 kg of municipal waste (MSW), 1074 kg of construction and demolition waste (C&D), 498 kg of fly ash and 871 kg of other commercial and industrial (C&I) waste. Masonry material, organic wastes and fly ash are the largest waste streams, representing nearly two-thirds of waste generated in 2018- 19. Figure 6 below highlights the trend of increased quantities of waste being recycled, however, the figure also shows little change in the quantity of waste to disposal (landfill) generated.

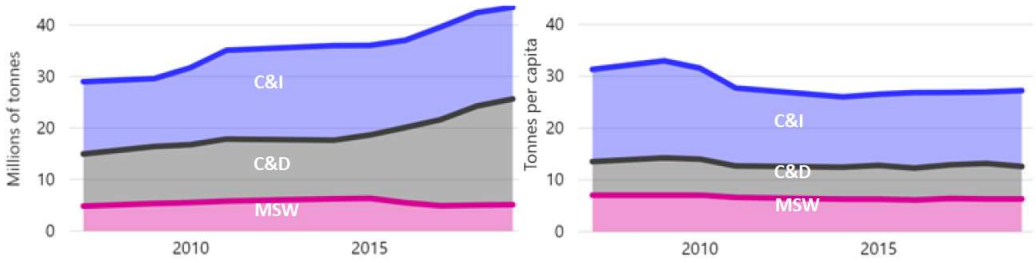


Figure 6: Trends in the recycling (left) and disposal (right) of core waste plus ash by stream, Australia 2006-07 to 2018-19[11]

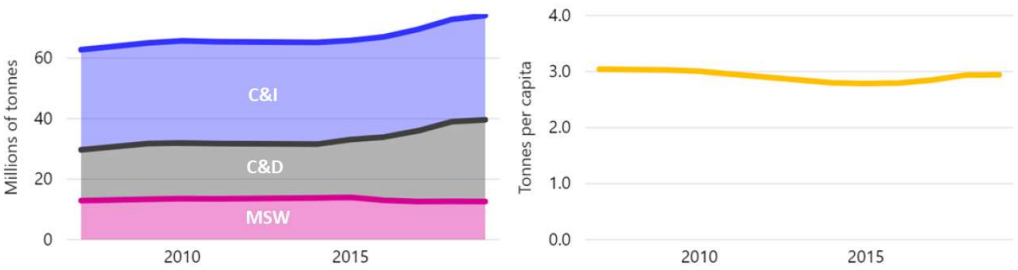


Figure 7: Trends in the generation of waste in tonnes (left) and kg per capita (right), Australia 2006-07 to 2018-19[11]

[11] (Department of Agriculture, Water and the Environment, 2020)

Figure 7 above illustrates the trends in total generation and generation per capita by waste stream. The figure shows that generation rates per capita are remaining stable meaning increases in total generation of waste is driven predominantly by increases in population.

The integrated waste management stage will need to consider future changes in waste generation patterns and the design of waste collection infrastructure in the Precinct will need to accommodate for these changes, as discussed further in Section 10.

5.7 Investment and ESG

Investors are increasingly applying non-financial factors as part of their analysis process to identify material risks and growth opportunities for assets and developments. ESG (Environmental, Social, Governance) metrics, while not mandatory for financial reporting, are increasingly being disclosed as part of regular sustainability reporting.

The Australian Sustainable Finance Roadmap, released in 2020, provides a plan for aligning Australia's financial system with a sustainable, resilient, and prosperous future for all Australians. This roadmap will increase financial accountability and market for more sustainable assets.

The ability of the development to demonstrate that environmental, social, and governance factors have been adequately considered within the design and future operation of the Precinct will likely become a material factor in the access to development finance and investor finance in the medium term.

5.8 Connecting with Country

There is an increasing acknowledgement of the need for Aboriginal and non-Aboriginal peoples 'to work together collectively, respectfully, and with open minds' to develop connections with Country 'to inform the planning, design, and delivery of built environment projects in NSW'[12]. Connecting with Country, by the Government Architect of NSW, sets out a draft framework for 'helping support the health and wellbeing of Country by valuing, respecting, and being guided by Aboriginal people'. By following the Connecting with Country framework, built environment projects will:

- 'reduce the impacts of natural events such as fire, drought, and flooding through sustainable land and water use practices
- value and respect Aboriginal cultural knowledge with Aboriginal people co-leading design and development of all NSW infrastructure projects
- ensure Country is cared for appropriately and sensitive sites are protected by Aboriginal people having access to their homelands to continue their cultural practices'[13]

Central to Connecting with Country is the need for planning and design processes to be 'Country-centred' – considering natural systems as including people, animals, resources, and plants equally – rather than 'Human-centred' – considering animals, resources, and plants as secondary to people.

The framework sets out several pathways for connecting with Country – via cultural expression, relationship with Country, learning from Country, and knowledge-sharing – at every stage of a project life cycle – project formation or 'sensing', project design and conceptualisation or 'imagining', project delivery or 'shaping', and project maintenance or 'caring'.

[12] Better Placed: Draft Connecting With Country Framework, Government Architect New South Wales, Issue no. 01-2020 – Draft for Discussion (page 8).
[13] Better Placed: Draft Connecting With Country Framework, Government Architect New South Wales, Issue no. 01-2020 – Draft for Discussion (page 8).

Connecting with Country will require a holistic approach to the development of the Precinct that supports the right of Country to be cared for; prioritises Aboriginal people's relationship to Country, financial and economic benefits to the Country and the local, place-specific cultural identity of the Country; shares tangible and intangible benefits with the Country and the Traditional Custodians of that Country, including current and future generations; prioritises recognition and responsibility of Aboriginal people; and supports Aboriginal people continue their practices of managing land, water, and air.

6 Sustainable Design Integration

This section introduces the sustainability principles and how they have been incorporated into the proposal. It also provides guidance on sustainability considerations for future stages of the Precinct renewal.

6.1 Principles

This section defines the sustainability principles applied for the proposed planning amendment. The following SSP study requirements are being addressed as part of this section:

Requirement:

- *"Provides detail of proposed sustainability principles and how they will be incorporated into the proposal"*

The sustainability principles for the report were developed in direct response to the themes set out in the Study Requirements under section 8 *Environmental Sustainability, Climate Change and Waste Management* with consideration of practice of sustainability in urban developments. The development of the associated design and project response to these principles was informed by several objectives and requirements including the relevant SSP study requirements (Section 1), site history (Section 3), policy context (Section 4), and industry trends and drivers of change (Section 5).

The Precinct's sustainability principles are formed to address the following four key themes:

- **Energy and Greenhouse Gas Emissions** - Maximise energy efficiency and minimise GHG emissions,
- **Water** - A water positive precinct, with water at the heart of design,
- **Solid Waste** - Maximise resource efficiency and recovery at precinct scale
- **Climate Change & Microclimate** - A precinct that is resilient to extreme weathers and resource constraints

The Precinct's sustainability principles are reinforced through the Precinct's Connecting with Country Framework[14] Statements of Commitment 1 through to 7.

[14]Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework, Balarinji (5/11/2021).

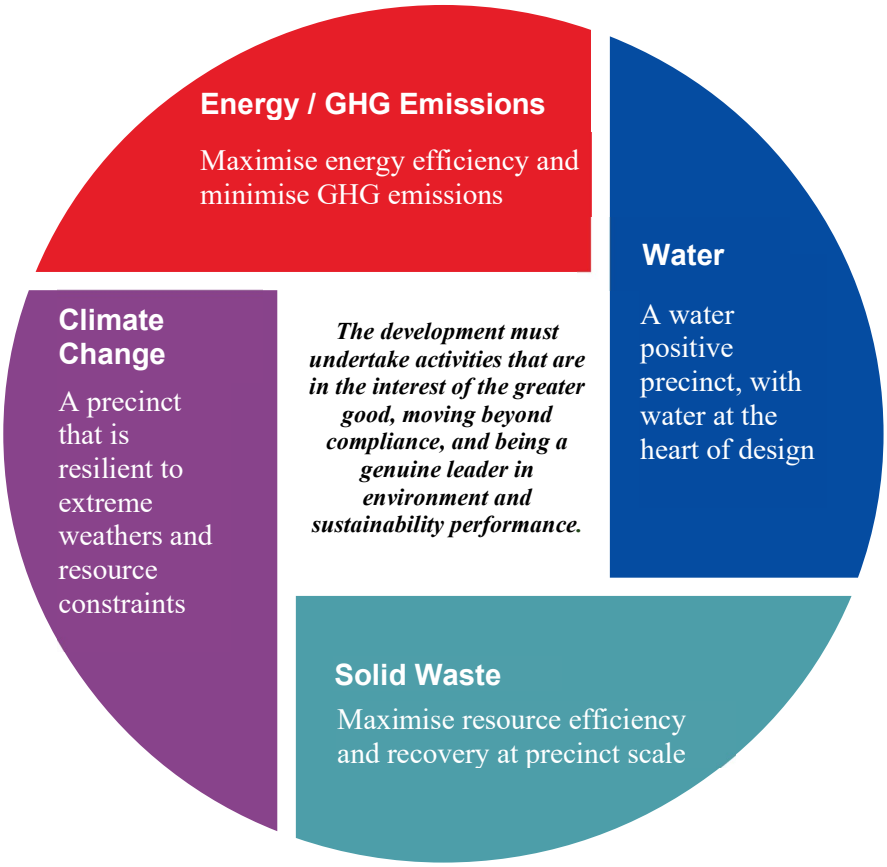


Figure 8 – Key sustainability themes[15]

The overarching sustainability driver for the Precinct is that the development must *undertake activities that are in the interest of the greater good, moving beyond compliance, and being a genuine leader in environment and sustainability performance* (Source: NSW Government Transport Environment and Sustainability policy, 2020). To achieve this, associated principles for the Precinct have been defined in context of the four sustainability themes, which enable a number of desired sustainability outcomes as outlined in the SSP Study Requirements, which will continue to evolve throughout the next project stages with the view to underpin a Country-centred approach. These are detailed below.

[15] Figure 8 references Better Placed: Draft Connecting With Country Framework, specifically Figure 6: Human-centred or Country-centred adapted from German architect Steffen Lehmann, Eco v Ego diagram 2010.

Table 6 – Sustainability themes and outcomes

Theme	Principle	Desired outcome
Energy & GHG Emissions	Maximise energy efficiency and minimise GHG emissions	• Carbon Neutral by 2050 • 100% renewable energy • Deliver beyond BASIX • Resilient and affordable energy
Water	A water positive precinct, with water at the heart of design	• An integrated water cycle management strategy • Greenspaces and WSUD integrated into the Precinct • Best practice stormwater management and reuse • Achieve a water positive Precinct
Solid Waste	Maximise resource efficiency and recovery at precinct scale	• An integrated waste management strategy that maximises resource recovery • Effective operational waste management
Climate Change	A precinct that is resilient to extreme weathers and resource constraints	• Resilient to extreme weather events • Minimises urban heat island effect

These sustainability principles and desired outcomes were then used to facilitate collaborative discussions within the project team. A number of online workshops explored the meaning of these principles and desired outcomes, and the team worked to identify how they could be incorporated in both the current and future stages of development. The outputs from the collaborative workshops are detailed in Section 7 and reflect how sustainability principles can be embedded in the current (Section 7.3 and Section 7.4 *Design Outcomes*) and future (Section 7.4 *Design Guidelines*) development of the Precent.

Reports from other disciplines detail the integration of sustainability into the proposal and how sustainability principles have influenced the design.

7 Implementation Plan

This section defines the sustainability principles applied for the proposed planning amendment. The following SSP study requirements and considerations are being addressed as part of this section:

Requirement:

- *"Provides detail of proposed sustainability principles and how they will be incorporated into the proposal"*
- *"Identify appropriate sustainability benchmarks for each development type within the precinct"*
- *"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"*

Considerations:

- *"How sustainability principles will be incorporated into the design, construction, and ongoing operation phases of the redevelopment to achieve sustainability best practise initiatives"*
- *"High benchmark sustainability performance targets for the precinct"*
- *"The incorporation of Green Roofs, Cool Roofs and Green Walls into the design of any future buildings"*
- *"Taking a whole-of-life- approach to sustainability through planning design, construction, and ongoing precinct management"*
- *"Maximising resource efficiency to contribute to net zero emissions by 2050"*

7.1 Justification

The proposed benchmarks and design guideline provisions have been developed collaboratively with the project team to inform planning controls and drive sustainability outcomes for the Precinct. They incorporate targets and initiatives detailed in the Concept Plan approval and the SSP requirements, as well as other relevant policies, guidelines, and statutory requirements. Best practice sustainability frameworks are also used where appropriate to provide clear direction and to ensure the materialisation of sustainability outcomes.

It is noted that the recommendations presented reflect the current rezoning and proof of concept stage, and the ability to impact and influence sustainability outcomes at this stage. Often the effective delivery of a number of physical and technical solutions at a precinct-scale relies on proper governance and ownership structures, which are not established at this stage.

7.2 Objectives

The following objectives describe the key outcomes identified for the Precinct, separated into the four themes of Energy and Greenhouse Gas Emissions, Water, Solid Waste, and Climate Change and Microclimate. It should be noted that these are based on the current landscape and technologies available, and future development and innovations may influence how these objectives are achieved.

7.2.1 Energy and Greenhouse Gas Emissions

Ensure that both individual development sites and the Precinct incorporate best practice sustainability and environmental performance measures relating to energy and greenhouse gas emissions. This includes supporting the following objectives:

- Efficient, productive, resilient, low carbon and affordable energy for the Precinct
- Carbon neutrality by 2050
- 100% renewable energy supply and optimised onsite renewable energy generation
- Replacing intensive carbon power sources with low carbon and renewable energy
- Delivering beyond BASIX developments
- Responsible sourcing of materials through appropriate supply chain management and product stewardship which encompasses social, economic, and environmental considerations
- Optimising human indoor and outdoor comfort within the Precinct
- GANSW Statement of Commitment 4[16] as set out in the Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework[17]

7.2.2 Water

Ensure that both individual development sites and the Precinct incorporate best practice sustainability and environmental performance measures relating to water. This includes supporting the following objectives:

- Delivering an integrated water cycle management strategy
- Reducing the use of potable water
- Encourage sustainable water use practices
- Optimising water efficiency and productivity across the Precinct and seek alternative water supply sources where appropriate
- Integration of green spaces and WSUD into the Precinct
- Best practice stormwater management, targeting 100% capture, harvesting, and reuse
- GANSW Statements of Commitment 2[18], 4[19] and 7[20] as set out in the Redfern North Eveleigh Precinct Renewal Project–Final Connecting With Country Framework[21]

7.2.3 Solid Waste

Ensure that both individual development sites and the Precinct incorporate best practice sustainability and environmental performance measures relating to waste. This includes supporting the following objectives:

[16] GANSW Statement of Commitment 4 – We will share tangible and intangible benefits with the Country where we are working, and by extension the Traditional Custodians of that Country, including current and future generations.
[17] Balarinji (5/11/2021), pg 39.
[18] GANSW Statement of Commitment 2 – We will prioritise Aboriginal people's relationship to Country and their cultural protocols, through education and enterprise by and for Aboriginal people.
[19] GANSW Statement of Commitment 4 – We will share tangible and intangible benefits with the Country where we are working, and by extension the Traditional Custodians of that Country, including current and future generations.
[20] GANSW Statement of Commitment 7 – We will support Aboriginal people to continue their practices of managing land, water, and air through their ongoing reciprocal relationships with Country. We will create opportunities for traditional first cultures to flourish.
[21] Balarinji (5/11/2021), pgs 34, 35, 39, 40, 47, and 48.

- Prioritising waste reduction
- Delivering an integrated waste management strategy that maximises resource recovery
- Identification and adoption of opportunities based on the principles of circular economy
- Reduce the environmental impact from building materials through reduction, re-use and recycling of materials, resources and building components
- GANSW Statement of Commitment 4[22] as set out in the Redfern North Eveleigh Precinct Renewal Project– Final Connecting With Country Framework[23]

7.2.4 Climate Change & Microclimate

Ensure that both individual development sites and the Precinct incorporate best practice sustainability and environmental performance measures relating to climate change and microclimate. This includes supporting the following objectives:

- Incorporating measures to address the impact of climate change including urban heat and extreme weather events
- Reduce the cause and impacts of the urban heat island effect
- Increase the resilience of development to the effects of climate change
- GANSW Statement of Commitment 4[24] as set out in the Redfern North Eveleigh Precinct Renewal Project– Final Connecting With Country Framework[25]

[22] GANSW Statement of Commitment 4 – We will share tangible and intangible benefits with the Country where we are working, and by extension the Traditional Custodians of that Country, including current and future generations.
[23] Balarinji (5/11/2021), pg 39.
[24] GANSW Statement of Commitment 4 – We will share tangible and intangible benefits with the Country where we are working, and by extension the Traditional Custodians of that Country, including current and future generations.
[25] Balarinji (5/11/2021), pg 39.

7.3 Benchmark targets for development types

A proposed benchmark is nominated for each target to inform the minimum commitment for future master planning and approvals. It is recommended that these benchmarks guide future tendering options for development and establish baseline sustainability outcomes for future development. These minimum benchmarks can also be improved upon as a point of differentiation for future developers.

Theme	Target	Applicable development type*	Proposed Minimum Benchmark	Responding to the following SSP Requirements and Considerations	Comment
Sustainability Frameworks	Green Star Communities precinct rating	Masterplan & Public Domain	5 Star rating	Net Zero Resource Efficiency	Either v1.1 or latest version
	Green Star Buildings	Residential Mixed use Offices Hotels Retail	5 Star rating	Net Zero Resource Efficiency	Either v1 or latest version Applicable to all new residential, office, public and commercial buildings; including mixed use.
Energy & Greenhouse Gas Emissions	BASIX Energy targets			BASIX+	Zone E1A Expressed as percentage reduction over NSW Benchmarks (in bracket) Applicable to all residential buildings
	Midrise (4-5 storey units)	Residential	(35) +10%		
	High rise (6 storey units or higher)	Residential	(25) +10%		
	NABERS Energy rating for commercial buildings	Mixed use Offices Hotels Retail	5.5 Star	Net Zero Resource Efficiency	NABERS commitment agreement (base building)
	Promote initiatives for Net-Zero Carbon Precinct	All	100% by 2050 50% by 2030 (in line with NSW State's objective)	Net Zero Resource Efficiency	Percentage reduction in greenhouse gas emissions
	Onsite renewable energy generation	Residential Mixed use Offices Hotels Retail	Allocate minimum 20% of new roof space to energy generation	Net Zero	
	Electric vehicle ready car parking spaces	Residential Mixed use Offices Hotels Retail	Residential; 100% car parking spaces Mixed use, Offices, Hotels, Retail; All other building	Net Zero	The NCC 2022 (current Draft) states the following requirements for electric vehicle car parking spaces: *Electrical distribution boards dedicated to servicing EV charging in a carpark must be provided for the following:* - *Class 2: 25% car parking spaces*

Theme	Target	Applicable development type*	Proposed Minimum Benchmark	Responding to the following SSP Requirements and Considerations	Comment
			classes – 25% car parking spaces A parking space is EV-ready when cabling to the space, and spatial allowance for GPO or charging head unit are provided. The level of charging infrastructure to be provided (Level 1 – 4) to be in line with expected charging behaviours (short, medium and long term parking).		- *Class 5 or 6: 10% car parking spaces* - *Class 3, 7b, 8, 9: 20% car parking spaces* NSW EV Strategy direction: it is intended to increase NSW EV sales to 52% by 2030–31
	Embodied energy	Residential Mixed use Offices Hotels Retail	20% reduction (immediate) 40% reduction for development commencing in 2030 and beyond	Whole of Life Resource Efficiency	As per Green Star Buildings 'Upfront Carbon Emissions' credit Applicable to all building typologies
Water	NABERS Water rating for non-residential buildings	Mixed use Offices Hotels Retail	4 Star	Integrated Water Strategy	
	BASIX Residential Water targets	Residential	(40) +10%	BASIX+ Integrated Water Strategy	CoS LGA Expressed as percentage reduction over NSW Benchmarks (in bracket) Applicable to all residential buildings
	Public open space irrigation with non-potable water	Public Domain	100%	Integrated Water Strategy	
Waste	Construction & demolition waste diverted from landfill - Buildings	Residential Mixed use Offices Hotels Retail	90%	Integrated Waste Management Resource Efficiency	Full points as per Green Star Buildings 'Responsible Construction' credit Applicable to all building typologies Note that any waste not normally sent to landfill is excluded from calculations
	Construction & demolition waste diverted from landfill – Public Domain	Public Domain	60%	Integrated Waste Management Resource Efficiency	As per Green Star Communities Credit 30.1 'Construction and Demolition Waste' Note that any waste not normally sent to landfill is excluded from calculations
	Diversions of operational waste across all waste streams	All	90% by 2030	Integrated Waste Management Resource Efficiency	Aligns with CoS resource recovery goals Applicable to all building typologies and the public domain

Theme	Target	Applicable development type*	Proposed Minimum Benchmark	Responding to the following SSP Requirements and Considerations	Comment
				Operational Waste Management	
Climate Change & Microclimate	Climate change and resilience risks addressed through design	Residential Mixed use Offices Hotels Retail	Achieve maximum points in Green Star submissions	Climate Change	Maximum points in Green Star Communities 'Adaptation and Resilience' credit and Green Star Buildings 'Climate Change Resilience' credit Applicable to all building typologies and public domain
	Green cover (i.e. streets, open spaces, walls, and roofs)	Masterplan & Public Domain	40%	Climate Change	Percentage cover of Precinct in plan-view
	Canopy cover	Masterplan & Public Domain	25%	Climate Change	Percentage cover of Precinct in plan-view
	Green roofs	Residential Mixed use Offices Hotels Retail	50%	Climate Change Green Infrastructure	Percentage cover of Precinct in plan-view 50% to new buildings, either being 100% to half of the new buildings, 50% coverage to all new buildings, or an adequate combination of the above.

*New development, or where significant refurbishment occurs

Abbreviations	Requirement
SPP Requirements	
Integrated Water Strategy	*Includes an integrated water cycle management strategy*
Integrated Waste Management	*Includes an integrated waste management strategy that maximises resource recovery*
Climate Change	*Includes measures to address the impact of climate change including urban heat and extreme weather events*
SSP Considerations	
Net Zero	*The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings*
BASIX+	*Compliance with BASIX and opportunities to deliver beyond BASIX scores*
Green Infrastructure	*The incorporation of Green Roofs, Cool Roofs and Green Walls into the design of any future buildings*
Climate Change	*Climate change, including the urban heat island effect, changing temperatures and rainfall patterns*
Whole of Life	*Taking a whole-of-life- approach to sustainability through planning design, construction, and ongoing precinct management*
Resource Efficiency	*Maximising resource efficiency to contribute to net zero emissions by 2050*
Operational Waste Management	*Precinct scale measures to ensure effective operational waste management*

7.4 Recommended DCP / Design Guideline provisions

This section describes the outcomes that have been achieved in the current design, and controls, standards, and guidance that are recommended to be included as part of the future design and development stages of the Precinct.

Energy and Greenhouse Gas Emissions

Design Outcomes

- Identified appropriate benchmark energy performance targets that can be used in future development
- Considered the NSW Government's net zero emissions target and identified options for achieving low carbon precinct and net zero buildings
- Developed strategies that can be used to achieve a 100% renewable energy supply for the precinct, including maximising onsite generation and securing offsite renewable electricity
- Considered / not precluded potential design options that can be used to deliver low carbon and net zero outcomes for the precinct (e.g. Microgrid)
- Identified how sustainability principles can be carried forward into the design, construction, and the ongoing operation phases of redevelopment
- Examined resource efficiency strategies and the role it can play in contributing to achieving net zero emissions by 2050
- Identified opportunities to deliver improvements to BASIX
- Identified how a whole-of-life approach can be taken through planning, design, construction, and precinct management
- Facilitated cross disciplinary discussions on energy and greenhouse gas emissions across the precinct, identifying a number of mitigation factors and design strategies that could be implemented to achieve better sustainability outcomes

Design Guidelines

- Prioritise electrification of all precinct systems (i.e. no gas connections) as a method of achieving net zero and renewable energy targets
- In the transition to 100% renewable energy, all development should consider the reduction of carbon intensive energy supply and maximise onsite renewable energy generation
- Utilise the load diversity of the Precinct to capture and reuse waste energy within a precinct (assuming the right governance structures exists)
- Consideration to be made of building’s density, form, orientation, external shading, wind, and green infrastructure to allow for precinct wide passive design planning
- Individual developments are to be designed and constructed to reduce the need for active heating and cooling by incorporating passive design measures including design, location and thermal properties of glazing, natural ventilation, appropriate use of thermal mass and external shading, including vegetation
- Ensure design follows the following circular economy hierarchy:
    - Retain
    - Refit
    - Refurbish

  - Reclaim/Reuse
  - Remanufacture
  - Recycle/Compost
- Ensure design follows circular economy principles such as the elimination of waste and pollution, circulate products and materials, and regenerate nature
- In multi-tenant or strata-subdivided developments, electricity sub-metering is to be provided for lighting, air-conditioning and power within each tenancy or strata unit. Locations are to be identified on the development plans
- The use, location and placement of photovoltaic solar panels is to take into account the potential permissible building form on adjacent properties
- Favour coupling Photovoltaic arrays with green roofs to improve efficiencies
- Reuse as much of the existing built heritage fabric as possible (buildings and public domain)
- Design buildings that are adaptable and have a long asset life
- Use low carbon construction technologies
- Ensure the responsible sourcing of materials e.g. FSC timber, responsible steel (Environmental Sustainability Charter of the Australian Steel)
- Lighting for streets, parks and any other public domain spaces provided as part of a development should be energy efficient lighting such as LED lighting

Water

Design Outcomes

- Identified appropriate benchmark water performance targets that can be used in future development
- The consideration of an integrated water cycle management process with the various design disciplines including architects, landscape, civil and utilities teams
- Identified pathways that can be taken to achieve or not preclude an integrated water cycle management practices and identification of design options that could be used to deliver an integrated water system and sustainable water practices
- Identified water, wastewater, stormwater, and other alternative water supply options that are possible for future development and have the potential to achieve water positive impacts
- Identified how sustainable water principles can be carried forward into the design, construction, and the ongoing operation phases of redevelopment
- Recommendation for a feasibility assessment of a precinct-scale recycled water scheme for future development
- Facilitated cross disciplinary discussions on water use and water management across the precinct, identifying mitigation factors and design strategies that could be implemented achieve better sustainable water outcomes

Design Guidelines

- At the Development Application stage develop a more specific integrated water cycle management strategies to ensure optimised sustainable water solutions for the precinct or buildings
- Do not preclude future scenarios where a decentralised water utility may operate

- Ensure water and green infrastructure are in close connection with each other
- Integrate any appropriate recommendations from the *The Australian Guidelines for Water Recycling: Managing Health and Environmental Risks* (2006)
- Ensure water discharged from a private building stormwater system is first used to supply to landscape of public domain ahead of immediate discharge to offsite drainage system
- Extensively collect and re-use stormwater run-off in the public realm to irrigate and sustain green infrastructure
- Design urban water systems and streetscapes that focus on passive systems that allow for irrigation through direct rainfall and natural water flows
- Use locally appropriate planting that suit environmental conditions and are drought resistant
- Separate meters are to be installed for each individual tenancy in commercial or retail buildings over 5,000sqm, such as separate tenant areas within a shopping centre
- Separate meters are to be installed for the make-up lines to cooling towers, swimming pools, on the water supply to outdoor irrigation, and other major uses

Solid Waste

Design Outcomes

- Identified appropriate benchmark waste performance targets that can be used in future development
- The inclusion of an integrated waste management strategy
- Considered / not precluded design options that could be used to deliver an integrated waste management system
- Identified opportunities for precinct scale measures that will ensure effective operational waste management
- Identified how sustainability waste principles can be carried forward into the design, construction, and ongoing operation phases of redevelopment

  Facilitated cross disciplinary discussions on waste and waste management across the precinct, identifying mitigation factors and design strategies that could be implemented achieve better sustainable waste outcomes

Design Guidelines

- At the Development Application stage develop a more specific integrated waste management strategy to ensure optimised sustainable waste solutions for the precinct or buildings
- Integrate any appropriate recommendations from the EPA *Better practice guide for resource recovery in residential developments* (2019)
- Integrate any appropriate recommendations from City of Sydney's *Guidelines for Waste Management in New Developments* (2018)
- Integrate any appropriate recommendations from City of Sydney's *Leave nothing to waste: Waste strategy and action plan 2017-2030*
- Partner with the City of Sydney for the collection of different waste streams when appropriate
- Ensure building design supports recycling behaviour, so that residents can easily separate and appropriately dispose of waste and recyclable materials in a way which increases resource recovery initiatives

- Provide sufficient spatial allocation for waste storage and separation at a building level, and consider the associated transport and maintenance requirements, as well as appropriate signage / educational material
- Encouraging reuse/recycling through dedicated areas for the storage/exchange of bulky goods and furniture for residents to store unwanted bulky items for exchange or reuse
- All residential buildings must be designed to support food waste separation and collection
- Consider sizing and access to waste chutes and/or storage areas and appropriate collection arrangements
- Ensure public place recycling is provided, and designed and located to enhance public amenity and encourage responsible recycling behaviour
- Consider opportunities for centralised solid waste system that transports waste through an underground network of pipes to one or several collection points in the Precinct
- Design public spaces for flexible use
- Design structures which could be utilised for different purposes in the future to extend the life of building stock and reduce future waste generation
- Prioritise locally sourced construction materials and responsible consumption practices. This includes preference for reused and recycled materials contributing to a lower carbon footprint where possible.

Climate Change & Microclimate

Design Outcomes

- Reviewed future climate change and identified measures to address the impact of climate change including urban heat and extreme weather events
- Considered / not precluded design options that could be used to deliver positive climate change and microclimate outcomes in the future
- Recommended that a Climate Change Risk Assessment to be undertaken to inform and optimise future development
- Facilitated cross disciplinary discussions on climate change and microclimate across the precinct, identifying mitigation factors and design strategies that could be implemented in development

Design Guidelines

- Address the impact of climate change including urban heat and extreme weather events by referencing and integrating appropriate recommendations from Low Carbon Living Guide to Urban Cooling Strategies and the WSROC Urban Heat Planning Toolkit 2021
- Align built form and infrastructure to maximise natural microclimate elements e.g. wind direction and cross ventilation
- Provide ‘all weather’ walkable public linkages across the Precinct
- Provide a walkable street grid and continuous bicycle lanes to link to the wider city network
- Favour the use of appropriate pavement and building materials e.g. cool materials, light in colour
- Species are to be predominantly Australian native species, to maximise biodiversity outcomes, with a minimum of 20–25% of the species to be endemic (indigenous) to the immediate area, and with non-Australian exotic species to be no more than 20-25% of the total population
- Include indigenous planting and opportunities for regeneration of endangered habitats

7.4.1 Potential Initiatives and Actions

Appendix 2 lists a number of potential initiatives and actions that were identified and developed collaboratively with the wider project team during a number of meetings and online workshops. It should be noted that these are to be used for consideration purposes only and do not form commitments unless they are detailed in the implementation plan above (Section 7).

8 Energy and Greenhouse Gas Emissions

8.1 SSP Requirements & Considerations

The following SSP study requirements and considerations are being addressed as part of this section:

Requirement:	Addressed in the following sections
• *"Outlines the likely impacts of the proposal in relation to energy use, greenhouse gas emissions"*	• 8.2 Introduction • 8.3 Impact
Considerations:	
• *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*	• 8.4 Scenarios and Initiatives to address SSP Study Requirements
• *"Strategies to achieve 100% renewable energy supply for the precinct including maximising on-site generation and securing a supply of off-site renewable electricity"*	• 8.4.1 100% electric precinct • 8.4.2 Optimising usage on-site through a microgrid and energy recovery systems • 8.4.3 Maximising on-site renewables • 8.4.5 Purchasing of renewable energy
• *"Maximising resource efficiency to contribute to net zero emissions by 2050"*	• 8.4.7 Reducing transport emissions • 8.4.8 Reducing waste emissions
• *"Taking a whole-of-life- approach to sustainability through planning design, construction, and ongoing precinct management"*	• 8.4.6 Decarbonisation of material and construction
• *"Compliance with BASIX and opportunities to deliver beyond BASIX scores"*	• 8.4.3 Maximising on-site renewables • 8.4.4 Reducing energy demand

8.2 Introduction

A precinct's impact in relation to energy and greenhouse gas emissions are determined by two predominate factors, operational emissions, and embodied emissions.

The primary driver of **direct operational emissions** (commonly referred to as Scope 1 and 2 Emissions) is the energy demand and supply profile of the Precinct. This profile is determined by factors such as the principal fuel source, energy intensive requirements such as space conditioning and ventilation, energy efficiencies, technological advancements, and human behaviours.

Further, a precinct also generates **indirect operational emissions** (commonly referred to as Scope 3 Emissions) as it produces waste, uses water, provides transport options, and consumer goods. The associated emissions with these are also included in a precinct's operational greenhouse gas emission profile.

Embodied emissions associated with a precinct are all the emissions generated during construction, refurbishments, and demolition phases, and includes emissions generated during material extraction, manufacturing, transport, and disposal. The vast majority of embodied emissions occur at the 'before use' stage. It is projected that between now and 2050, embodied carbon will make up almost half of total emissions associated with new construction.[26]

[26] https://architecture2030.org/new-buildings-embodied/

8.2.1 Embodied Emissions

To minimise the level of embodied emissions in the Precinct, a number of fundamental design principles can be implemented, as well as referencing the circular economy hierarchy (Figure 9). In the construction of the Precinct there will be significant quantities of concrete, steel, aluminium, asphalt, timber, and other materials, which all have different levels of embodied greenhouse gas emissions associated with the mining, manufacturing, and transport of the materials. At early design stages choices are available to consider material switching, durability or low emission options.

Strategies can include commitments to the calculation and reduction of upfront carbon emissions, prioritising the retainment of existing structures where possible, minimising waste in design, building for longevity, flexibility and adaptability, material selection, and tailored procurement processes.

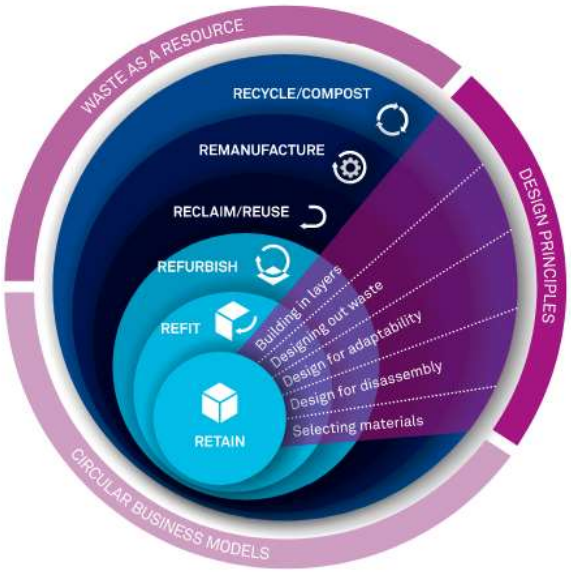


Figure 9 – Circular Economy hierarchy[27]

8.2.2 Operational Emissions

Scope 1 operational emissions from within the Precinct include use of fossil fuels (natural gas, LPG, diesel, and petrol), waste sources (organic waste) and refrigerant gasses during construction and operation of the Precinct. These will represent most of the direct emissions from the site that are under direct control / influence from Precinct stakeholders.

The Scope 2 emissions are mostly associated with electricity demand and supply sources for the Precinct. The major sources of energy demand within a precinct are space conditioning (heating and cooling), ventilation, lighting, water heating, and appliances. As the market begins its transition to electric vehicles, an increasing portion of a precinct's energy demand will also need to cater for the charging requirements of electric vehicles.

The type of energy supply that is used to the meet the precinct demands have different carbon intensities. Typically, energy is sourced from the electricity grid, natural gas, or from renewable energy sources such as solar photovoltaics (PVs), wind, and geothermal. Each of these supply options carry a different carbon intensity per kWh or GJ of energy consumed, with on-site renewable energy generation typically being the lowest carbon energy source. It is important to note that as the national electricity grid increases its uptake of renewable energy, the carbon intensity of electricity consumption sourced from the grid will reduce over time. The current carbon intensity of the grid in NSW is 0.77kg CO2-e per kWh, and this is forecasted to reduce to 0.47kg CO2-e kWh by 2030 as the grid incorporates additional renewable energy sources.[28]

[27] Bring Embodied Carbon Upfront, World Green Building Council, 2019
[28] https://www.industry.gov.au/data-and-publications/australias-emissions-projections-2020

The carbon intensity of energy supply within a precinct can also be shaped by energy retailers and contacts through the procurement of green power, power purchase agreements and carbon offsets, as well as the ability to integrate different energy systems that coordinate efficiencies, onsite generation, and precinct scale storage.

8.3 Impact

This section assesses the baseline impact of the proposed development in relation to its future embodied and operational energy demand and associated greenhouse gas emissions.

8.3.1 Embodied Emissions

At the concept phase of development, the required information and level of detail that is required to assess the embodied emissions associated with construction is not yet available e.g. material type and quantity. However, some general comments can be made on reducing embodied emissions in the current design, and considerations for the future.

- The current design indicates the retainment or repurpose of a large number of existing buildings and structures (Figure 10) below, with beige indicating existing structures. Retaining, refitting, or repurposing existing structures greatly reduces the embodied emissions associated with construction.

Figure 10 – North Eveleigh Masterplan (existing structures to be retained or repurposed shown in beige) (Source: Bates Smart)

- The concept design presents the use of timber on existing structures which has lower embodied emissions compared to other building materials (e.g. steel, concrete). This can also reduce the need for additional structural supports and the footprint of development. Promoting the use of natural materials, such as timber, may also weave into the cultural narrative expressed onsite
- Understanding the built forms and materials that currently exist onsite can lay the foundation for reducing emissions associated with construction
- Given the site conditions, the use of modular construction is appropriate. This can reduce material waste and embodied emissions and improve construction timelines

8.3.2 Operational Emissions

The forecasted energy demand (Scope 1 and 2 Emissions) for the residential and non-residential developments in the Paint Shop sub-precinct in 2025 were calculated using high-level assumptions (summarised in Appendix 3). Scope 3 Emissions, such as those related to water, waste, and transport (other than EV) are not included. A summary of these calculations are shown below:

- Electricity - residential and non-residential buildings ≈ 15,005 MWh/year (8,253 tCO2-e)
- Electricity - EV car spaces (500 total) ≈ 2,400 MWh/year (1,338 tCO2-e)
- Gas - residential and non-residential buildings ≈ 18,750 GJ/year (966 tCO2-e)
- Total greenhouse gas emissions ≈ 10,558 tCO2-e

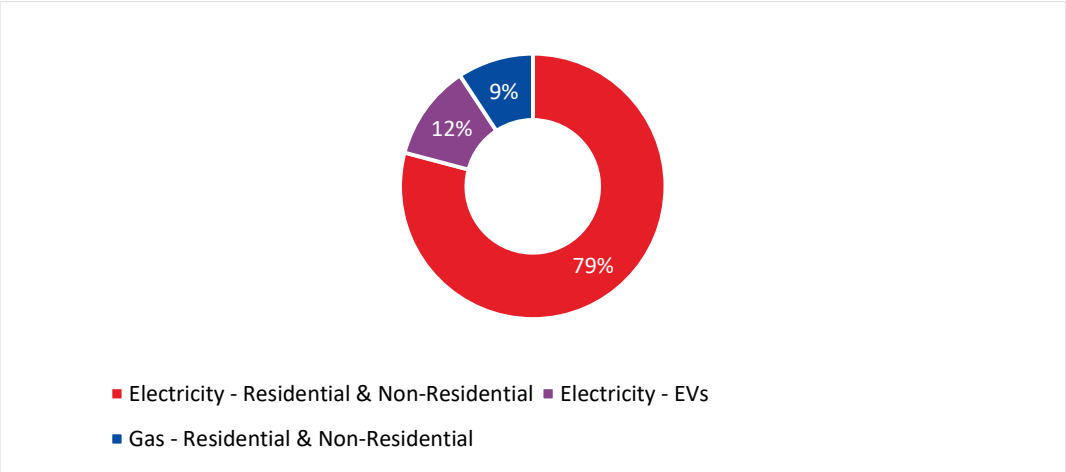


Figure 11 – Breakdown of energy related greenhouse gas emissions in the precinct

It is also important to highlight that the NSW electricity grid is decarbonising with time (Figure 12). The decarbonisation of the grid will influence the carbon benefits associated with precinct scale actions (e.g. alternative energy supply or energy efficiency strategies), and the economics that underpins their deployment.

Note: This does not include operational emissions from petrol, diesel, LPG, water, solid waste, or refrigerants.

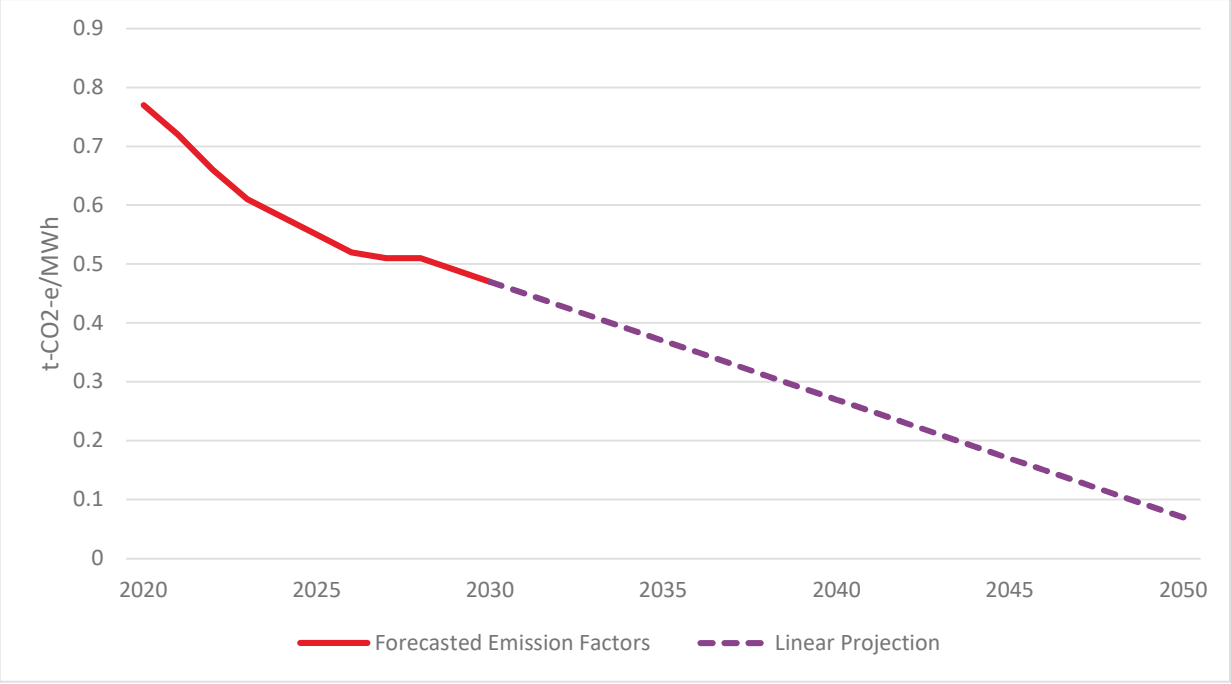


Figure 12 – Forecasted Indirect Scope 2 emission factors from the NSW/ACT Electricity Grid to 2030[29] and a linear projection to 2050

8.3.3 Carbon Offsets

The use of carbon offsets are often necessary to achieve net zero emission targets, however an over reliance on offsets in a low-carbon future can increase the expose of the precinct to a number of risks. These risks include creating stranded assets and financial risks, especially as the cost of offsets are expected to increase over time.

[29] https://www.industry.gov.au/sites/default/files/2020-12/australias-emissions-projections-2020.pdf

To achieve a number of emission targets (e.g. net zero emissions), all residual greenhouse gas emissions must be managed and accounted for by emission reduction or removal processes. Carbon offsets provide the mechanism by which this balance of carbon accounting can occur, in theory, by balancing the 'damage' caused by carbon emissions in one location with 'repair' elsewhere.

Carbon offsets are certifiable and transferrable units of emission (reduction or removal) that can be purchased by an entity to balance their emission outputs. Typically, entities follow the emission management hierarchy

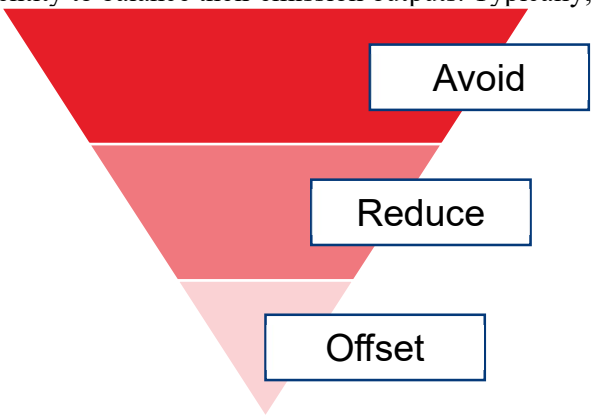


Figure 13) and use offsets as the final option to account for their residual emissions that may be seen as unavoidable, labour-intensive, or financially inhibitive to mitigate.

The transferable carbon offset is sold at a predetermined price and is typically certified by governments or an independent certification body to represent the reduction or removal of one metric tonne of CO2 or CO2 equivalents (CO2e). The offset then needs to be 'retired' from the market in order for the emissions reduction to be claimed. The current cost of carbon offsets in Australia is approximately $20tCO2e[30] and can range anywhere between approximately $5-$50 tCO2e. This price is expected to increase in the future as more entities enter into emission pledges and regulation shifts.

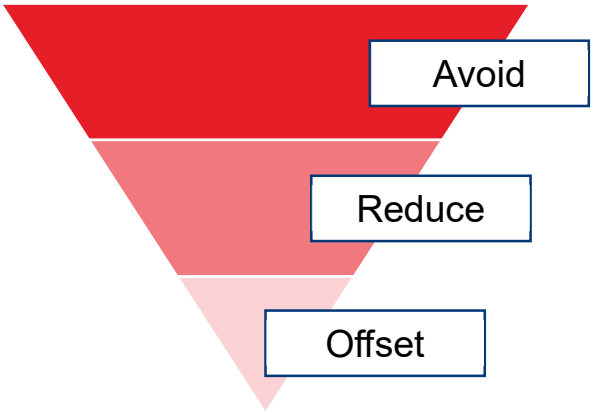


Figure 13 - Emission management hierarchy[31]

8.4 Scenarios and Initiatives to address SSP Study Requirements

As a number of the considerations required as a part of the SSP requirements are intrinsically linked, eight different initiatives will be presented that in combination make a number of scenarios to achieve the desired outcomes. Responding to the SSP study requirements in this way will highlight the interrelationship between energy and greenhouse gas emissions that exist across a precinct, and identify opportunities that can have broad and a large scale

[30] https://www.afr.com/companies/energy/carbon-offset-prices-reach-record-as-buyers-grow-20210707-p587js
[31] Figure adapted from: https://www.iema.net/document-download/51806

8.4.1 100% electric precinct (no fossil fuel)

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*
- *"Strategies to achieve 100% renewable energy supply for the precinct including maximising on-site generation and securing a supply of off-site renewable electricity"*

With such a clear projection on the decarbonisation of the electricity network (Figure 14), a clean and simple solution to enable a net zero precinct would be a commitment to 100% electricity onsite and the exclusion of a connection to the gas network. This would set the foundation to achieve net zero emissions from energy consumption within the Precinct, noting that there will always be some residual emissions from scope 1 and 3 sources within the Precinct.

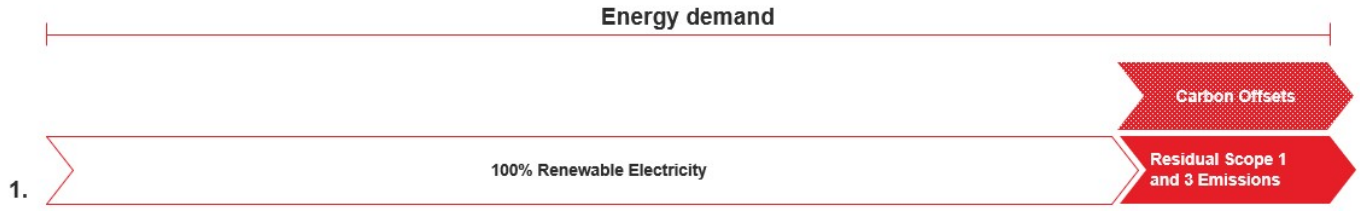


Figure 14 – Scenario 1, 100% renewable electricity and carbon offsetting for residual scope 1 and 3 emissions

Natural gas is a fossil-based fuel, and as such, cannot be used as a fuel source to achieve net zero targets without the use of carbon offsets. The shift to green hydrogen as an alternative fuel source is mainly applicable for industrial uses that require extremely high temperatures and is not a suitable fuel for a mixed-use precinct. Other factors excluding the use of hydrogen in this Precinct include the need to create a specific hydrogen network given that it would leak from the existing network, safety issues, efficiencies, and the costs of generation far outweighing that of electricity. Renewables based hydrogen is currently around four times the price of gas (~$40/GJ)[32], and although this may halve by 2030, the economics will still not achieve a parity compared to renewable electricity alternatives. Although the use of a blended mix of hydrogen and natural gas that may be supported in the existing network, it will still contain around 90% of fossil-based gas.

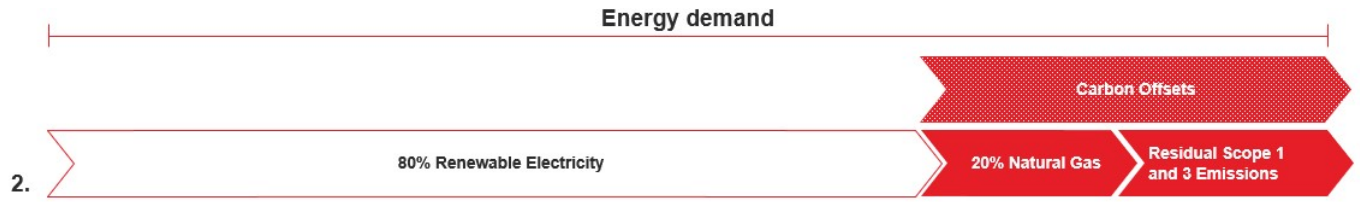


Figure 15 – Scenario 2, 80% renewable electricity and carbon offsetting for 20 % natural gas and residual scope 1 and 3 emissions

Once the Precinct is all electric, it can maximise onsite generation and procure the remaining supply offsite from renewable energy providers/generators, or from a decarbonising grid, with the latter requiring offsets to achieve net zero emissions until it is fully decarbonised.

8.4.2 Optimising usage on-site through a microgrid and energy recovery systems

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*

[32] https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/CSIRO-futures/Futures-reports/Hydrogen-Roadmap

- *"Strategies to achieve 100% renewable energy supply for the precinct including maximising on-site generation and securing a supply of off-site renewable electricity"*

The size and diversity that exists at the precinct scale (e.g. energy supply and demand profiles) presents a number of opportunities to optimise energy use and recovery that would not be possible at the building scale. However, an integrated systems approach at the precinct scale is also inherently more complex given commercial and governance barriers, business models, stakeholder split incentives, planning, and physical variables.

Microgrid

Through a fully integrated micro-grid system, a localised electricity micro-grid can be established to service the Precinct. The micro-grid operator would purchase electricity from the network distributor (e.g. Endeavour Energy) and then on-sell this electricity to residents through their selected retailer. Through this mechanism, the micro-grid operator becomes the "gatekeeper" for electricity flow into the precinct and can engage into a Power Purchase Agreement (PPA) from a renewable electricity supplier to ensure 100% renewable energy with net zero emissions. A microgrid also enables the simple integration of on-site renewable generators and the distribution of on-site renewable energy across the precinct without having to export into the wider grid.

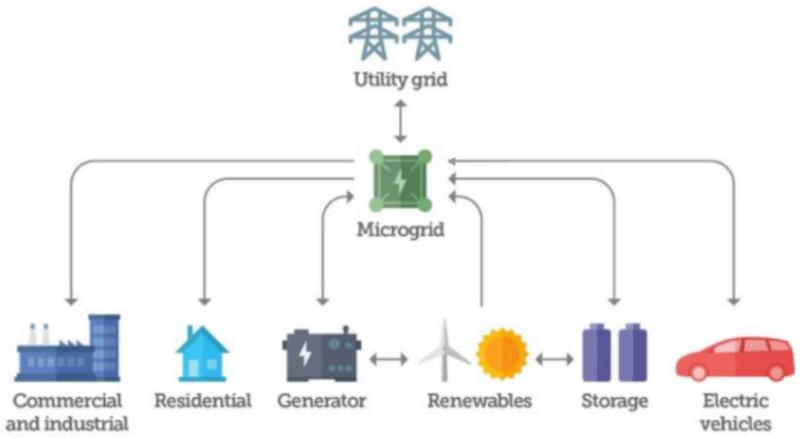


Figure 16 – Example microgrid system[33]

Energy recovery

Further to the opportunity to exchange and trade electricity via a microgrid, there is also the opportunity to recover, trade, and exchange energy (latent and sensible heat), either within a building or across an entire precinct. Energy recovery provides the opportunity to recover up to 90% of waste heat and for this energy to be reused either within the same or another application. A typical scenario is the recovery of heat via the mechanical ventilation system. Other options are to recover heat from wastewater (sewerage) or utilise waste heat from cooling processes and using such to heat domestic hot water.

8.4.3 Maximising on-site renewables

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*
- *"Strategies to achieve 100% renewable energy supply for the precinct including maximising on-site generation and securing a supply of off-site renewable electricity"*
- *"Compliance with BASIX and opportunities to deliver beyond BASIX scores"*

For this development, onsite renewable energy generation can be sourced from the following:

[33] https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2016/02/why-and-how-microgrid-technology-is-a-good-power-source

- Solar Photovoltaics
- Wind
- Geothermal

Given the physical constraints of the development, it is considered that onsite renewable energy generation will be able to produce between 5-10% of the total energy demand, depending on availability of roof space, energy efficiency measures and operational initiatives across the precinct and uptake of electric vehicles (high level assumptions listed below).

Total Electricity	MWh/year
Total Energy demand (all electric) approx. across precinct based on current demand profiles for development types.	15,886 MWh/Year
Total On-site generation assuming 25-50% of suitable roof space available for PV (excluding podium roofs and heritage structures)	850 – 1,900 MWh/Year
Potential percentage on-site generation possible assuming with current technology, current efficiencies, and roof space assumptions:	5.0 – 10.0%

Table 7 – Potential for on-site renewables

8.4.4 Reducing energy demand

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*
- *"Compliance with BASIX and opportunities to deliver beyond BASIX scores"*

Residential
Within the Precinct, the primary drivers of energy demand reduction for residential development will be the NCC Section J building code requirements, BASIX requirements (which includes NatHERS ratings), and any voluntary sustainability frameworks that can be applied onsite (e.g. Green Star).

In NSW, the State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (BASIX SEPP) mandates provisions that aim to reduce the consumption of mains-supplied potable water, reduce emissions of greenhouse gases, and improve thermal comfort in all residential developments. The BASIX SEPP sets the minimum standards that a development is to achieve. The NatHERS climate zone (Figure 17), heating and cooling load requirements (Table 8) and minimum BASIX energy targets (Table 9) that are applicable to the Precinct are shown below.

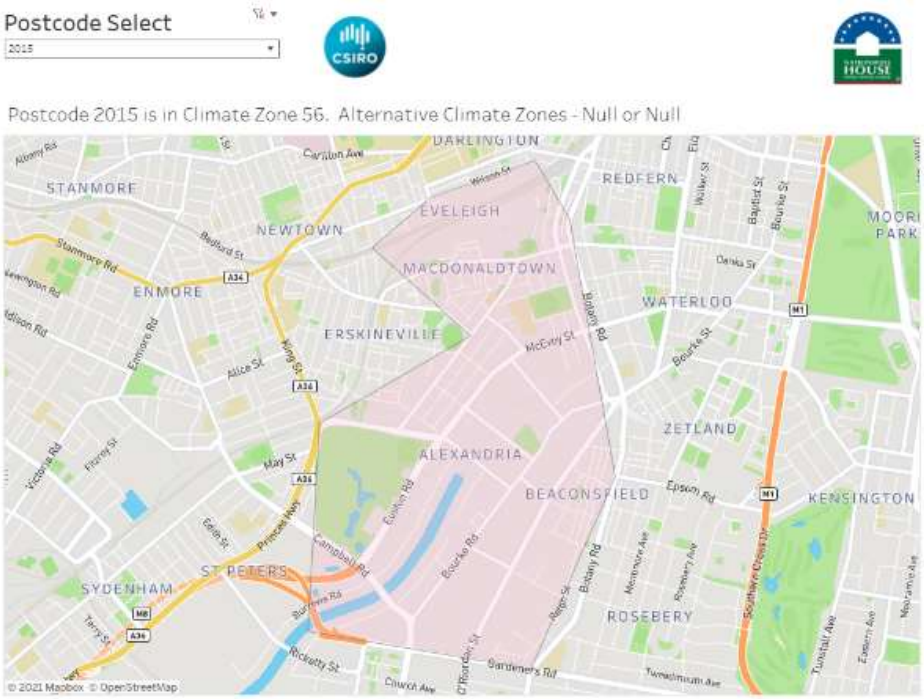


Figure 17 – Redfern North Eveleigh - NatHERS Climate Zone 56[34]

Zone	Region	Metric	Heating (MJ/year/m2)	Cooling (MJ/year/m2)
56	East Sydney	Average	40	26
		Maximum	45.4	29.5

Table 8 – BASIX heating and cooling load requirements in multi dwelling developments[35]

Building Type	Energy Target (Zone - E1A)
Detached and semi-detached	50
Low-Rise (3 storey unites)	45
Mid-rise (4-5 storey units)	35
High-rise (6 storey units or higher)	25

Table 9 - BASIX minimum energy targets[36]

Building performance optimisation through a variety of design considerations can help reduce energy demand and the delivery of net zero buildings. On occasions, controls and incentives can be used to drive better building performance by applying NABERS targets, more stringent BASIX requirements, or through other sustainability frameworks. Strategies to optimise building performance include:

- Prioritise passive design measures in all buildings including optimised orientation, taking advantage of natural wind movements, ambient lighting, shading devices, appropriate window to wall ratios (WWR), and using high performance insulation and glazing to reduce overall energy consumption.
- Use efficient and well-integrated mechanical and electrical systems and user-friendly controls.
- Maximise the incorporation of on-site renewable energy generation and use low and zero carbon technologies to minimise energy purchases and carbon emissions.

[34] https://www.nathers.gov.au/themes/custom/govcms8_uikit_starter/climate-map/index.html
[35] https://basix.nsw.gov.au/iframe/images/BASIX_Thermal_Comfort_Protocol_20170701.pdf
[36] https://basix.nsw.gov.au/iframe/new-to-basix/basix-assessment/basix-targets.html

- Install smart metering systems that allow users to track and modify their behaviour.
- Ensure energy meters on all end uses (e.g. heating, cooling, fans, domestic hot water (DHW), lighting, receptacles) that represent 10% or more of the total annual energy of the building, which enables inefficiencies to be identified and tuning of systems
- Use automated systems connected to a Building Management System (BMS) where possible, such as lighting control that includes occupant detection and daylight adjustment.
- Integrate design features and technologies that support peak demand shifting and energy storage, helping shift demand away from both network peaks (resilience / cost) and fossil peaks (carbon intensity / baseload).

8.4.5 Purchasing of renewable energy

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*
- *"Strategies to achieve 100% renewable energy supply for the precinct including maximising on-site generation and securing a supply of off-site renewable electricity"*

For the Precinct development, offsite procurement of renewable energy can occur via two pathways; form of a centralised energy provider for the Precinct, or procurement that occurs separately for each building. Offsite renewable energy procurement can be sourced in the following ways, at a precinct or building level.

Table 10 - Offsite renewable energy procurement at precinct level

Mechanism	Description	Benefits	Risks
Microgrids (Fully integrated) with PPA	• Establish a localised electricity micro-grid to service the Precinct. The micro-grid operator purchases electricity from the network distributor and then on-sells to the precinct via individually selected retailers. • As the 'gatekeeper' for all electricity flow into the precinct, the micro-grid operator engages into a PPA to supply minimum 100% of its electricity from a renewable source. • Potential business models include: ▪ Wholly publicly owned ▪ Privately owned ▪ Public Private Partnerships ▪ Government-owned redevelopment authorities ▪ Joint venture partnerships ▪ Community owned/not-for-profit ▪ Co-operatives ▪ Collective business models ▪ Business to business arrangement	• Retailer contestability remains intact • Innovative and elegant solution • Simple integration of on-site renewable generators into microgrid from governance perspective • Potential to incentivise the micro-grid operator to also reduce kwh on the network (energy as a service rather than as a kWh)	• Limited market experience in micro-grid operation • Long term commercial viability and market volatility • Guaranteeing affordable energy supply for tenants and resident
Energy Service Company or Energy Savings Company (ESCO) [Can also be applied at a building scale]	• A commercial or non-profit business that offers energy services. ESCOs guarantees a particular energy saving and/or the provision of an energy service at lower cost by taking responsibility for energy-efficiency investments or/and improved maintenance and operation of a system. • This is generally executed legally through an arrangement called an energy performance contract (EPC),	• With a Performance Contract the owner does not have to take out a loan or invest any money upfront • Return on investment is guaranteed • Limited liability and financial risk	• May ignore a comprehensive approach which will provide deeper savings that may come at a greater cost (lost opportunity) • More expensive than if the owner would do it themselves

Mechanism	Description	Benefits	Risks
	with remuneration being directly tied to the energy savings achieved.		

Table 11 - Offsite renewable energy procurement at building level

Mechanism	Description	Benefits	Risks
Body corporate and Greenpower PPAs (Base Building)	• The body corporate as a single entity can directly influence the site's total energy demand. The body corporate may enter a Green Power PPA to ensure 100% renewable energy is supplied to the building. As the single entity, the body corporate can influence the building systems such as centralising the building hot water systems (preferably as heat pumps) which account for approximately 25% of energy use. Through this example, hot water is circulated through the building to the residents as required. Additional examples of body corporate influence include: • A solar thermal hot water system to provide hot water boosting, or on-site PV to supply electricity, equivalent to 5% of total energy use. • Elements of the base building such as lifts, basement HVAC and common area lighting (approx. 20% of total energy) to be operated by the body corporate. • The resulting energy demand such as the common areas can be supplemented with Green Power. Green Power PPA should be accredited (Green Power Accredited Renewable Energy).	• Minimal parties involved in the arrangement – only the body corporate is required to enter into a Green Power PPA (Business Guide to Green Power) • Avoids potential regulatory issues with retailer contestability with regards to tenant choice over electricity provider	• Risks that are inherent to PPAs such as generator failure will apply • A covenant may be required to guarantee purchase which may be subject to legal challenges
Property Title Covenants	• Covenants and community title schemes are typically administered by a body corporate for the ongoing management of properties. Property covenants can be applied to directly mandate the purchase of Green Power from an electricity retailer of choice. This will allow the total energy use from private residential units be sourced from renewable electricity providers; this roughly equates to 50% of the total development energy.	• Quick to implement • Green Power is an established and accredited scheme to guarantee supply of renewable energy	• Potentially introduces regulatory complexities due to large number of parties involved • May be difficult to enforce requirement and ensure compliance
Single building owner (Build to Rent)	• A build to rent model for the development would encourage a single owner of all assets (residential, commercial, and retail) and therefore a single owner responsible for offsetting all communal energy sources through a PPA or Green Power purchases. This may extend to the private consumers if the owner also becomes an energy retailer within the development. It could also allow for significant efficiencies in	• This may extend to the private consumers if the owner becomes an energy retailer within the development. • It could also allow for significant efficiencies in design, services and plant driving better energy and cost efficiencies.	• May still require a covenant over the title to enforce a 100% renewable energy requirement.

Mechanism	Description	Benefits	Risks
	design, services and plant driving better energy and cost efficiencies.		

8.4.6 Decarbonisation of materials and construction

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*
- *"Taking a whole-of-life- approach to sustainability through planning design, construction, and ongoing precinct management"*

Decarbonising construction is also integral to achieving net zero emission buildings and low carbon precincts. The precinct can implement strategies to reduce embodied emissions and use procurement to drive innovation and reduce the carbon and energy intensity of buildings and infrastructure constructed in the Precinct. Strategies to decarbonise construction include:

- Prioritise building re-use
- Monitoring and modelling of materials lifecycle impacts
- Promote use of local materials to reduce transport emissions
- Promote use of natural materials, such as timber
- Consider modular off-site construction systems
- Innovating product design for longevity, re-use, remanufacture and resource recovery
- Minimising the inefficient use of virgin materials
- The use of Concrete (including pre-cast) clinker substitutes
- Waste to landfill diversion targets (construction and demolition)
- Contractors and sub-contractors have environmental management policies and procedures, such as ISO14001

Setting embodied energy benchmarks for different typologies can also greatly reduce emissions associated with construction. The Green Building Council of Australia (GBCA) Green Star Buildings guidelines requires the modelling of a reference project and demonstration of improvements in the reduction of embodied emissions (referred to as upfront carbon emissions in the guidelines). This percentage reduction increases in stringency up to 2030 (Figure 18).[37]

[37] GBCA Green Star Buildings Submission Guidelines v1

Figure 18 – Green Star embodied energy reduction targets

8.4.7 Reducing transport emissions

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*

Transport emissions are emissions associated with the use of cars, buses, trains, and other motorised travel. This can also include commuting, personal travel, freight, and logistics both within the Precinct itself and from those travelling through it. The boundary of transport emissions for a precinct is complex as it depends on the origin, destination or passing nature of the journey.

Impact on transport emissions reductions can be realised through reclaiming space from private vehicles and prioritising pedestrians, cyclists, and net zero public transport. It is also essential to consider how people travel beyond the precinct and for this reason, investing in critical connections is essential. Transport decisions must also be inherently linked to land use decisions and urban form planning – particularly in new precincts. Precincts can consider how these features can be used to reduce overall travel or promote use of existing infrastructure investments such as existing public transport and bike lanes.

Considerations may include:

- Electric Vehicle infrastructure
- Cycling parking requirements
- Minimising private parking in public domain and promoting walkability and cycling
- Design that promotes the use of public transport e.g. public transport accessibility

8.4.8 Reducing solid waste emissions

SSP Study Requirement - Considerations:

- *"The NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings"*

Waste, and particularly organic waste management, can have a significant emission intensity (mostly methane) depending on how it is stored, collected, and managed. Recognising waste as a valuable commodity, maximising recycling, promoting landfill diversion, and efficient collection can all help to reduce waste related emissions. Trialling innovative technologies and programmes at the precinct scale (e.g. energy from waste) can help deliver meaningful change. In addition, applying circular economy principles at the precinct scale can better enable natural system regeneration, keep products and materials in use for longer, and better capture and recognise waste as a valuable commodity. Waste is considered in greater detail in Section 10 of this report.

Considerations may include:

- Applying circular economy principles to materials and recognising waste as a potentially valuable commodity
- Designing waste systems to enable effective material (waste) separation, storage, and export

- Separating organic waste streams to be managed separately to minimise methane release through composting or energy generation

8.5 Summary - Energy and Greenhouse Gas Emission Scenarios

As previously mentioned, a number of key considerations directly influence the intrinsically linked SSP Study Requirements. Further to the previously introduced Scenario 1 (100% renewable energy and carbon offsetting of residual scope 1 and 3 emissions) and Scenario 2 (80% renewable electricity and carbon offsetting of natural gas usage and residual scope 1 and 3 emissions), there are many more scenarios that will lead to achieving the NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings by 2050.

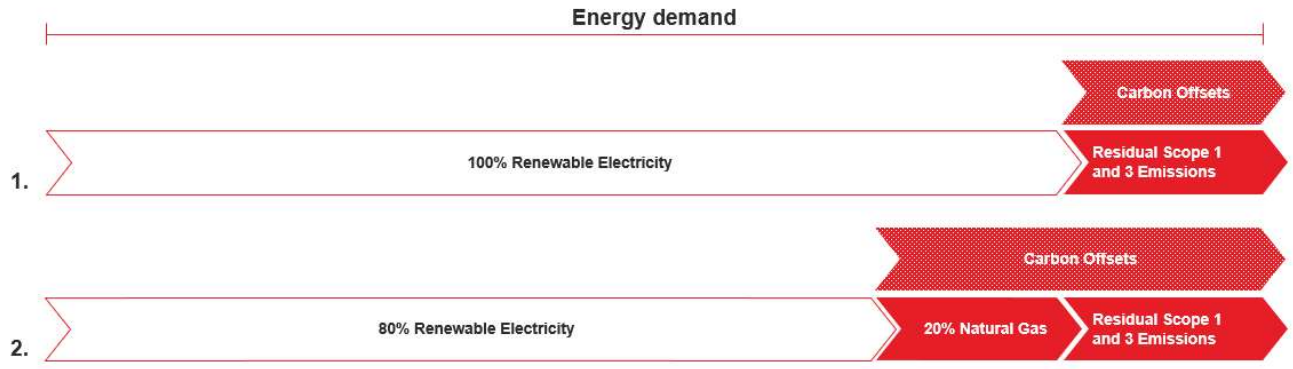


Figure 19 – Scenarios 1-2 - Achieving carbon neutrality, various energy and GHG emission scenarios

The below diagram also introduces Scenarios 3, 4, and 5 with various degrees of carbon offsetting requirements in combination with a number of efficiency initiatives (i.e. reducing energy demand), the introduction of on-site renewable energy, and the purchase of renewable electricity.

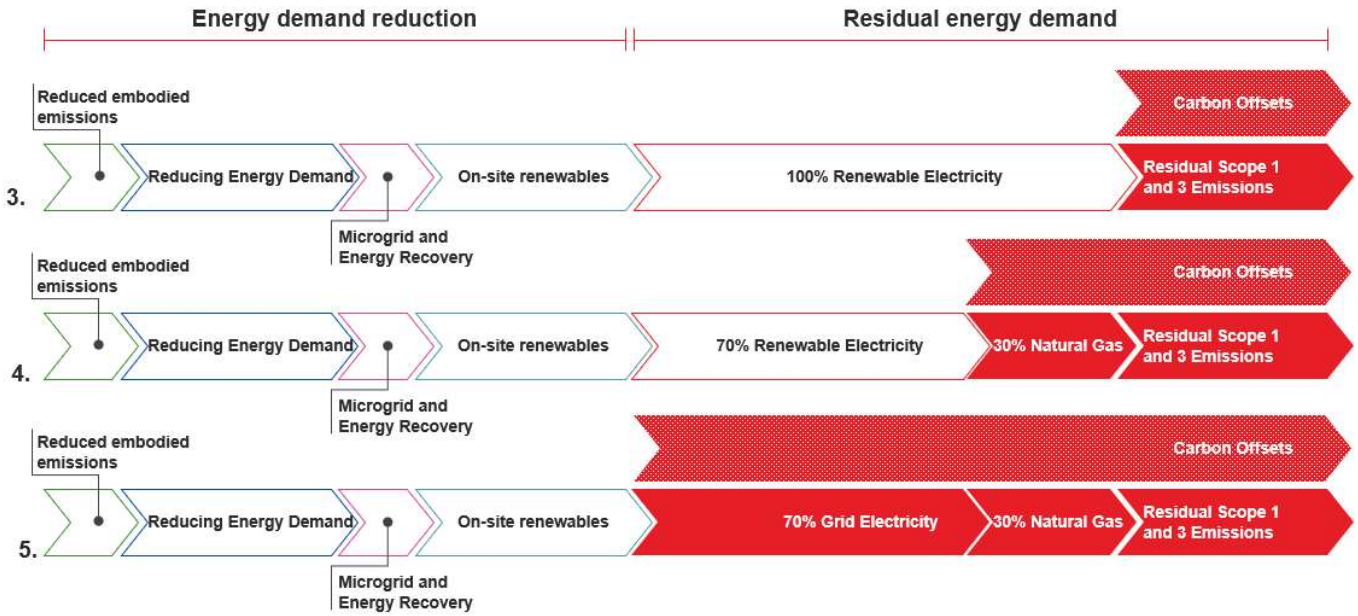


Figure 20 – Scenarios 3-5 - Achieving carbon neutrality, reducing energy demand and various energy and GHG emission scenarios

In summary, different scenarios and initiatives provide different opportunities and challenges when targeting a net zero precinct by 2050. A detailed cost benefit analysis will be required at future development stages to assesses the different economical scenarios of investing into upfront operational energy demand reduction, renewable energy purchases, and future carbon offsetting. In the current market, high performance building materials and products

are commonly not competitive with the purchase of renewable energy and carbon offsetting. With an increasing demand for renewable energy and carbon offsets, it is however anticipated that the cost for both will increase. On the other hand, it also anticipated that the demand and the associated availability for high performance building materials, products, and technologies will increase, which in return will see the cost for those reducing in the future. With this future shift in mind, a wide range of scenarios will become available to realise a net zero carbon precinct by 2050.

9 Water

9.1 SSP Requirements & Considerations

The following SSP study requirements and considerations are being addressed as part of this section:

Requirement:	Addressed in the following sections
• *"Outlines the likely impacts of the proposal in relation to ……, water use, wastewater…"*	• 9.2 Impact
• *"Includes an integrated water cycle management strategy"*	• 9.3 Integration
Considerations:	
• *"Water, wastewater, and stormwater plus options for potential alternative water supply including potential to achieve a water positive precinct"*	• 9.3 Integration
• *"Opportunities for and assessment of the feasibility of a precinct-scale recycled water scheme including the possibility"*	• 9.3 Integration
• *"Compliance with BASIX and opportunities to deliver beyond BASIX scores"*	• 9.3 Integration

9.2 Impact

Integrated Water Management (or Integrated Water Cycle Management (IWCM)) is a process that brings together all stakeholders involved in the planning and management of all water across the entire water cycle, to ensure that the liveability, resilience and sustainability outcomes that the community is seeking are maximised across our cities and regions. (WSAA, 2020).

The purpose of IWCM is to establish a collaborative approach that brings together all elements of the water cycle, including waterways, bays, wastewater management, alternative and potable water supply, stormwater management and water treatment. It considers multiple benefits and is a holistic approach.

IWCM planning considers stressors – current and emerging issues – that are impacting on the management of water resources, including:

- Population growth and urbanisation, resulting in a high demand for water supplies as well as risk of increased water pollution due to an increased percentage of impervious surfaces
- Climate change stressors, reducing the availability of potable water supplies due to reduced rainfall as well as changing flooding and stormwater management
- Community preferences for improved environmental performance and recycled water
- Knowledge and technology, providing developments in water recycling, stormwater reuse and water sensitive urban design

The following section outlines the basis for IWCM planning, including the demand and supply assumptions, covering drinking water, wastewater, stormwater, and recycled water. These will form part of a preliminary IWCM approach. At this stage, all inputs are preliminary, and assumptions have been made, therefore the figures are indicative only. To inform a comprehensive water balance, IWCM plan or infrastructure sizing, additional analysis is required.

9.2.1 Inputs and basis

To inform a preliminary IWCM plan, information has been sourced from various consultants who have been engaged by Transport. The analysis to date has been preliminary, therefore several assumptions have been made which are outlined in the following sections below. Additional, detailed water balance modelling, MUSIC modelling and flood modelling is required to inform the final strategy.

Table 12 - Inputs and basis

Aspect of IWCM	Key reference	Inputs provided	Additional assumptions
Residential water demand	*Redfern North Eveleigh Feasibility Application – Sydney Water (AECOM, 2022)*	Residential unit rates and total maximum potable water demand range including BASIX reduction	Split of internal potable and non-potable demands
Residential wastewater generation		Residential unit rates and total average dry weather flow (ADWF) range including BASIX reduction	
Non-residential water demand		Non-residential unit rates and total maximum potable water demand range BASIX reduction	Split of internal potable and non-potable demands
Non-residential wastewater generation		Non-residential unit rates and total average dry weather flow (ADWF) range including BASIX reduction	
BASIX reductions		BASIX reductions are applied to water and wastewater figures	
Greening demand	*Green Infrastructure Water Usage Calculations (Arterra, 2022)*	Greening water demands (including green spaces, green roofs, and trees)	
Construction phase water demand	N/A	N/A	General strategy assumed – no quantitative analysis undertaken at this stage
Construction phase wastewater generation			
Stormwater/rainwater harvesting potential	*Green Infrastructure Water Usage Calculations (Arterra, 2022)*	Total annual rainfall received on site	100% of stormwater/ rainwater capture
Potential recycled water resources	N/A	N/A	First principles calculation of technically feasible recycled water production based on wastewater generation

Appendix 4 details the assumptions above in greater detail, including:

- Breakdown of demand – residential, non-residential, greening, BASIX reductions, wastewater generation, stormwater, and rainwater harvesting
- Breakdown of supply - Reticulated drinking water, rainwater and stormwater, recycled water

9.3 Integration

Integrated water management strategy

As mentioned, Integrated Water Cycle Management planning considers the integration of all elements of the water cycle, delivering a holistic approach to water management that delivers multiple benefits for all stakeholders involved.

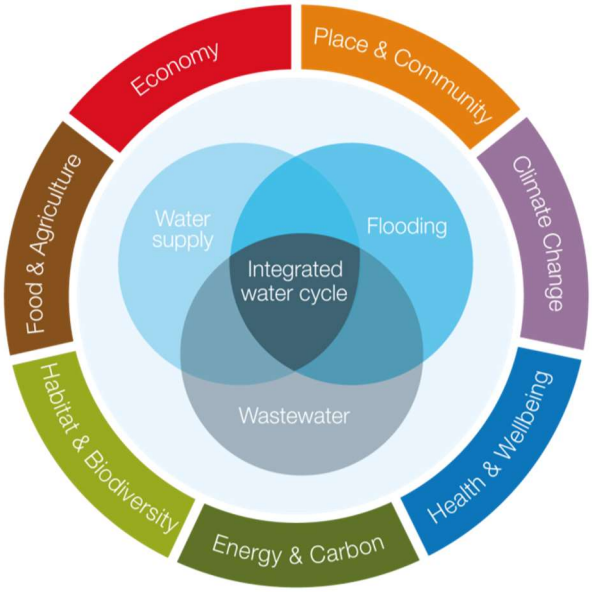


Figure 21 – Integrated water management

Re-integrating precinct scale water management, with urban planning and design, requires collaboration and partnership with government, water authorities, regulators, infrastructure providers, business, local, including Aboriginal communities, and others. By placing the water cycle at the heart of sustainable planning, design and delivery, critical issues relating to resilience, flood risk, water supply and water quality are addressed.

Placing the integrated water cycle at the centre of design can deliver multiple wider benefits. In particular, for the Redfern North Eveleigh precinct, this includes:

Category	Benefit and outcome
Economy	Potential direct contribution through water-related investment in infrastructure, associated new technologies, partnership with small enterprise or community organisations, etc. Developer investment in the precinct. Indirect impact on land and property values, attracting inward investment and improved labour productivity.
Place and Community	Access to and engagement with water can play a significant role in creating better places with a strong sense of identity. Water reuse can be used to irrigate open space and trees, treating stormwater can be used as a community feature. Making space for water can open up and reconnect people and places. Water is an integrator which can facilitate partnership and collaboration, as well as enhance cultural values.
Climate Change	Design for water helps to mitigate and adapt to climate change. Tree planting and greening directly contribute to improved microclimate. Wastewater recycling and stormwater reuse can be used for non-potable uses - locally managed water can increase resilience to water scarcity and drought.
Health and Wellbeing	Water-related green infrastructure can absorb air pollutants and improve microclimate, provide opportunities for recreation, exercise and education. Increased amenity from WSUD can encourage active transport, including cycling and walking. Water can help to improve overall living environments and provide opportunities for community engagement.

Category	Benefit and outcome
Energy and Carbon	Removal and sequestration of greenhouse gases as a result of urban greening. Reduction in energy demand due to shading/insulation and reduced pumping. Reduced water demand from efficient water fittings reduce energy usage. Potential for renewable energy generation from biosolids.
Habitat and Biodiversity	Green space provides new and improved habitats through traditionally urban areas making space for water within green infrastructure networks, provision for natural treatment of runoff, improving water quality, river/wetland and coastal restoration.
Food and Agriculture	Local food production could be integrated, including food-compatible use of open space, edible planting, runoff harvesting and treatment and improved agricultural practice. Improved water quality and runoff will also improve the quality of water extracted for agricultural purposes.

A best practice, integrated approach to total water cycle management is recommended for the Redfern North Eveleigh precinct. This is driven by:

- Vision of a 'water positive precinct'
- BASIX requirements of a 40% water reduction across the site
- Relevant SSP Study Requirements, including ESD, Climate Change Mitigation and Adaptation and Utilities
- Targets from the City of Sydney Sustainable Sydney 2030
- The Greater Sydney Commission's 'Metropolis of Three Cities'
- Sydney Water's Integrated Water Management planning approach

This approach is recommended to include:

- Minimising water consumption and wastewater generation through water efficient planning, design, construction, and operation
- Maximising opportunities for onsite harvesting, treatment and re-use of rainwater, stormwater, and potentially site generated wastewater
- Managing stormwater quality and quantity through the integration of best practice water sensitive urban design into the site master plan

The Integrated Water Cycle Management Plan below has been developed for the Precinct to inform future development stages, including future development applications, providing initiatives that can help establish a water positive precinct.

Precinct scale IWCM resilience, liveability and wider catchment benefits

Drought resilience

Water demand reduced as a result of water efficiency at the precinct level.

Water footprinting

Undertake studies to understand embodied water use within the city and determine water footprint dependencies.

Spatial planning and land use

Understanding of the integrated water cycle will inform planning, land use and landscape architecture, ensuring sustainable urban development.

Precinct planning

Decentralised planning at a precinct scale encourages localised recycling and sharing of water resources.

Protection of critical infrastructure

Water at the centre

Water reintegrated as a central feature of high quality public realm, using green roofs, facades and intelligent management systems. This improves liveability, health and well-being, microclimate and controls runoff. Water features at the centre of a precinct bring people together, creating a sense of community.

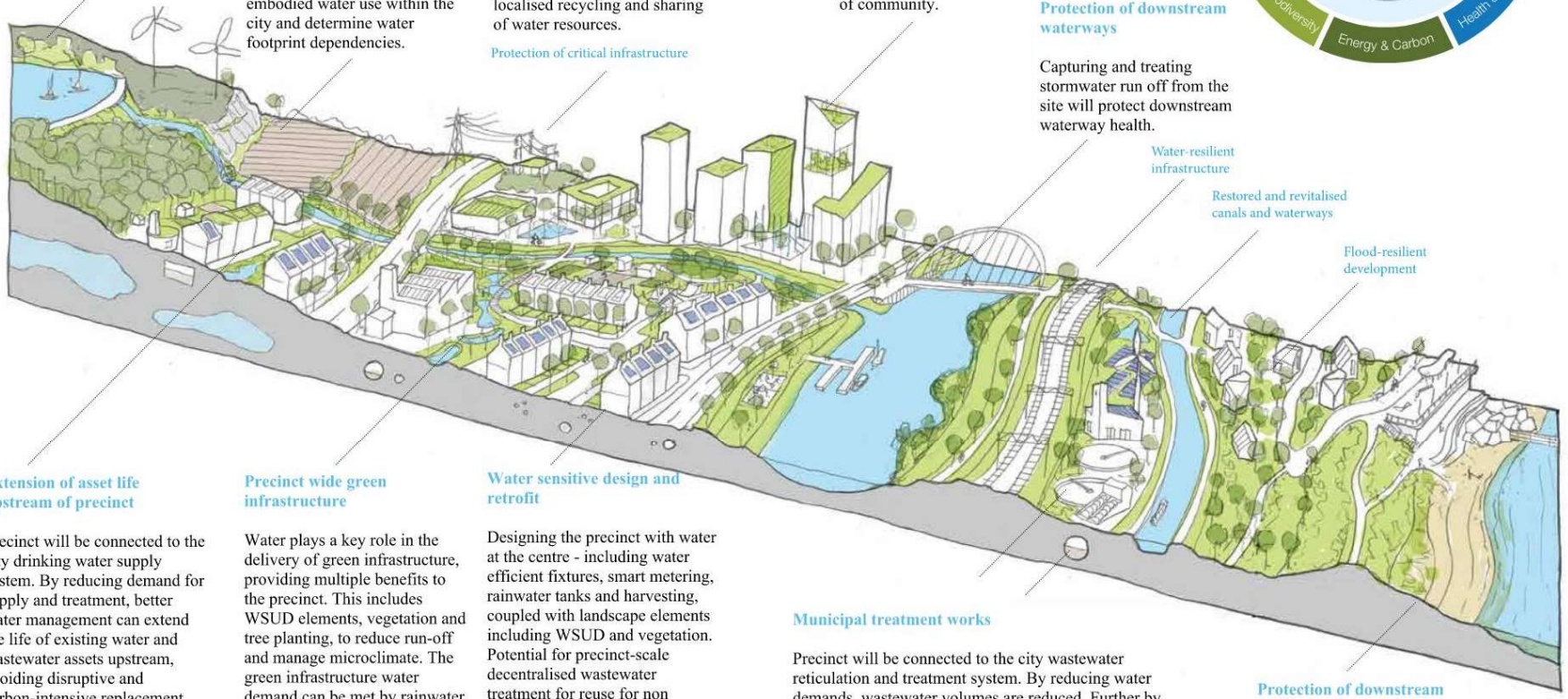
Protection of downstream waterways

Capturing and treating stormwater run off from the site will protect downstream waterway health.

Water-resilient infrastructure

Restored and revitalised canals and waterways

Flood-resilient development



Extension of asset life upstream of precinct

Precinct will be connected to the city drinking water supply system. By reducing demand for supply and treatment, better water management can extend the life of existing water and wastewater assets upstream, avoiding disruptive and carbon-intensive replacement.

Precinct wide green infrastructure

Water plays a key role in the delivery of green infrastructure, providing multiple benefits to the precinct. This includes WSUD elements, vegetation and tree planting, to reduce run-off and manage microclimate. The green infrastructure water demand can be met by rainwater and stormwater harvesting and potentially on-site wastewater recycling.

Water sensitive design and retrofit

Designing the precinct with water at the centre - including water efficient fixtures, smart metering, rainwater tanks and harvesting, coupled with landscape elements including WSUD and vegetation. Potential for precinct-scale decentralised wastewater treatment for reuse for non potable demands, including indoor non-potable demands (toilet flushing and laundry) and irrigation of green spaces.

Municipal treatment works

Precinct will be connected to the city wastewater reticulation and treatment system. By reducing water demands, wastewater volumes are reduced. Further by implementing on-site wastewater treatment and recycling, there is less demand for treatment downstream, extending the life of the assets.

Protection of downstream waterways

Capturing and treating stormwater run off from the site will protect downstream waterway health.

Figure 22 Conceptual integrated water cycle management strategy

10 Solid Waste

10.1 SSP Requirements & Considerations

The following SSP study requirements and considerations are being addressed as part of this section:

Requirement:	Addressed in the following sections
• *"Outlines the likely impacts of the proposal in relation to ....solid waste."*	• 10.2 Impact
• *"Includes an integrated waste management strategy that maximises resource recovery."*	• 10.3 Integration
Considerations:	
• *"Precinct scale measures to ensure effective operational waste management"*	• 10.3 Integration

10.2 Impact

The City of Sydney area produces more than 5,500 tonnes of waste every day and contributes to approximately 8% of the city's total greenhouse gas emissions. This is made up of waste generated at home, the workplace, venues, and events and in response to the demand for new buildings and infrastructure. Each person within the City of Sydney is estimated to produce around 1 kg of waste daily and 2 tonnes of rubbish each year.

Almost all of this product can be effectively re-used, recycled, remanufactured, or transformed into another useful application. The City of Sydney has set out long term goals to reduce all waste for maximum resource recovery, with a minimum 90% diversion of waste across all waste streams from landfill by 2030.

Opportunities to reduce resource consumption across the Precinct lifecycle from design, construction to operations will be critical to enable maximum resource recovery and facilitate appropriate solutions to properly consider material consumption and waste reduction.

Demolition & Construction waste

Minor demolition will take place across the site with the majority of the heritage fabric retained where possible. The most significant waste streams which would be produced during demolition are likely to be:

- Timber – predominantly from floors and roofs
- Bricks – predominantly from existing buildings
- Steel – predominantly from steel structures

The primary goal for the construction phase relates to the minimisation of waste generation. The project will aim to retain and reuse as much of the existing heritage building fabric as practicable. As such, the volume of waste produced during demolition and construction phases will be relatively small in comparison to developments of similar size. An overview of the major waste streams resulting from both phases is provided in Figure 23. Waste streams which are predicted to be the largest in volume are highlighted in pink.

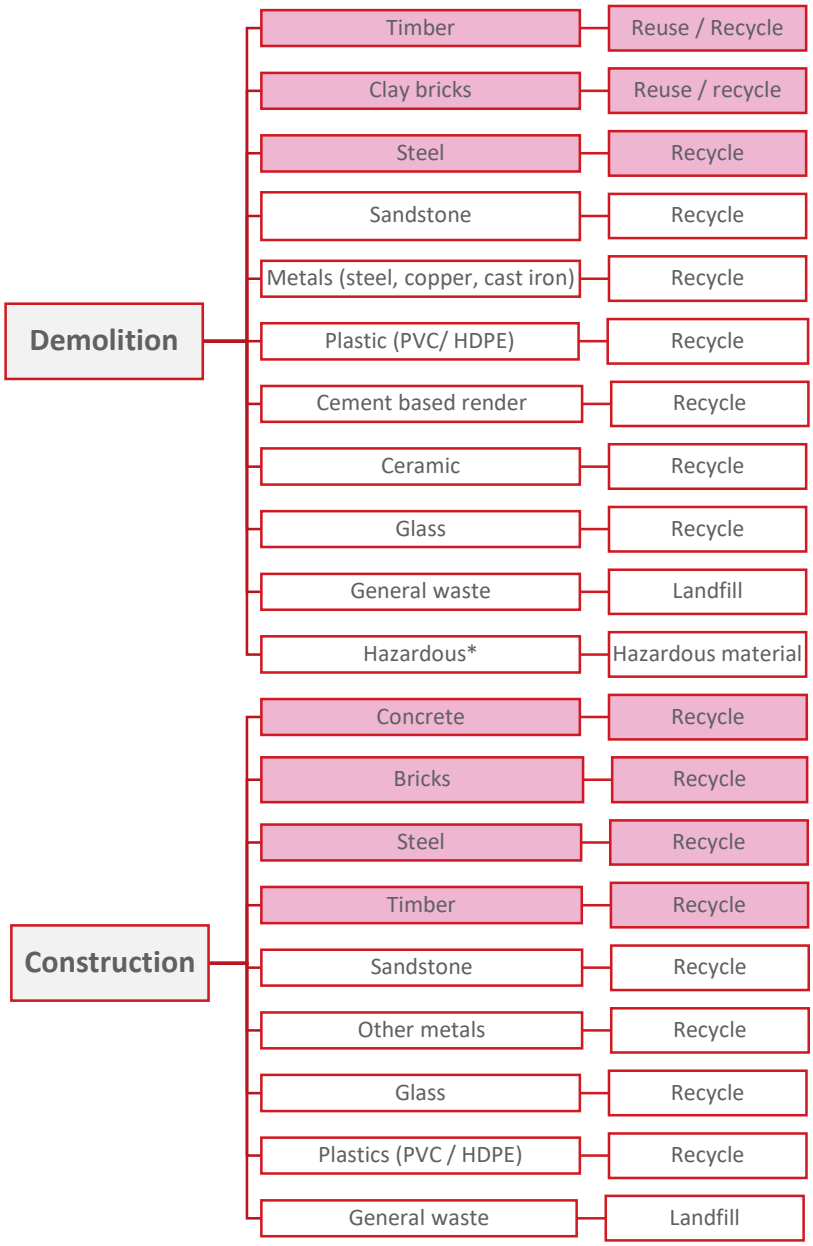


Figure 23 - Overview of major construction waste streams

Operational Waste

Source segregation of solid waste within the area of the City of Sydney is currently limited to three streams (comingled recyclables, garden waste and residual waste/garbage). Council does not currently collect segregated food waste, however a trial involving both residential houses and apartment buildings across the City is currently being undertaken across some residential households and apartment complexes for the separate collection and recycling of food scraps.

The anticipated waste streams generated during operations of the Precinct, resulting from a combination of residential, commercial, retail and food/café outlets will likely include:

- General waste
- Paper/cardboard
- Food organics
- Co-mingled recycling

- E-waste
- Cooking oils
- Hard/bulky waste

As outlined above, household waste collection and disposal are currently managed by the City of Sydney and the Council has set in place plans to potentially roll out separate collection of food waste to households following the trial. NSW EPA audits (2019) have found that food waste makes up on average 37.6% of residual waste streams for councils with garden only organics collection, therefore food waste is considered a high priority for improving resource recovery and landfill diversion.

10.3 Integration

Waste and recycling generated within the site including all buildings and public realms will require a holistic integrated approach to co-ordinate the individual waste management systems in place for each building within the Precinct. It will include for collection schedules, reticulation pathways and accessibility, adequate provision for the storage and sorting of waste and clearly defined access strategy for the various waste collection points.

The future of waste management is the circular economy model which brings together opportunities to enable circular economy practices and allow the Precinct and its tenants and residents to maximise recycling. In line with future trends and regulatory goals and targets, precinct scale measures are being considered to ensure effective operational waste management.

The above outlined considerations and initiatives identified at this stage of the Precinct development will help support effective and efficient waste minimisation and resource recovery. This integrated waste management approach considers the full resources flow to and from the site and seek to not only optimise the value of the materials but also help to reduce costs.

Figure 24 outlines an integrated waste flow from the manufacture of products through to the circular recovery and reuse where possible, with the main principles applicable to the Precinct

- **Produce** – looks at the input of natural resources for manufacturing and production and the opportunity to consider cleaner production, with the integration of recovered materials
- **Consume** – innately, consumption of goods and products has an adverse environmental impact. The integrated approach looks at firstly reducing consumption, and the promotion of reuse or recycling to maintain the product within its lifecycle
- **Collection** – where products cannot be reused or repurposed, effectively rendering its end-of-life use, appropriate collection enables opportunity for alternatives to disposal. This includes off site sorting and **recycling** where possible or for the residual use in such opportunities as energy recovery. Materials recovered can then be cycled back to appropriate product manufacture.

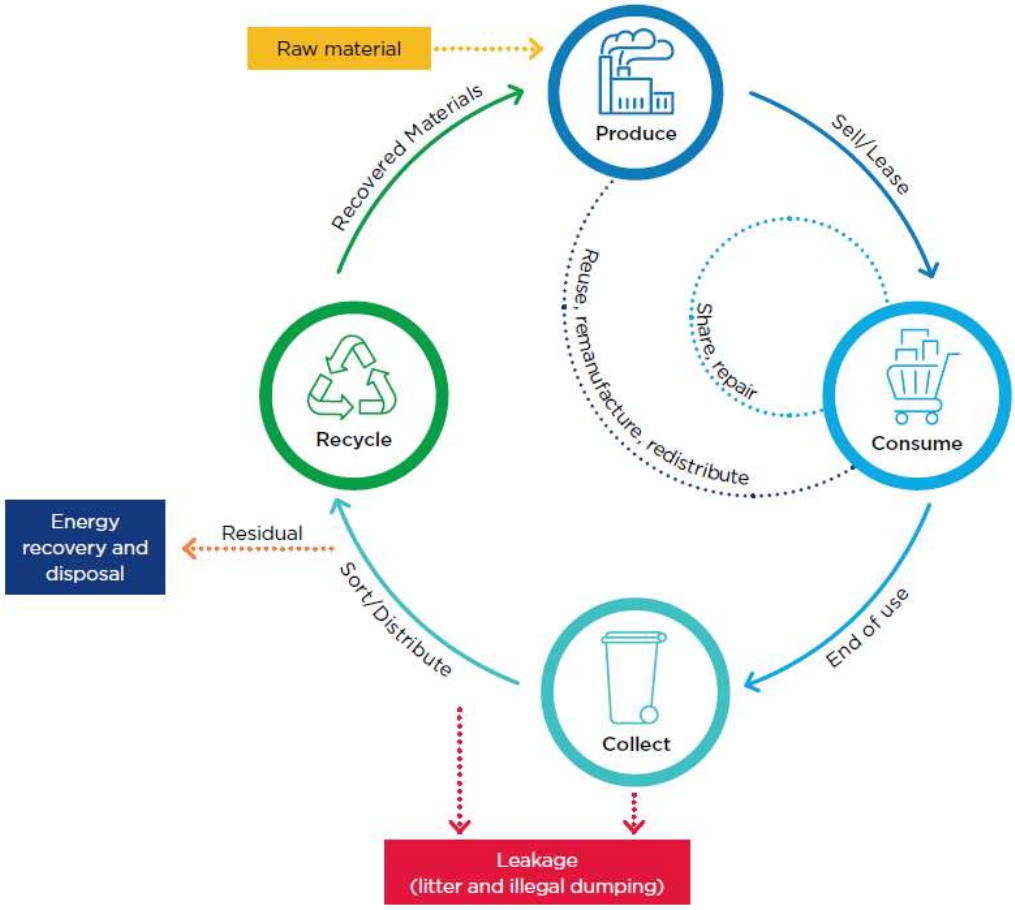


Figure 24 - Integrated waste management

11 Climate Change & Microclimate

11.1 SSP Requirements & Considerations

The following SSP study requirements and considerations are being addressed as part of this section:

Requirement:	Addressed in the following sections
• *"Outlines the likely impacts of the proposal in relation to ……. climate change resilience"*	• 11.2 Impact
• *"Includes measures to address the impact of climate change including urban heat and extreme weather events."*	• 11.3 Integration
Considerations:	
• *"The incorporation of Green Roofs, Cool Roofs and Green Walls into the design of any future buildings"*	• 11.3 Integration
• *"Climate change, including the urban heat island effect, changing temperatures and rainfall patterns"*	• 11.3 Integration

11.2 Impact

The impacts of climate change are already being experienced within Sydney and will be further exacerbated over the coming decades. Under the RCP8.5 emissions scenario (in line with our current trajectory) temperatures in Sydney are expected to increase by 3.8ºC by 2070, resulting in a range of changes across primary and secondary climate variables.

Table 13 – Primary and secondary climate variables and projections

Type of Effect	Climate variable/ Potential hazards	Indicator	Projections under scenarios [1]			Qualitative Description
			Baseline [2]	2040 [3] RCP 8.5	2070 [4] RCP 8.5	
Primary	Temperature	Annual mean max. temperature	22.8°C	+1.52°C	+3.82°C	Increase in average annual temperatures (minimum and maximum), and number of extreme heat days. Reduced number of extreme cold days. (Very high confidence)
		Annual mean min. temperature	14.7°C	+1.31°C	+3.58°C	
		Number of hot days (>35 °C)	3.1	4.3 [5]	11.0 [6]	
	Precipitation	Annual mean rainfall	1149.7 mm	-4.2 %	-6.3 %	Decrease in average annual rainfall in winter and spring. (Medium confidence)
	Sea-level rise	Sea-level rise	-	0.14m [7]	0.66m [8]	Sea level will continue to rise. (Very high confidence)
Secondary	Humidity	Relative humidity change	-	-1.9%	-1.7%	Humidity will decrease. (Medium confidence)
	Drought	Time spent in drought is projected, with medium confidence, to increase over the course of the century.				
	Flood	Increase in intensity of extreme rainfall events is likely to lead to an increase in flooding events especially in urbanised areas (with low permeability; high confidence)				
	Wind	Annual wind speed change	-	0.2%	-0.8%	Annual changes to wind speed will be small overall. (High confidence)
	Cyclones	Cyclones are very unlikely to impact Sydney. However, a greater proportion of high intensity storms is projected. (Low confidence)				
	Bushfire	An increase of up to 160-190% [9] in the frequency of severe fire danger days is projected by 2090 under RCP 8.5. This is due to harsher fire weather climate - increasing fuel dryness and hot, dry, windy conditions. (High confidence)				

For a more detailed breakdown of these climate variables refer to Appendix 6.

11.3 Integration

Figure 25 demonstrates the climate change and microclimate initiatives to be implemented across the site.

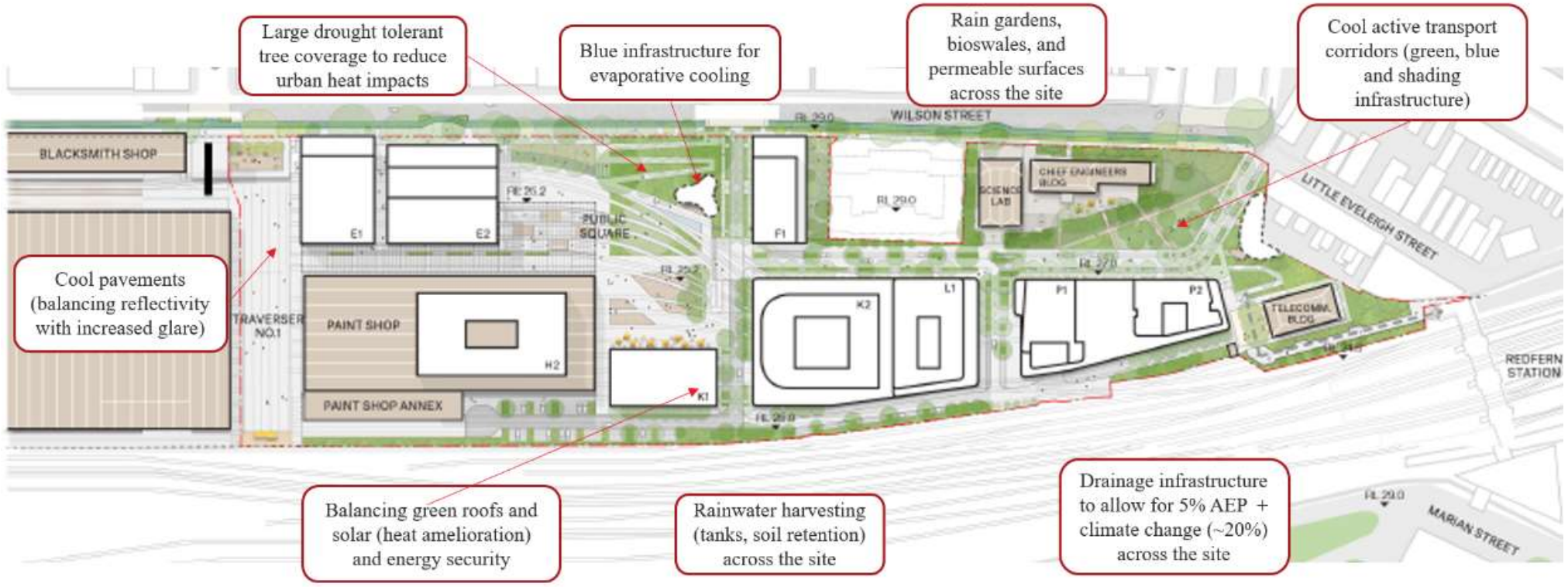


Figure 25 – Climate change and microclimate strategies (2D)

12 From Sustainability to Connecting with Country

‘Country-centred’ approaches as set out in the Draft Connecting With Country Framework are, by their very nature, regenerative. Regenerative approaches are different from sustainability approaches. While sustainability approaches seek to maintain systems, so they continue to perform, regenerative approaches seek to continuously renew and improve overall system performance. Connecting with Country by taking a ‘Country-centred’ approach to the development of the Precinct suggests a shift from sustainability to regeneration.

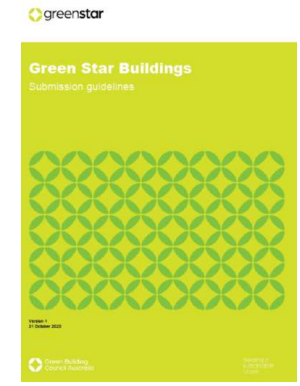
It is recommended that the approach to subsequent stages of the Precinct’s development consider the implications of this shift. A fully integrated approach to subsequent stages of the Precinct’s development that puts Aboriginal peoples at the centre of decision-making will be required to successfully embed an approach that is truly Country-centred and regenerative.

Appendices

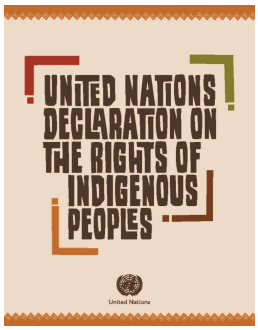
1. Policy Context

National and International Context

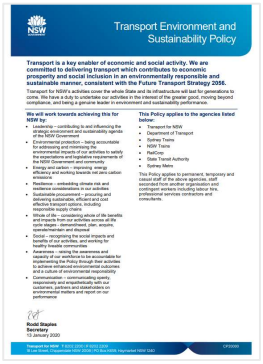
Driver	Brief Description	Precinct Relevance
United Nation Sustainable Development Goals 	In 2015, the United Nations General Assembly passed a resolution on the global agreement of 17 Sustainable Development Goals (SDGs) to form a roadmap for global development efforts to 2030 and beyond.	A number of the SDG's are influenced by precinct developments. Although currently non-binding, the 2030 UNSDG Agenda can influence the precinct outcomes, capital flows, and reporting.
Paris Agreement 	The Paris Agreement formed by United Nations Framework Convention on Climate Change members, sets out a global action plan to reduce the impacts of climate change by limiting global warming to below 2°C and pursue efforts to keep warming below 1.5°C above pre-industrial levels. To limit global average temperature increase to 1.5°C means that all sectors of the economy need to achieve net zero emissions by 2050. Australia has set a target to reduce emissions by 26-28% below 2005 levels by 2030 which builds upon the current 2020 target of reducing emissions by 5% below 2000 levels under the Kyoto Protocol.	The planning and development of the Precinct will occur under the carbon emissions trajectory set by Australia's involvement in the Paris Agreement. Therefore, the design and operation of the development must consider how it will contribute to the achievement of these carbon reduction targets set by the Australian Government.
Climate Active Carbon Neutral Standard 	The Climate Active Carbon Neutral Standard (formerly the National Carbon Offset Standard) is an ongoing partnership between the Australian Government and Australian businesses to drive voluntary climate action. Certification is awarded when a state of carbon neutrality is reached for a Product, Service, Organisation, Event, Building, and Precinct.	These standards will frame the due diligence process and future carbon measurement and reporting efforts for the Precinct and its buildings.
National Australian Built Environment Rating Systems (Rating Tool) 	National Australian Built Environment Rating Systems (NABERS) is a national rating system that measures the environmental performance and impacts of Australian buildings, tenancies, and homes in terms of energy efficiency, water usage, waste management and indoor environment quality of a building or tenancy.	There is opportunity to consider NABERS benchmarking targets during the buildings' early design phases to enable effective delivery in line with the Precincts desire sustainability outcomes.

Driver	Brief Description	Precinct Relevance
Nationwide House Energy Rating Scheme (NatHERS) (Rating Tool)	The Nationwide House Energy Rating Scheme (NatHERS) rates the energy efficiency of a home on a 10-star rating system. 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 Building Codes of Australia and for multi-residential units must: • Collectively achieve an average energy rating of not less than 6 stars • Individually achieve an energy rating of not less than 5 stars It should be assumed though that with future NCC versions higher performance than the currently stipulated 5- and 6-star benchmarks will be introduced.	Achieving high NatHERS benchmarks will provide greater opportunity for the reduction of energy used in buildings for thermal comfort as well as provide means for better futureproofing from climate change and related temperature increases.
Green Star (Buildings and Communities) (Rating Tool) 	Green Star is an internationally recognised rating system that delivers independent verification of sustainable outcomes throughout the life cycle of the built environment. It is designed to be a voluntary rating tool to incentivise better practice within the property development industry. The Green Star Communities rating tool was released in 2012 and evaluates the sustainability attributes of the planning, design, and construction of large-scale development projects at a precinct, neighbourhood and/or community scale. It provides a rigorous and holistic rating across five impact categories; Governance, Liveability, Economic Prosperity, Environment, and Innovation and strives to incentivise more sustainable outcomes from master plans. Green Star Communities also rewards credit points for non-residential buildings on the precinct that are certified under building-scale rating tools. Green Star Buildings assesses the sustainability outcomes from the design and construction of new buildings or major refurbishments, across eight holistic impact categories. This can drive better sustainable outcomes for buildings and by extension the precinct by providing a framework for sustainable building design.	Green Star Communities can be applied to validate the environmental and sustainability initiatives of the planning, design and/or construction phases and incentivise better practice within the development industry. Green Star Buildings can be applied to the retail, commercial and residential building elements within the development.
United Nations Declaration on the Rights of Indigenous Peoples	The United Nations Declaration on the Rights of Indigenous Peoples (the Declaration) 'is the most comprehensive international instrument on the rights of indigenous peoples'. The Declaration was adopted in 2007 and the Australian Government announced its support in 200938. The Declaration 'affirms the minimum standards for the survival, dignity, security and well-being of Indigenous peoples	There is an opportunity to take a rights-based approach to the implementation of sustainability and environmental performance measures in line with the Declaration.

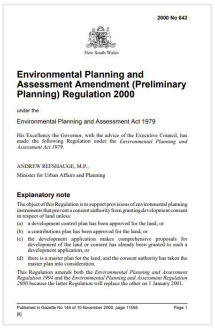
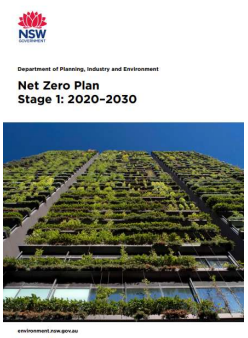
[38] https://www.humanrights.gov.au/our-work/aboriginal-and-torres-strait-islander-social-justice/projects/un-declaration-rights; viewed 3 March 2020

Driver	Brief Description	Precinct Relevance
	worldwide and enshrines Indigenous peoples' right to be different'39. The Declaration 'affirms that (I)ndigenous peoples make a unique contribution to the diversity and richness of civilisations and cultures'40. In addition, the Declaration 'is of utmost importance to combat discrimination against (I)ndigenous peoples created by... centuries of racism, marginali(s)ation and exclusion''41.	
National Partnership Agreement on Closing the Gap	The National Agreement on Closing the Gap is an agreement between Australian Governments and the Coalition of Aboriginal and Torres Strait Islander Peak Organisations (Coalition of the Peaks) *'to enable Aboriginal and Torres Strait Islander people and governments to work together to overcome the inequality experienced by Aboriginal and Torres Strait Islander people, and achieve life outcomes equal to all Australians'.* The National Agreement on Closing the Gap sets out four priority reforms and 16 targets monitored by the Productivity Commission.	There is an opportunity for the approach to the implementation of sustainability and environmental performance measures be designed to reinforce the four priority reforms and Targets 6, 7, and 8.

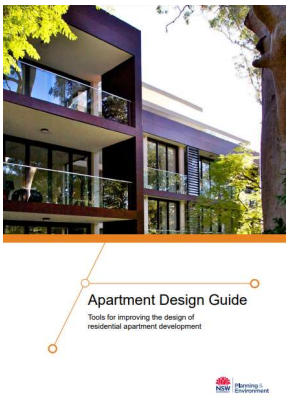
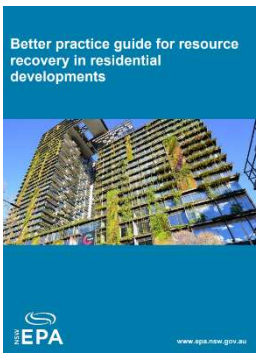
NSW State Context and Guidelines

Driver	Brief Description	Precinct Relevance
Transport for NSW Environment and Sustainability Policy 	Transport has an Environment and Sustainability Policy (2020) which outlines its commitments to environment and sustainability performance. These include: • Leadership • Environmental protection • Energy and carbon • Resilience • Sustainable procurement • Social • Awareness • Communication	As a project delivered by Transport, Redfern North Eveleigh should ensure that the development aligns with Transport's environmental and sustainability policy.
Environmental Planning & Assessment Act and Regulation	ESD principles set out in the EP&A Regulation requires an Ecologically Sustainable Development Report which details how ESD principles (as defined in clause 7(4) of Schedule 2 of the EP&A Regulation 2000) will be incorporated.	The redevelopment of the Redfern North Eveleigh Precinct is subject to the requirements set under the Environmental Planning and Assessment (EP&A) Act 1979 and the regulations supporting the Act. The Study Requirements specifically call out the

39 https://www.humanrights.gov.au/our-work/aboriginal-and-torres-strait-islander-social-justice/projects/un-declaration-rights; viewed 3 March 2020.
40 Fact Sheet 2: Key features (https://www.humanrights.gov.au/our-work/un-declaration-rights-indigenous-peoples-0; viewed 3 March 2020)
41 Fact Sheet 2: Key features (https://www.humanrights.gov.au/our-work/un-declaration-rights-indigenous-peoples-0; viewed 3 March 2020)

Driver	Brief Description	Precinct Relevance
	The principles of ecologically sustainable development, as contained in the Regulation, are as follows: • The precautionary principle • Inter-generational equity • Conservation of biological diversity and ecological integrity • Improved valuation, pricing, and incentive mechanisms	ESD principles set out in the EP&A Regulation and requires an Ecologically Sustainable Development Report which details how ESD principles will be incorporated.
Net Zero Plan Stage 1: 2020-2030 	The Net Zero Plan Stage 1: 2020–2030 (2018) sets out how the NSW Government will achieve net zero emissions by 2050 through creating new jobs, cutting household costs, and attracting investment over the next decade. As the Precinct will continue to operate in 2050, the design of the Precinct should consider how it will operate in a net zero future. The study requirements also request a consideration of the NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings.	The Precinct's development should align itself with the policy directions and enable and support net zero emissions targets. The importance of addressing this goal is reflected in the SSP requirements.
NSW Electric Vehicle Strategy 	The NSW Electric Vehicle Strategy (2021) is the NSW Government's plan to accelerate the State's vehicle fleet of future. The Strategy is expected to increase EV sales to 52% by 2030-31 and see the vast majority of new car sales being EVs by 2035. Increasing the number of EVs on the road requires strategic planning and direction.	The Precinct should consider the integration of EV charging infrastructure in the design of the Precinct.
NSW Circular Economy Policy Statement 	The NSW Government has developed a Circular Economy Policy Statement (2019) to deliver positive economic, social, and environmental outcomes and transition NSW to a circular economy. It sets the ambition and approach for a circular economy in NSW and provides principles to guide resource use and management. The NSW Circular Economy Policy Statement will provide a framework for implementing initiatives throughout the product life cycle, from design, manufacturing, and retail to end-of-life-disposal. These initiatives will promote long-lasting design, maintenance, repair, re-use, sharing, transforming products into services, remanufacturing, and recycling. The NSW Government will be an early adopter,	The Precinct should consider how the construction and operation of the Precinct can integrate circular economy design principles. The study requirements also request a consideration of a whole-of-life- approach to sustainability through planning design, construction, and ongoing precinct management.

Driver	Brief Description	Precinct Relevance
	implementing those opportunities where the benefits are clear.	
NSW Waste and Sustainable Materials Strategy 2041 	The NSW Waste and Sustainable Materials Strategy 2041: Stage 1 – 2021-2027 (2021) focuses on the environmental benefits and economic opportunities in how we manage our waste. The targets outlined within the strategy are outlined below: 5 Year Target: • Phase out problematic and unnecessary plastics by 2025 • Plastic litter reduction target of 30% by 2025 10 Year Targets: • Reduce total waste generated by 10% per person by 2030 • 80% average recovery rate from all waste streams by 2030 • introduce new overall litter reduction target of 60% by 2030 Sub-targets – Plastics: • Eliminate problematic and single use plastics by 2025 • Triple the plastics recycling rate by 2030 Sub targets – Organics: • Halve the amount of organic waste sent to landfill by 2030 • Net zero emissions from organics to landfill by 2030	The Precinct should consider how its construction and operation can integrate best practice waste management strategies to achieve progress against the targets. This strategy has informed the integrated waste management strategy proposed in Section 10. This forms part of the SSP study requirements to include an integrated waste management strategy that maximises resource recovery, and to consider precinct-scale measures to ensure effective operational waste management and maximising resource efficiency.
Building Sustainability Index (BASIX) 	The requirement identifies performance benchmarks to allow sustainability to be considered in site planning, building design and in the construction and operational phases. This sets the minimum sustainability requirements for energy and water for residential developments only. BASIX controls are a statutory requirement for all residential developments including new constructions and renovations worth $50,000 or more in NSW.	BASIX Energy and Water targets will influence overall electrical and potable water demand on the Precinct, with an increase in BASIX targets implying more thermally efficient building envelops and services and decreased potable water demand. The study requirements also request a consideration of how the development may exceed the BASIX targets.

Driver	Brief Description	Precinct Relevance
SEPP 65 and the Residential Apartment Design Guide 	The State Environmental Planning Policy No 65 – Design Quality of Residential Apartment Development (2015) promotes better apartment design across NSW through the establishment of a consistent approach to the design and assessment of apartments and the way they are assessed by councils. SEPP 65 provides guidance on features for apartment buildings through a number of key design criteria relating to the sustainability performance of the development including: • Bicycle and car parking • Solar and daylight access • Natural ventilation • Apartment size and layout • Universal design • Energy efficiency • Water management and conservation • Waste management • Building maintenance	The Residential Apartment Design Guide provides consistent planning and design standards for better apartment building design and amenity within the Precinct. This design criteria and guidance can also achieve additional benefits by reducing energy and water demand, and waste generation during the operational phase.
Future Transport Strategy 2056 	Future Transport 2056 (2018) is an overarching strategy, supported by a suite of plans to achieve a 40-year vision for NSW's transport system. The Strategy and Plans focus on the role of transport in delivering movement and place outcomes that support the character of the places and communities we want for the future. The Strategy recognises that transport infrastructure impacts every person, business, and visitor in the state, and supports economic, social, and environmental outcomes. The vision for future transport in NSW is built on the following outcomes: • Customer Focused • Successful Places • A Strong Economy • Safety and Performance • Accessible Services • Sustainability	The 2056 Strategy is highly relevant to the Precinct as the design decisions being considered now will have implications on the Precinct and its surrounds for decades to come.
Better Practice Resource Recovery and Waste Management 	There are numerous state guidelines and tools which advise on best practice resource recovery and waste management. These include: • Better Practice Guide for Resource Recovery in Residential Development (2019) • Better Practice Guidelines for Waste Management and Recycling in Commercial and Industrial Facilities (2012) • Better Practice for Public Place Recycling These guidelines and tools provide advice to incorporate best practice in the design, establishment, operation and ongoing management of waste and recycling services in	The Precinct should consider the above objectives in the development of the integrated waste management strategy that maximises resource recovery for the Precinct as outlined in the study requirements.

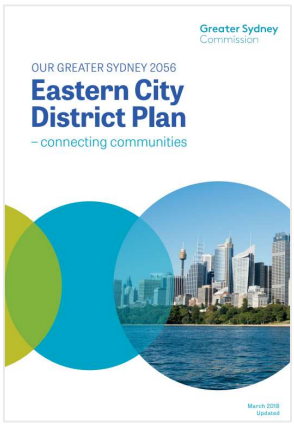
Driver	Brief Description	Precinct Relevance
	residential, commercial, and industrial developments.	
NSW Climate Change Policy Framework 	The aim to this policy framework (2016) is to maximise the economic, social, and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change. The aspirational long-term objectives are: • Achieve net-zero emissions by 2050 • Ensure NSW is more resilient to a changing climate	The Precinct should consider these objectives in the development as the study requires that the likely impacts of the proposal are outlined in relation to energy use, greenhouse gas emissions, water use, wastewater, solid waste, and climate change resilience as well as consideration of the NSW Government's net zero emissions target, by creating a low-carbon precinct and net zero buildings.
NSW and ACT Regional Climate Modelling NARCliM NSW | ACT Regional Climate Modelling project	The NSW and ACT Regional Climate Modelling (NARCliM) is a partnership between the NSW, ACT and South Australian governments and the Climate Change Research Centre at the University of NSW. NARCliM provides high resolution climate projections at a scale that supports local decision makers.	The relevant future climate data should be considered as part of the Precinct's climate change adaptation and resilience response.
The Australian Guidelines for Water Recycling: Managing Health and Environmental Risks 	The guidelines (2006) are designed to provide an authoritative reference that can be used to support beneficial and sustainable recycling of waters generated from sewage, grey water, and stormwater, which represent an underused resource. The guidelines are intended to be used by anyone involved in the supply, use and regulation of recycled water schemes, and support a broad range of recycling options, without advocating particular choices. These guidelines provide the scientific basis for implementing those decisions in a safe and sustainable manner.	The guidelines have been reviewed and consideration of its details is recommended during the precinct's future design stages with the objective to develop an integrated water cycle management strategy that maximises the reuse of recycled water within the Precinct as outlined in the study requirements.
Government Resource Efficiency Policy 	The aim of the NSW Government Resource Efficiency Policy (2019) is to reduce the NSW Government's operating costs and lead by example in increasing the efficiency of its resource use. The policy continues to drive resource efficiency by NSW Government agencies in four main areas – energy, water, waste, and air emissions from government operations.	As Transport is an agency of the NSW Government, they should consider the impacts of the policy on the design of the development to drive resource efficiency energy, water, waste, and emissions.

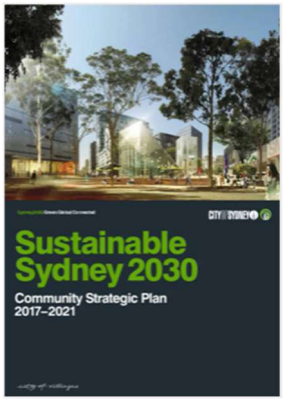
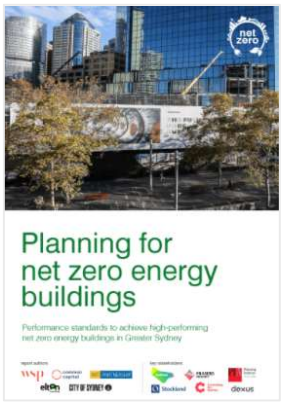
Driver	Brief Description	Precinct Relevance
Better Placed: Draft Connecting With Country Framework	Connecting with Country, by the Government Architect of NSW, sets out a draft framework for 'helping support the health and wellbeing of Country by valuing, respecting, and being guided by Aboriginal people'. By following the Connecting with Country framework, built environment projects will: • 'reduce the impacts of natural events such as fire, drought, and flooding through sustainable land and water use practices • value and respect Aboriginal cultural knowledge with Aboriginal people co-leading design and development of all NSW infrastructure projects • ensure Country is cared for appropriately and sensitive sites are protected by Aboriginal people having access to their homelands to continue their cultural practices'42	Connecting with Country will require a holistic approach to the development of the Precinct that supports the right of Country to be cared for; prioritises Aboriginal people's relationship to Country, financial and economic benefits to the Country and the local, place-specific cultural identity of the Country; shares tangible and intangible benefits with the Country and the Traditional Custodians of that Country, including current and future generations; prioritises recognition and responsibility of Aboriginal people; and supports Aboriginal people continue their practices of managing land, water, and air.
NSW Aboriginal Land Rights Act (ALRA) 1983	The NSW Aboriginal Land Rights Act (ALRA) 1983 'recognises the traditional ownership and occupation of the land by Aboriginal peoples and the importance of their connection to land' 43. The ALRA 'recognises the spiritual, social, cultural and economic importance of land to the state' s Aboriginal peoples' 44. The ALRA sets out the objects of Local Aboriginal Land Councils under the Act, which are 'to improve, protect and foster the best interests of all Aboriginal persons within the Council's area'45 and 'other persons who are members of the Council'46 (Section 51). The ALRA also sets out the functions of a Local Aboriginal Land Council under the Act which, in relation to Aboriginal culture and heritage, are to '(a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law'47	There is an opportunity to involve the Metropolitan Local Aboriginal Land Council in developing the approach to the implementation of sustainability and environmental performance measures for the Precinct.

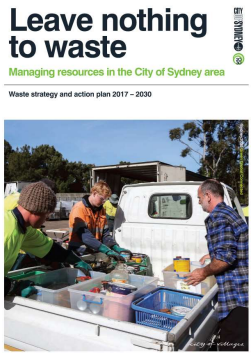
[42] Better Placed: Draft Connecting With Country Framework, Government Architect New South Wales, Issue no. 01-2020 – Draft for Discussion (page 8).
[43] https://www.aboriginalaffairs.nsw.gov.au/land-rights/alra, viewed 3 March 2020
[44] https://www.aboriginalaffairs.nsw.gov.au/land-rights/alra, viewed 3 March 2020
[45] Section 51 of the ALRA 1983
[46] Section 51 of the ALRA 1983 (http://www5.austlii.edu.au/au/legis/nsw/consol_act/alra1983201/s51.html; viewed 3 March 2020)
[47] Section 52, http://www8.austlii.edu.au/cgi-bin/viewdoc/au/legis/nsw/consol_act/alra1983201/s52.html; viewed 3 March 2020

Driver	Brief Description	Precinct Relevance
Transport for NSW Reconciliation Action Plan (RAP) July 2019- July 2021	TfNSW's 'Innovate' Reconciliation Action Plan (RAP) (July 2019- July 2021) sets out the commitment of all organisations within the Transport cluster to work towards reconciliation with Aboriginal and Torres Strait Islander peoples. TfNSW and its operating agencies recognise Aboriginal and Torres Strait Islander peoples 'as the First Peoples of Australia and acknowledges their continuing spiritual, cultural, social and economic connection to our lands and waters'. TfNSW and its operating agencies acknowledge that respect, collaboration and partnership foster greater inclusion, recognition and celebration.	There is an opportunity reinforce TfNSW's RAP in the approach to the implementation of sustainability and environmental performance measures for the Precinct.

Regional and Local Controls and Guidelines

Driver	Brief Description	Precinct Relevance
Regional Controls & Guidelines		
Greater Sydney Region Plan and Eastern District Plan 	The Greater Sydney Commission (GSC) is an independent organisation formed to coordinate and align the planning to shape Greater Sydney. The aim of the Greater Sydney Region Plan (2016) is to give rise to a productive, liveable, and sustainable Sydney. The commission is underpinned by an environmental, social, and economic values with a focus on planning for improved futures across the triple bottom line.	The Redfern North Eveleigh Precinct falls within the Eastern City District Plan (2016) which is characterised with high concentrations of jobs, with good road and public transport connectivity and high levels of interaction between business and people. The Eastern City District Plan includes the following planning priorities and objectives which are relevant to this strategy for Redfern North Eveleigh Precinct: • Planning Priority E19 - Reducing carbon emissions and managing energy, water, and waste efficiently • Objective 33: A low-carbon city contributes to net-zero emissions by 2050 and mitigates climate change • Objective 34: Energy and water flows are captured, used, and re-used • Objective 35: More waste is re-used and recycled to support the development of a circular economy • Objective 69: Support precinct-based initiatives to increase renewable energy generation, and energy and water efficiency, especially in Planned Precincts, Collaboration Areas, State Significant Precincts and Urban Transformation Projects • Objective 72: Encourage the preparation of low-carbon, high efficiency strategies to reduce emissions, optimise the use of water, reduce waste, and optimise car parking provision where an increase in total floor area greater than 100,000 square metres is proposed in any contiguous area of 10 or more hectares

Driver	Brief Description	Precinct Relevance
Local Controls & Guidelines		
City of Sydney Sustainable Sydney 2030 (2017-2021) 	Sustainable Sydney 2030 is the overarching program for the development of the city to 2030 and beyond. The overall themes within the strategy are 'Green', 'Global', and 'Connected'. The strategy ties together a number of plans covering the economy, carbon neutrality, green infrastructure, renewable energy, decentralised water, sustainable transport, light rail, and car sharing. Some of the key targets set out are: • Reduce carbon emissions within the Sydney LGA by 70% on 2006 levels by 2030, and by 2050 achieve carbon neutrality • 50% of electricity demand met by renewable sources • Zero increase in potable water use from 2006 baseline • Total canopy cover increased by 50% from 2008 baseline	As a development within the Sydney LGA, the Precinct should consider how to make progress towards these targets within the design.
City Plan 2036 (2020) 	This Local Strategic Planning Statement reinforces the links between the NSW Government's strategic plans and the City's community strategic plan, Sustainable Sydney 2030, and the planning controls that guide development in our city.	The following sustainability objectives from the plan are particularly relevant to the Precinct: • Protecting and enhancing the natural environment for a resilient city • Creating better buildings and places to reduce emissions and waste and use water efficiently • Increasing resilience of people and infrastructure against natural and urban hazards
Planning for Net Zero Energy Buildings (2021) 	This report looks at how the City of Sydney and other Greater Sydney councils can embed optimum energy efficiency, on-site renewable energy, and off-site renewable energy to set a path to net zero in the planning and design process for larger buildings.	The Precinct should consider these outcomes can be achieved in the development of its' buildings.

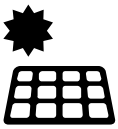
Driver	Brief Description	Precinct Relevance
City of Sydney Policy for Waste Minimisation in New Developments (2018) 	The City of Sydney's Guidelines for Waste Management in New Developments (the Guidelines) promote the efficient storage, separation, collection, and handling of waste to maximise resource recovery and provide safe and healthy spaces for people to live and work in. The Guidelines provide the minimum waste management requirements for all development and for completing Waste and Recycling Management Plans for Development Applications (DAs). All new developments that will generate demolition, construction and operational waste are required to develop a Waste and Recycling Management Plan. Operational waste is waste generated by occupants of developments as part of typical occupancy and use.	This policy is relevant for the Precinct as it can inform the integrated waste management plan and ensure there are synergies that fit with the existing waste infrastructure in the City of Sydney.
City of Sydney Leave nothing to waste – Managing resources in the City of Sydney Area. Waste strategy and action plan 2017-2030 	The plan sets a 'zero waste by 2030' pathway and includes clear targets, priority areas, and actions to reach this zero-waste goal. The plan notes that many international cities that have adopted zero waste targets which are defined as greater than 90% of waste diverted from landfill. The plan provides recommendations that accommodate future legislative requirements and advances in technology. The long-term objectives are: • to reduce the amount of waste produced • to recycle as much as possible • to treat what's left over in the most sustainable way The plan also outlines priority areas and actions which include; • Promote innovation to avoid waste • Improve recycling outcomes • Sustainable design • Clean and clear streets • Better data management • Future treatment solutions	The plan sets a number of targets and priority areas and actions that the Precinct should support and enable. This includes waste diversion targets for operations, residents, and businesses. This includes: Targets for operations: • To divert 90% of waste from City parks, streets, and public places from landfill • To divert 90% of waste from City-managed properties from landfill • To divert 90% of waste from construction and demolition, generated and managed by City operations, from landfill. Targets for residents: • To divert 90% of waste (with a minimum of 35% as source-separated recycling) from landfill. Targets for businesses: • To divert 90% of waste from operating businesses in the local government area from landfill • To divert 90% of waste from construction and demolition activities in the local government area from landfill.

Driver	Brief Description	Precinct Relevance
City of Sydney Development Control Plans 	The Sydney Development Control Plan (DCP) (2012) is a consolidation of the previously separate DCPs and policies in force within the City of Sydney LGA.	The Sydney DCP does not apply to the Redfern North Eveleigh Precinct as the SEPP (Precincts – Eastern Harbour City) 2021 takes precedence for planning controls. However, the Redfern North Eveleigh Precinct is surrounded by the Sydney DCP. To enable connection with the surrounding urban fabric, considerations will be made to the general provisions as detailed in the Sydney DCP 2012 in recognition that the Redfern North Eveleigh Precinct interfaces with the City of Sydney LGA. There are a number of general provisions that could have a measurable effect on the physical quality of the environment in the Redfern North Eveleigh Precinct. In the context of energy, water and waste, the following general provisions may inform future detailed design as applicable in the context of the new planning framework proposed for the Precinct: • Streets, Lanes and Footpaths • Defining the Public Domain • Urban Ecology • Ecologically Sustainable Development • Water and Flood Management • Waste

2. Potential Initiatives and Actions

The following table lists a number of potential initiatives and actions that were identified and developed collaboratively with the wider project team during a number of meetings and online workshops. It should be noted that these are to be used for consideration purposes only and do not form commitments unless they are detailed in the implementation plan (Section 7).

Potential initiatives and actions for future development (FOR CONSIDERATION ONLY)

Principle / Outcome	Potential initiatives & actions
Energy & Greenhouse Gas Emissions 	*Energy* • No gas connections to enable 100% renewable energy targets • Set minimum % of all predicted building energy to be generated by onsite PV • Set minimum % of public domain energy to be powered through onsite PV (discuss with City of Sydney) • Determine if the Precinct is large enough for an efficient centralised system • Establish a Precinct low carbon or net zero microgrid • Establish the ownership / governance structures of decentralised systems and renewable energy generation to achieve 100% renewable targets • Enable vehicle connectivity to grid • Use high performance building materials which have the ability to increase operational performance, reduce energy expenditure, and contribute new potential functionalities to building design *Embodied Energy* • Minimise embodied carbon • Build with biomass; use plant-based construction materials such as timber, bamboo, straw, and bio-composites *Transport* • Cycling parking requirements for City of Sydney are met • Design promotes walkability and cycling • Minimise private parking in public domain • Ensure the Precinct is EV ready • Demonstrate ability of compliance with the NSW EV Strategy and feasibility assessment for the uplift in energy demand • Minimise private vehicle parking within buildings • Enable bike and car sharing options *Green Infrastructure* • Rooftop farming (similar to South Eveleigh) to assist with local food production while creating additional indigenous food-based gardens
Water 	*Water Demand* • All new water fittings and fixtures are to be the highest Water Efficiency Labelling Scheme (WELS) star rating available at the time of development *Cultural Narrative* • Recognise the link to historical water use onsite • Water as an element of gathering in the public domain and a link to the indigenous heritage • Consider community engagement opportunities *Water Sensitive Urban Design (WSUD)* • Favour collection and retention rather than discharge • Promote aquifer recharge • Increase the percentage of permeability in new design • Bioswales embedded in the landscape infrastructure • WSUD that integrates in with the catchment and all landscape elements • Podium planting and storage e.g. roof gardens

Principle / Outcome	Potential initiatives & actions
	• Paving and building materials should be light in colour to minimise heat staying in landscape and stressing the surrounding vegetation and people *Water Recycling and Reuse* • Site wide strategy for water use and reuse, including recycled water, stormwater harvesting and rainwater reuse • Utilise mostly stormwater and greywater to facilitate growing and sustaining healthy green infrastructure • Explore the possibility of an on-site wastewater recycling plant • Identify areas for potential recycled water infrastructure • The use of smart water tanks • Consider cone storage *Benchmarks* • Refer to CoS requirements for podium planting, storage, and water quality
Waste 	*Waste & Material Reuse* • Favour locally sourced construction materials and responsible consumption practices. Preference for reused and recycled materials contributing to a lower carbon footprint where possible including the local sourcing of materials • Investigate recycling all existing concrete and road base onsite *Circular Economy* • Circular economy through design - designing of public spaces for flexible use, design of structures which could be utilised for different purposes in the future to extend the life of building stock and reduce future waste generation • Celebrate a circular economy through design *Built Form* • Public place recycling designed and located to enhance public amenity and encourage responsible recycling behaviour • Appropriate coordination of waste, transport, and architecture so that waste can be collected, separated, and picked up in an integrated manner
Climate Change & Microclimate 	*Built Form* • Coordinate the presence of utilities and the level of tree ambitions • The use of cool materials (high albedo, emissivity), noting potential glare impacts *Green Infrastructure* • Retaining and protecting existing mature trees on site for greater shading and wind mitigation, to attenuate noise, improve air quality, contribute to sequestration of carbon, and provide significant habitat resource for threatened fauna • Endemic planting for maximum biodiversity • Take a holistic approach to new streetscape design to ensure trees are one of the core elements within the design to ensure adequate final sizes of tree pits and drainage systems that passively irrigates trees via stormwater run-off • Explore opportunities for implementing urban agriculture and community orchards within open spaces/ roof terraces/ podiums. (Increasing local community food growing can help increase access to fresh, healthy, and sustainable food for people facing challenges linked to poverty or other barriers to healthy diets) • Ensure adequate soil volumes for all tree planting and prioritise planting directly into natural soils, rather than in containers • Complete on-site soil surveys to match planting types and soil amelioration to maximise growing conditions • Incorporate large ranges of plant species and sizes to increase resilience and diversity

Principle / Outcome	Potential initiatives & actions
	• Include indigenous planting and opportunities for regeneration of endangered habitats • Consider species that tolerate future warmer climates • Incorporate some deciduous trees and vines in appropriate locations to provide for winter solar access and human comfort during cooler months • Utilise large civic-scaled trees such as Figs, Araucarias, Eucalypts and Agathis over numerous small trees to maximise canopy cover and provide significant habitat resource • Utilise generous setback zones near the buildings and streets • Do not over plant for instant effects but allow trees to mature with full and symmetrical canopies where possible

3. Energy Demand Calculations

Using the NABERS Base Building reverse calculator and the average energy consumption of residential dwellings, the forecasted energy demand (Scope 1 and 2 Emissions) for the residential and commercial developments for the Paint Shop sub-precinct only for the year 2025 were calculated using high-level assumptions. The calculations and assumptions are detailed below.

	Electricity (MWh/year)	Gas (GJ/year)	Assumptions
Non-Residential	13,616	12,254	Commercial: GFA = 121,392m2, Based on 4 Star NABERS Base Building reverse calculator for offices, 50 hours per week, 80% electricity 20% gas, GFA=NLA
Residential	1,391	6,496	550 apartments with average local apartment size 75.4m2[48] Electricity – based on daily average usage of 10kWh/customer/day in Sydney LGA[49] Gas – based on average annual household consumption of 17.05 GJ/year in 2020 for Sydney LGA[50]
EV	2,433		500 EV car spaces 40kWh battery (Nissan Leaf[51]) assuming full charge every 3 days.
TOTAL	**17,440**	**18,750**	
Emissions (tCO2-e)	**9,591**	**966**	Electricity emission factor in 2025 = 0.55t CO2-e/MWh 2025[52] Gas emissions calculated using National Greenhouse Accounts Factors 2021 Table 2 – Natural gas distributed in a pipeline[53]
Total Emissions (tCO2-e)	**10,558**		

[48] https://ahd.csiro.au/dashboards/energy-rating/ncc-climates/
[49] https://www.ausgrid.com.au/Industry/Our-Research/Data-to-share/Average-electricity-use
[50] https://jemena.com.au/about/document-centre/gas/average-gas-consumption
[51] https://jetcharge.com.au/resources/electric-vehicle-models/nissan-leaf-charging-2019.
[52] https://www.industry.gov.au/data-and-publications/australias-emissions-projections-2020
[53] https://www.industry.gov.au/sites/default/files/August%202021/document/national-greenhouse-accounts-factors-2021.pdf

4. Water Demand and Supply

An overarching, precinct wide Integrated Water Management strategy is proposed. For a breakdown of the total residential units by sub-precinct, refer to the Redfern North Eveleigh Feasibility Application − Sydney Water (AECOM, 2021). The following section outlines the potential breakdown of demand and proposes supply options.

Demand

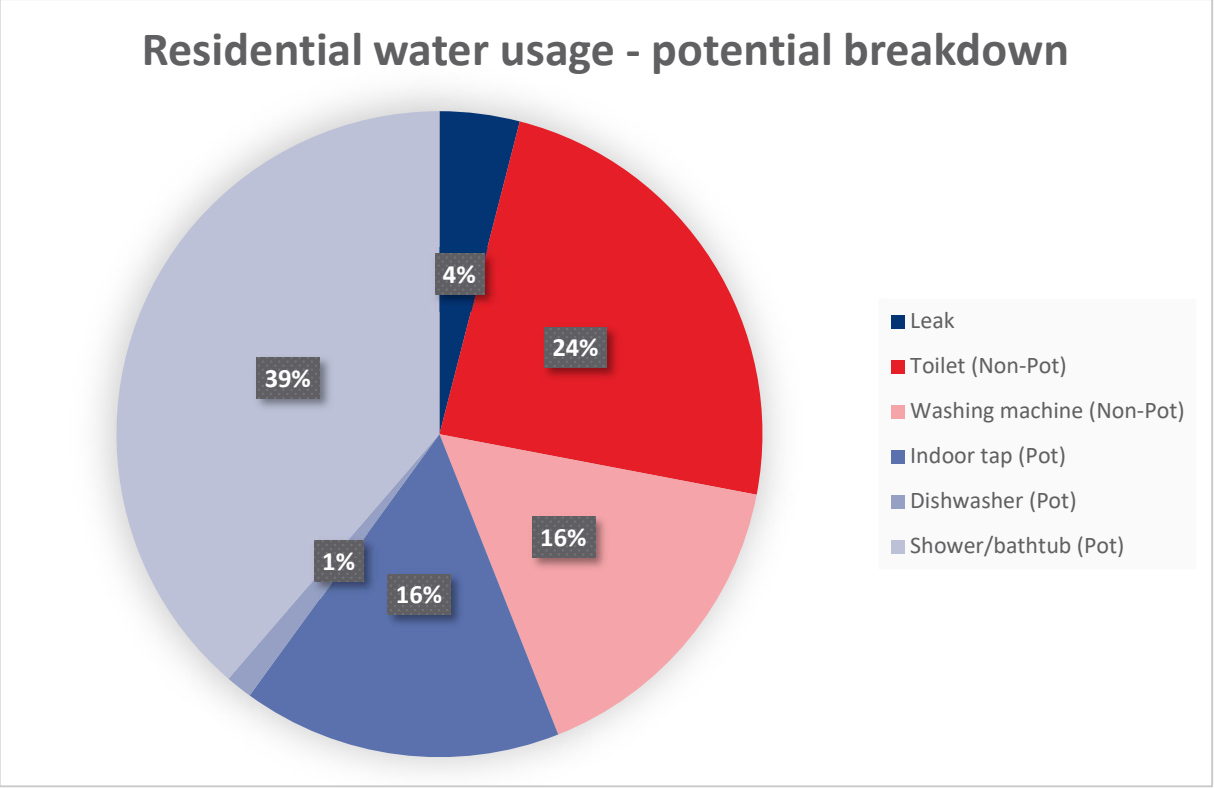
Residential water demand

The total maximum residential water demand range has been calculated in the AECOM report using unit rates from the Sydney Water System Planning Guides and applying a BASIX reduction of 40%. A range of ±15% has been provided. This is proposed to be recalculated for the 381 residential units proposed by Bates Smart (refer Area Schedule per Building (Bates Smart, 2022).

It is proposed in the next phase, potential water demands for potable and non-potable internal use will be estimated. Internal residential potable uses (shaded in blue) include showers, washing machine, indoor taps, bathtub and dishwashers. Non-potable uses (shaded in red) include toilets and laundry.

An example of the potable and non-potable uses breakdown can be seen below. These estimates have been developed using industry rates and experience on previous projects. Due to the nature of the precinct (i.e. high-density apartments), no outdoor non-potable usage (i.e. irrigation) has been calculated. This illustrates up to 40% of internal uses could be non-potable and therefore supplied by alternative water to drinking water.

These figures are to be treated as indicative only as the unit rates are based on averages for medium to high density residences. For more detailed estimates, additional analysis is recommended.



Non-residential water demand

The total maximum non-residential water demand range has been calculated using unit rates from the Sydney Water System Planning Guides. This is proposed to be recalculated for the 109,500m^2 non-residential area proposed by Bates Smart (refer Area Schedule per Building (Bates Smart, 2022).

It is proposed in the next phase, potential water demands for potable and non-potable internal use will be estimated. Internal non-residential potable uses include kitchen, bathroom and cooling uses. Non-potable uses include toilets.

An estimate of demand breakdown has not been provided as "Commercial" non-residential demand covers a wide range of potential uses from small shops to large shopping centres and office towers. Depending on the end-user non-potable demand could vary significantly. Proposed alternative supply for commercial buildings vary from rainwater tanks for toilet flushing to third pipe reticulation for toilet flushing, cooling and industrial purposes.

Greening water demand

The greening water demands have been estimated for the Paintshop sub-precinct by Arterra using various demand, evaporation and soil rates noted in the Green Infrastructure Water Usage Calculations (Arterra, 2021). An overall estimate has been provided below:

Greening demands (Arterra, 2022)

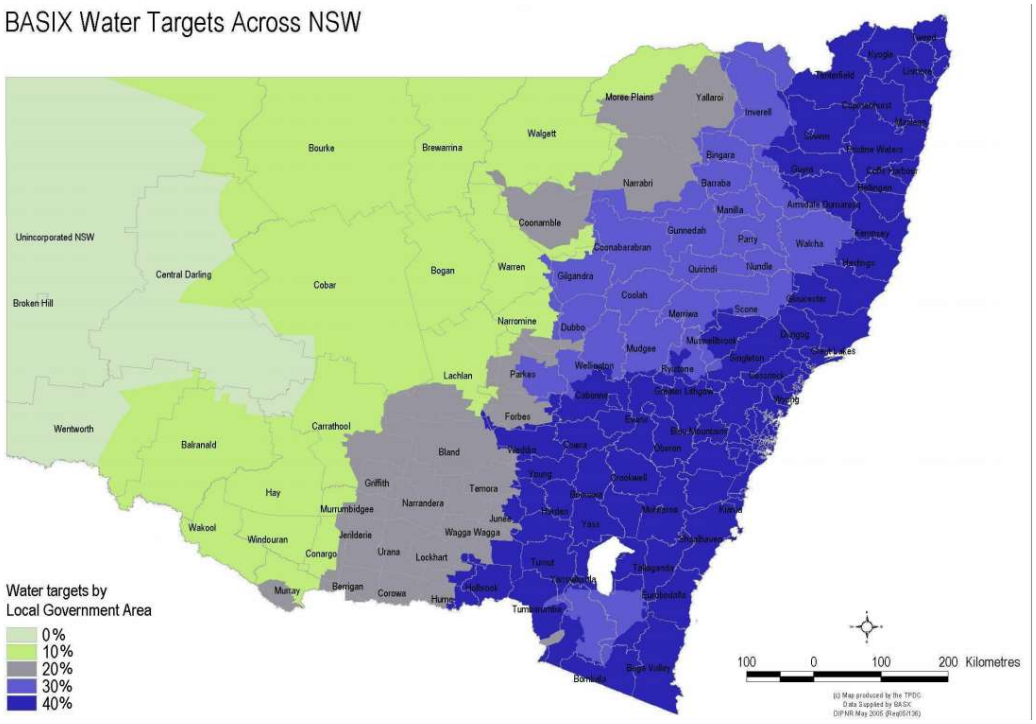
Water requirements for green areas	Total water demand (L/week)	Total water demand (kL/day)*
Gardens	60,000	9
Lawns	48,000	7
Podium and Green Roofs	91,200	13
Trees – Large	962,500	138
Trees – Medium	574,400	82
Trees – Small	17,500	3
Total	1,753,200	250

**Note that the greening estimates are seasonal. Total weekly demand has been calculated using an estimate of summer and winter irrigation factors. The daily total water demand calculated is an average across the year, calculated for the purpose of the plan. In reality, this estimate would be higher in summer and lower in winter. For a more detailed water balance and IWCM plan, additional analysis is recommended, including a daily analysis over the period of 20+ years for an understanding of rainfall variation. In particular, this will influence storage sizing requirements.*

Greening demand is considered non-potable demand and therefore can be provided by an alternative supply.

BASIX reductions

BASIX controls are a statutory requirement for all residential developments including new constructions and renovations worth $50,000 or more in NSW. BASIX Water targets will influence overall demand on the Precinct. As shown below, the BASIX water target for the Redfern North Eveleigh Precinct is a water reduction of 40%. This is already integrated into the demand assumptions.


BASIX Water Targets Across NSW
Moree Plains
Yallaroi
Inverell
Walgett
Bourke
Brewarrina
Bingara
Narrabri
Barraba
Coonamble
Manilla
Unincorporated NSW
Gunnedah
Parry
Walcha
Coonabarabran
Central Darling
Cobar
Bogan
Warren
Gilgandra
Quirindi
Nundle
Broken Hill
Coolah
Merriwa
Scone
Narromine
Dubbo
Mudgee
Lachlan
Parkes
Wellington
Ryelstone
Forbes
Carrathool
Wentworth
Balranald
Bland
Griffith
Temora
Hay
Narrandera
Murrumbidgee
Junee
Wakool
Jerilderie
Wagga Wagga
Windouran
Conargo
Urana
Lockhart
Murray
Berrigan
Corowa
Holbrook
Hume
Water targets by
Local Government Area
0%
10%
20%
30%
40%
100
0
100
200 Kilometres

Wastewater generation

The total maximum wastewater generation range has been calculated using the Water Services Association Gravity Sewerage Code of Australia and applying a BASIX reduction of 40%. A range of ±15% has been provided. The average dry weather flow (ADWF) provided has been converted to a daily rate for comparison with the water demand. This is proposed to be recalculated for the proposed Masterplan by Bates Smart (refer Area Schedule per Building (Bates Smart, 2022)).

Stormwater and rainwater harvesting

At this stage, the stormwater runoff assessment and subsequent MUSIC modelling has not been undertaken. Based on the site masterplan, and the percentage of pervious to non-pervious area, the stormwater runoff will be calculated, including the pollutant loads. WSUD interventions will be proposed based on the results of the storm water runoff calculations. At this stage, it is assumed that WSUD interventions will be implemented and that all rainwater on the site will be captured and reused.

Supply

Potential water resources include:

Potable

Reticulated drinking water

Connection to the Sydney Water network will provide drinking water for potable and non-potable uses. Its flow rate will be set to meet the demands with no cap.

Non-potable

It is proposed alternative supplies are provided for the non-potable purposes. As outlined below, this would be for residential, non residential and greening demands. Potential alternative supplies are below.

Rainwater and stormwater

As outlined in the Greater Sydney Commission's, A Metropolis of Three Cities, key directions include: *A city of great places*, *A city in its landscape* and *A resilient city*. These directions lend themselves to Water Sensitive Urban Design (WSUD) and reusing water for place-based outcomes.

As aforementioned, a stormwater runoff or WSUD assessment has not been undertaken. However, it is assumed interventions will be implemented to capture rainwater and stormwater for reuse. This could be used for non-potable uses, in particular for greening demands. As estimated by Arterra, there is 56 ML/year (Arterra, 2021) of rainfall received each year on the site. It is assumed that rainwater tanks and stormwater harvesting measures will be implemented to capture this water.

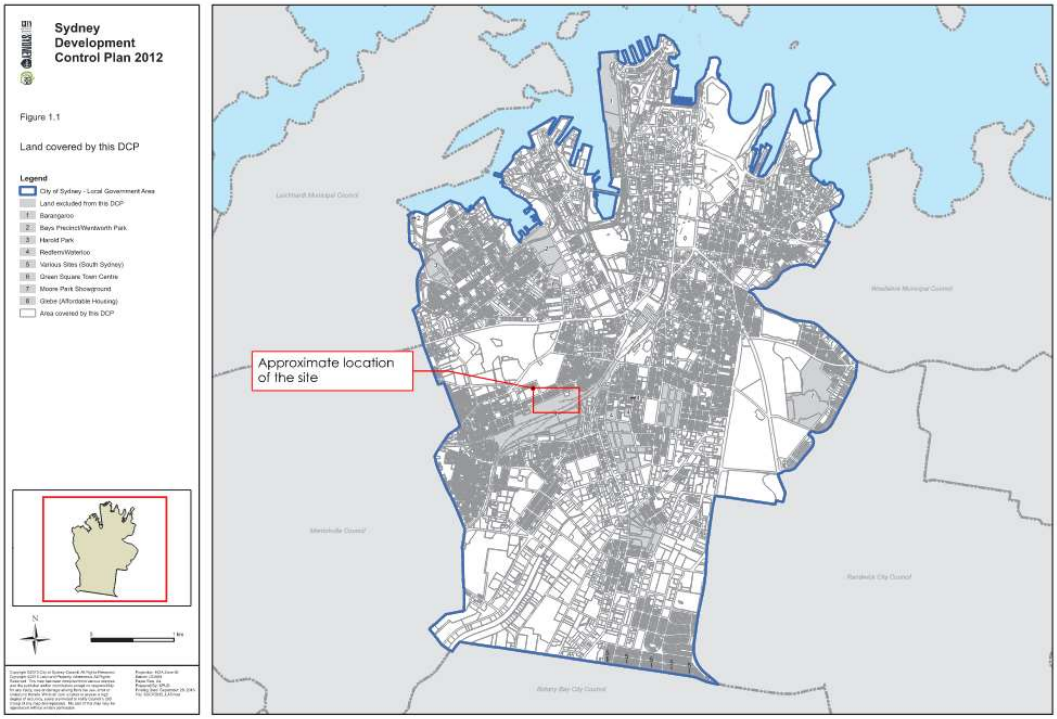
Recycled water

As outlined in the Greater Sydney Commission's, A Metropolis of Three Cities, key directions include: *A city supported by infrastructure* and An *efficient city*. These two directions lend themselves to circular economy approaches, in particular recycled water.

An on-site wastewater treatment plant could treat site generated wastewater and produce high quality recycled water for non-potable reuse. Depending on the technology and level of treatment selected, the efficiency factor will vary (i.e. the recycled water recovered). This could potentially supply the residential and non-residential buildings with third pipe reticulated water for non-potable uses.

5. City of Sydney DCP Requirements

Below is a list of provisions detailed in the City of Sydney DCP 2012 that are deemed relevant to the Precinct.



Applicable Provisions

3.5 Urban Ecology

3.5.2 Urban vegetation

(2) Provide at least 15% canopy coverage of a site within 10 years from the completion of development

(7) One tree per 4 car spaces is to be provided within ground level parking areas in addition to perimeter planting.

(8) Car parking areas and access aisles should be designed, surfaced and graded to reduce run-off, allow stormwater to be controlled within the site, and provide for natural infiltration of stormwater runoff through landscaping

3.6 Ecologically Sustainable Development

In NSW, State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (BASIX SEPP) mandates provisions that aim to reduce consumption of mains-supplied potable water, reduce emissions of greenhouse gases and improve thermal comfort in all residential development. The BASIX SEPP sets the minimum standards that a development is to achieve. The BASIX SEPP also mandates that a DCP cannot include provisions which require a development to exceed its minimum standards. However, where voluntarily proposed, Council encourages development to exceed minimum BASIX scores.

3.6.1 Energy efficiency in non-residential developments

(1) Development is to be designed and constructed to reduce the need for active heating and cooling by incorporating passive design measures including design, location and thermal properties of glazing, natural ventilation, appropriate use of thermal mass and external shading, including vegetation.

(2) Lighting for streets, parks and any other public domain spaces provided as part of a development should be energy efficient lighting such as LED lighting.

(3) In multi-tenant or strata-subdivided developments, electricity sub-metering is to be provided for lighting, air-conditioning and power within each tenancy or strata unit. Locations are to be identified on the development plans.

(4) Electricity sub-metering is to be provided for significant end uses that will consume more than 10,000 kWh/a.

(5) Car parking areas are to be designed and constructed so that electric vehicle charging points can be installed at a later time.

(6) Where appropriate and possible, the development of the public domain should include electric vehicle charging points or the capacity for electric vehicle charging points to be installed at a later time.

(7) Applications for new developments containing office premises with a net lettable area of 1,000sqm or more are to be submitted with documentation confirming that the building will be capable of supporting a Base Building National Australian Built Environment Rating System (NABERS) Energy Commitment Agreement of 5.5 stars with the NSW Office of Environment and Heritage. Such an agreement is to be entered into prior to any construction certificate being issued for the approved development.

(8) Applications for developments involving alterations, additions and refurbishments to existing office premises where the estimated cost of works is over $5 million, and contains a net lettable area of 1,000sqm or more, are to be submitted with documentation confirming that the building will be capable of supporting a Base Building National Australian Built Environment Rating System (NABERS) Energy Commitment Agreement of 5 stars with the NSW Office and Environment Heritage. Such an agreement is to be entered into prior to any construction certificate being issued for the approved development. Notwithstanding, a Base Building National Australian Built Environment Rating System (NABERS) Energy Commitment Agreement of 5 stars is not required where the consent authority is satisfied that:

   a) the upgrade works would negatively impact on significant heritage fabric or the heritage significance of a listed heritage item, or

   b) the costs associated with the energy efficiency upgrade works are unreasonable when compared to the overall estimated cost of works for the alterations, additions and refurbishment.

(9) Any application which may impact on significant heritage fabric or the heritage significance of a listed item is to be supported by a Heritage Impact Statement prepared by an appropriately experienced heritage consultant.

(10) Where it is asserted that the costs are unreasonable under subclause (8)(b) the development application is to be supported by a registered Quantity Surveyor's detailed cost report itemising and verifying the cost of the required energy efficiency upgrade works.

3.6.2 Water efficiency in non-residential development

(1) All new water fittings and fixtures such as showerheads, water tap outlets, urinals and toilet cisterns, in all non-residential development, the public domain, and public and private parks are to be the highest Water Efficiency Labelling Scheme (WELS) star rating available at the time of development.

(2) Generally, rainwater tanks are to be installed for all non-residential developments, including major alterations and additions that have access to a roof form from which rainwater can be feasibly collected and plumbed to appropriate end uses.

(3) Where a non-residential building, the public domain, a public or private open space or a community facility is serviced by a dual reticulation system for permitted non-potable uses such as toilet flushing, irrigation, car washing, firefighting and certain industrial purposes, the development is to be connected to the system.

(4) Generally, water used for irrigation of public and private open space is to be drawn from reclaimed water or harvested rainwater sources. Possible sources include harvested stormwater, treated greywater and wastewater and water from a decentralised local network.

(5) Separate meters are to be installed for each individual tenancy in commercial or retail buildings over 5,000sqm, such as separate tenant areas within a shopping centre.

(6) Separate meters are to be installed for the make-up lines to cooling towers, swimming pools, on the water supply to outdoor irrigation, and other major uses.

(7) Where cooling towers are used they are to be connected to a:

   (a) recirculating cooling water loop; and

   (b) conductivity meter so that the blow down or bleed off system in a cooling tower can be automated based on conductivity. This ensures that the water is being re-circulated an optimum number of times before being discharged to the sewer.

(8) Cooling towers are discouraged where they are a single pass cooling system.

3.6.3 Photovoltaic solar panels

(1) The use, location and placement of photovoltaic solar panels is to take into account the potential permissible building form on adjacent properties.

(2) Where possible proposals for new buildings, alterations and additions and major tree plantings are to maintain solar access to existing photovoltaic solar panels having regard to the performance, efficiency, economic viability and reasonableness of their location

3.6.5 Materials and building components

(1) Paints and floor coverings with low levels of volatile organic compounds (VOC) and low formaldehyde wood products are to be used where possible.

(2) Where possible, use building materials, fittings and finishes that:

   (a) have been recycled;

   (b) are made from or incorporate recycled materials; and

   (c) have been certified as sustainable or ‘environmentally friendly’ by a recognised third-party certification scheme.

(3) Design building components, including the structural framing, roofing and facade cladding for longevity, adaptation, disassembly, re-use and recycling.

(4) Reduce the amount of materials used in the construction of a building wherever possible. Examples of potential methods include:

(a) exposing structures to reduce the use of floor, ceiling and wall cladding and finishes;

(b) naturally ventilating buildings to reduce ductwork;

(c) providing waterless urinals to reduce piping and water use;

(d) using prefabricated components for internal fit outs; and

(e) providing only one bathroom for every two bedrooms in residential developments.

3.7 Water and Flood Management

3.7.5 Water re-use, recycling and harvesting

(1) Development proposals that seek to re-use water runoff from paved surfaces for irrigation and wash down purposes are to incorporate measures into the design of the development that will treat the water to ensure that it is fit for this purpose. These measures are to clean the water to exclude contaminants such as litter, sediment and oil.

3.11 Transport and Parking

3.11.13 Design and location of waste collection points and loading areas

(1) Waste collection and loading is to be in accordance with the City of Sydney's Guidelines for Waste Management in New Developments (the Guidelines) and accommodated wholly within new development in order of preference:

(a) in the building's basement; or

(b) at grade within the building in a dedicated collection or loading bay; or

(c) at grade and off street within a safe vehicular circulation system where in all cases vehicles will enter and exit the premises in a forward direction. Consideration will only be given to less preferable options if the consent authority is satisfied the preferred options are unreasonable.

(2) The waste collection and loading point is to be designed to:

(a) allow waste collection and loading operations to occur on a level surface away from vehicle ramps; and

(b) provide sufficient side and vertical clearance to allow the lifting arc for automated bin lifters to remain clear of any walls or ceilings and all ducts, pipes and other services.

(3) Vehicle access for collection and loading will provide for:

(a) a 9.25m Council garbage truck and a small rigid delivery vehicle;

(b) minimum vertical clearance of 4.0 metres clear of all ducts, pipes and other services, depending on the gradient of the access and the type of collection vehicle;

(c) collection vehicles to be able to enter and exit the premises in a forward direction. Where a vehicle turntable is necessary to meet this requirement, it is to have a capacity of 30 tonnes;

(d) maximum grades of 1:20 for the first 6m from the street, then a maximum of 1:8 with a transition of 1:12 for 4m at the lower end;

(e) a minimum driveway width of 3.6m; and

(f) a minimum turning circle radius of 10.5m.

(4) Where vehicle access is via a ramp, design requirements for the gradient, surface treatment and curved sections are critical and must be analysed at an early stage in the design process.

3.14 Waste

Waste and Recycling Management Plans are to be prepared in accordance with the Guidelines and the City's Waste Management Local Approvals Policy, which outlines how waste and recycling must be managed, stored and collected in public places

3.14.1 Waste and Recycling Management Plans

(1) A Waste and Recycling Management Plan is to be submitted with the Development Application and will be used to assess and monitor the management of waste and recycling during construction and operational phases of the proposed development. The Waste and Recycling Management Plan is to be consistent with the City of Sydney Guidelines for Waste Management in New Developments.

3.14.2 Construction and demolition waste

(1) The Waste and Recycling Management Plan is to address construction and demolition waste and include:

(a) details regarding how waste is to be minimised within a development;

(b) estimations of quantities and types of materials to be re-used or left over for removal from the site;

(c) details regarding the types of waste and likely quantities of waste to be produced;

(d) a site plan showing storage areas away from public access for reusable materials and recyclables during demolition and construction and the vehicle access to these areas;

(e) targets for recycling and reuse;

(f) nomination of the role/person responsible for ensuring targets are met and the person responsible for retaining waste dockets from facilities appropriately licensed to receive the development's construction and demolition waste;

(g) confirmation that all waste going to landfill is not recyclable or hazardous; and

(h) measures to reuse or recycle at least 80% of construction and demolition waste, either on site or diverted for reuse and recycling with receipts sufficient to demonstrate the target will be achieved.

3.14.3 Collection and minimisation of waste during occupation

(1) The Waste and Recycling Management Plan is to address the generation of waste from the occupants of the development and include:

(a) plans and drawings of the proposed development that show:

(b) the location and space allocated to the waste and recycling management systems;

(c) the nominated waste collection point/s for the site; and

(d) identify the path of access for users and collection vehicles.

(e) details of the on-going management of the storage and collection of waste and recycling, including responsibility for cleaning, transfer of bins between storage areas and collection points, maintenance of signage, and security of storage areas; and

(f) where appropriate to the nature of the development, a summary document for tenants and residents to inform them of waste and recycling management arrangements.

(2) Waste incineration devices are not permitted.

(3) Development is to include sufficient space in kitchens to separate food waste collection or compostable material for composting or worm farming.

(4) Development is to include a separate space in a room or screened area for the storage and management of bulky waste (this can include furniture, mattresses and strip out waste) and problem waste (this can include light bulbs and electronic waste) for recycling collection.

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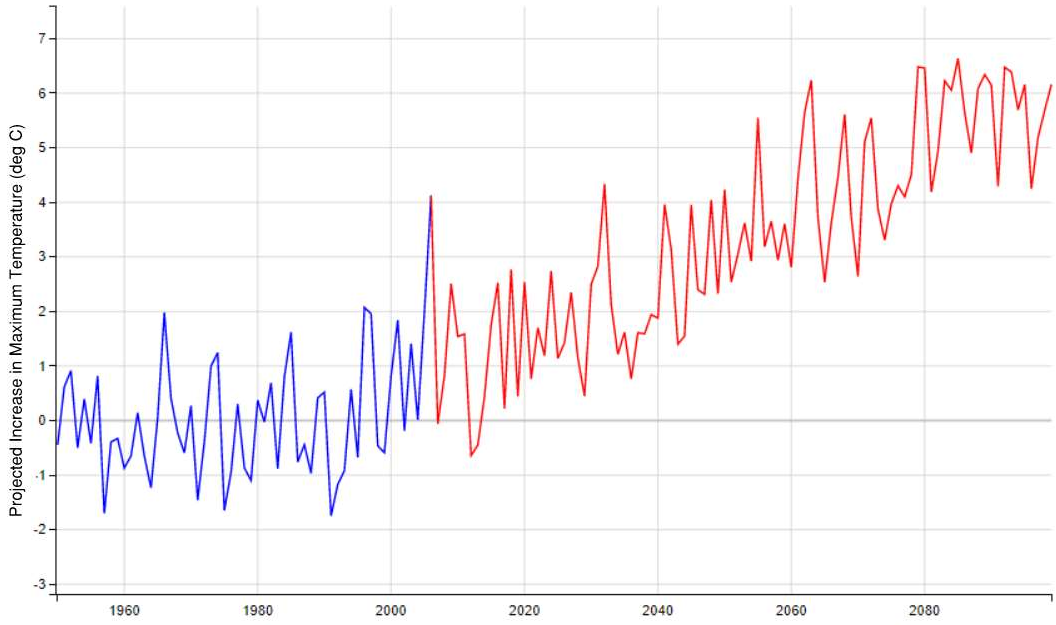
6. Climate Variable Analysis

Temperature

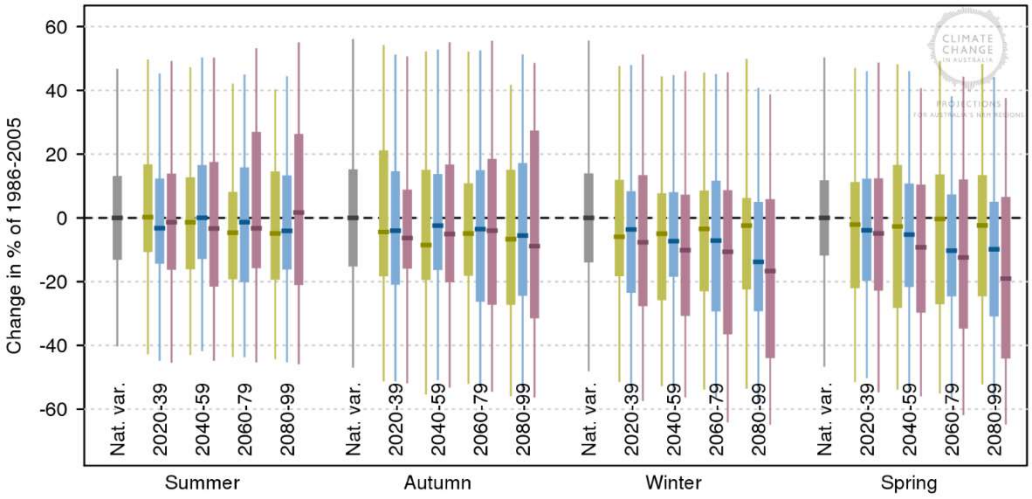
Under RCP8.5, the East Coast's average annual temperatures are expected to rise by 0.6 to 1.3°C by 2030 (Dowdy, 2015), as illustrated below. As the average temperature along the East Coast increases, more hot days and warm spells are projected as well as a harsher fire-weather climate (Webb and Hennessy, 2015). The current average number of annual hot days (>35°C) over the years 1981-2010 is 3.1 days. By 2040, this number is projected to increase to 4.3 days, and by 2070 increase to 11 days. The reality of this temperature increase on the east coast has been realised in recent years with Penrith peaking at 47.3°C on January 7, 2018 and the CBD reaching a record breaking 45.8°C on the same day (BoM, 2019).



Projected increase in annual mean maximum temperature in East Coast (South) cluster, using RCP8.5 scenario and CanESM2 model (Climate Change in Australia, n.d.)

Precipitation

Year to year changes in rainfall will dominate trends caused by greenhouse gases. The average annual rainfall is projected to decrease, however seasonal variations are predicted. The figure below presents the percentage change in rainfall against the baseline 1986-2005 period. It clearly illustrates the average projected rainfall in winter and spring months to decrease based on the RCP 8.5 scenario (pink). Changes to summer and autumn rainfall are possible but less clear. (CSIRO & BoM, 2015)

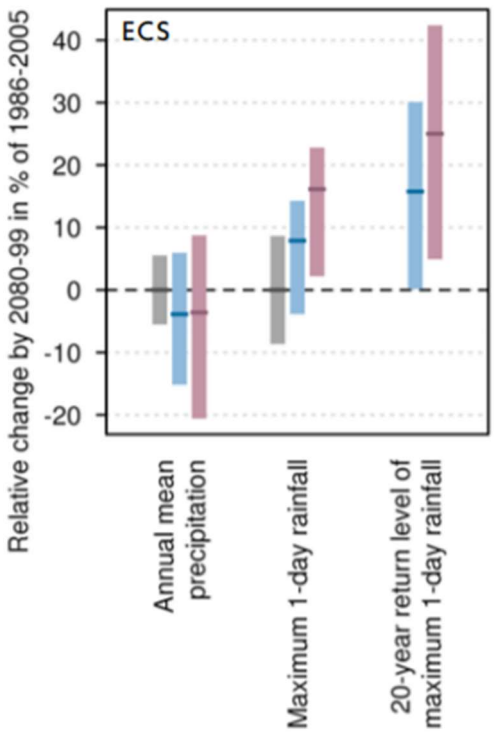


Projected seasonal rainfall changes for 2030, 2050, 2070 and 2090. Anomalies given in a percentage with respect to the 1986 - 2005 mean under natural variation (grey), RCP2.6 (green), RCP4.5 (blue) and RCP8.5 (pink) (CSIRO & BoM, 2015).

Flood

Flooding can be categorised as either mainstream or stormwater flooding. Mainstream flooding is associated with runoff from a catchment in waterways that continues until the water level exceeds the waterway channel and impacts on surrounding areas. Areas impacted by mainstream flooding are referred to as being located in a floodplain. Stormwater flooding occurs when catchment runoff exceeds the capacity of underground or piped drainage and passes overland. Flooding is directly attributed to hydro-metrological conditions, such as heavy rainfall events. The extent of flooding associated with heavy rainfall events will vary depending on the presence of impermeable surfaces, location of waterways, direction of underground and surface flows and the type of vegetation present.

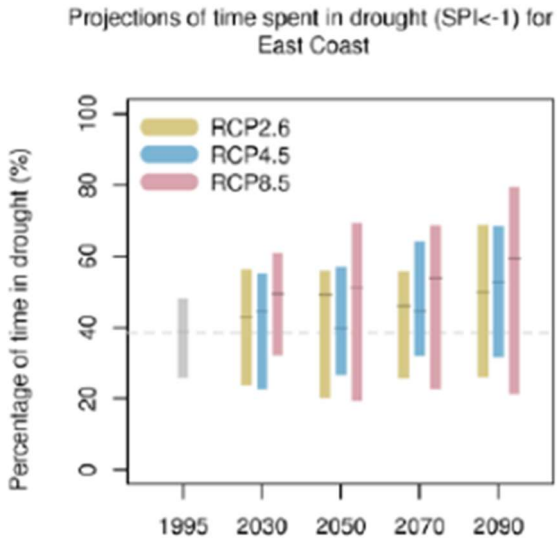
While there is an overall trend of declining rainfall, rainfall events will be more intense and extreme rainfall events more frequent. This is likely to lead to an increase in the incidence of flash floods, particularly in urbanised and small catchments. The figure below presents projections for the East Coast Cluster. While the average annual rainfall is expected to decrease, the wettest day per year and wettest day in 20 years are both expected to increase against the baseline 1986-2005 time period. (CSIRO & BoM, 2015)



Projected differences in annual average rainfall, rainfall on the wettest day each year and rainfall on the wettest day in 20 years on the east coast with respect to the 1986-2005 mean (grey) under RCP4.5 (blue) and RCP8.5 (pink). (CSIRO & BoM, 2015)

Drought

The length of time in drought over a 20-year period is projected to increase over the East Coast Cluster with medium confidence, consistent with the projected decline in mean rainfall. This length of time is projected to increase by up to approximately 20% against 1995 values. This is shown in the figure below. (CSIRO & BoM, 2015) The nature of droughts is also projected to change, with a greater frequency of extreme drought, and less frequent moderate to severe drought projected for all regions.



Median and 10th to 90th percentile range in projected change in proportion of time spent in drought for five 20-year periods (CSIRO & BoM, 2015).

Drought has been a constant feature of the NSW landscape. During the second half of the 19th century, increased population and droughts led to increasing the intensity of farming and attempts to drought proof agriculture through the expansion of irrigation. Two of the most significant droughts in NSW in the last two centuries include the

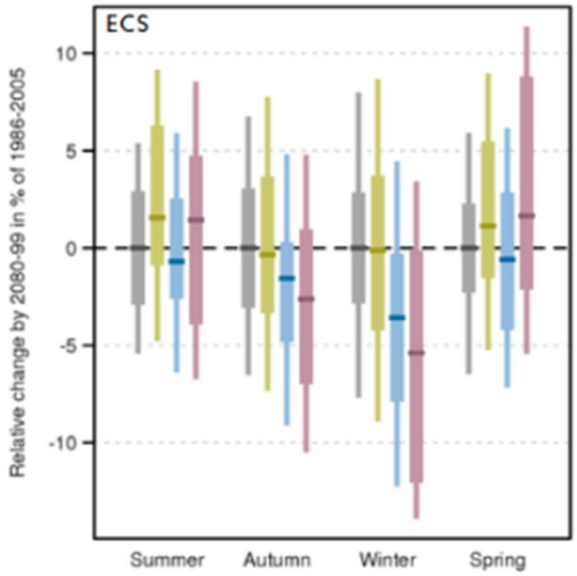
Federation Drought, which was experienced from 1895 - 1903 and the Millennium Drought which was experienced across NSW from 2001 until 2010 (Climate Council of Australia, 2018). By 7th June 2018, 16.4 percent of the state was declared in drought onset and 36.3 percent in drought watch (Climate Council of Australia, 2018).

Wind

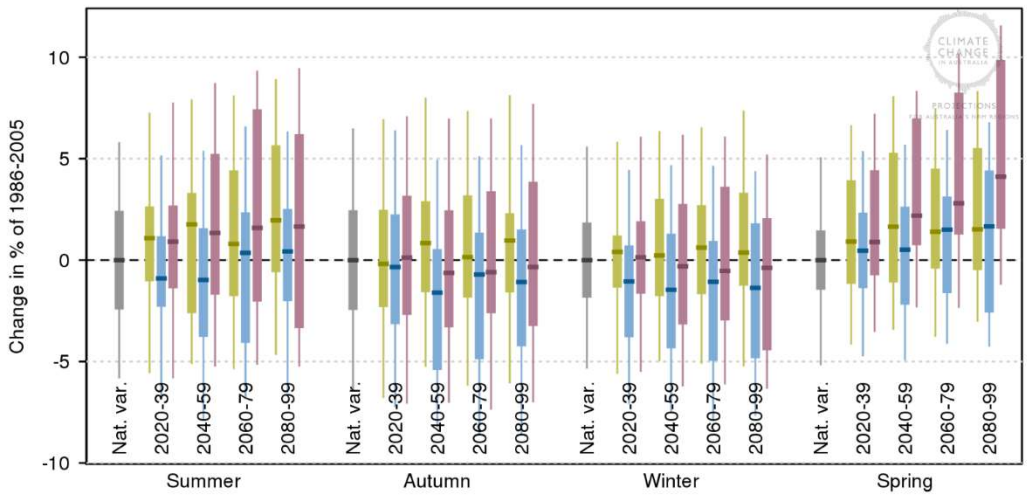
The seasonal surface wind speeds are projected to change to a small degree with high confidence for 2040 and with medium confidence for 2070. (CSIRO & BoM, 2015) The wind speed is projected to be quite variable across seasons, as shown in the table below For both timescales, the greatest change is seen in spring, which sees an increase of 2.8% in 2040 and an increase of 3.2% in 2070.

Wind speed (%) for the East Coast Cluster (Clarke JM, Whetton, & Hennessy, 2011)

	2040	2070
Annual	0.2%	-0.8%
Spring	2.8%	3.2%
Summer	0.2%	-1.2%
Autumn	-1.8%	-3.0%
Winter	-1.2%	-3.0%



Projected change in seasonal surface wind speed relative to 1986-2005, natural variation (grey). RCP2.6 (Green), RCP4.5 (blue) and RCP8.5 (purple) (CSIRO & BoM, 2015).

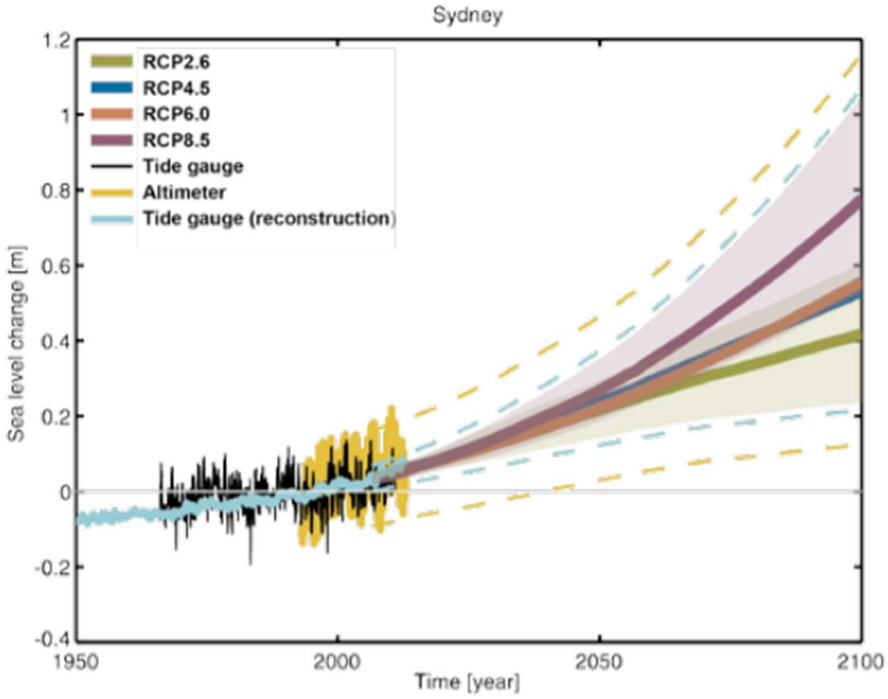


Projected change in seasonal surface wind speed relative to 1986-2005, natural variation (grey). RCP2.6 (Green), RCP4.5 (blue) and RCP8.5 (pink) (CSIRO and BoM, 2015).

There is a substantial decrease in surface winds expected during winter, which are likely related to a projected southward movement of storm tracks and the sub-tropical ridge. This would lead to a weakening of westerly winds along the east coast.

Sea-level rise

The available medium-term projection data for the RCP8.5 scenario is based on a timeframe centred around 2030, and the long-term projection data is centred around 2090. By 2030, the projected sea level rise in Sydney is 0.14 m, and by 2090 it will rise 0.66 m. (Dowdy, 2015) However, depending how much the Antarctic ice sheet melts, these levels may be higher. The extent of the impact of sea-level rise on a project site will depend on the site's distance from the coast.



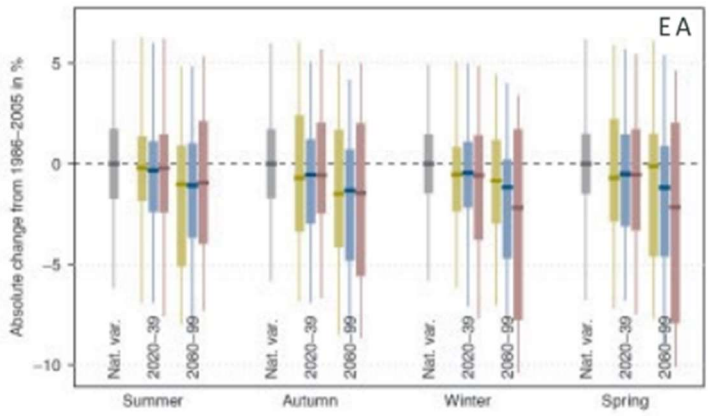
Observed and projected relative sea level increase in Sydney. Multi-model mean projection for RCP 8.5 is shown in thick purple line, with uncertainty ranges shown by purple shaded region. Projections shown between 2006-2100. (CSIRO & BoM, 2015)

Humidity

Relative humidity (RH) in Sydney indicates an annual average decrease for both 2040 and 2070 time scales as outlined in the table below. For 2040, the projected annual RH is reduced by 1.4% in comparison to the baseline average RH (1986-2005), with seasonal variations. For 2070, the projected annual RH is predicted to decrease by 1.7%.

Relative humidity (% absolute) (Clarke JM, Whetton, & Hennessy, 2011)

	2040	2070[10]
Annual	-1.4%	-1.7%
Spring	-2.2%	-5.9%
Summer	-1.5%	0.3%
Autumn	-0.8%	0.3%
Winter	-1.3%	-1.6%



Absolute change in relative humidity in Eastern Australia Super-Cluster relative to 1986-2005 period (grey). RCP2.6 (green), RCP4.5 (blue), and RCP8.5 (purple) (CSIRO & BoM, 2015)

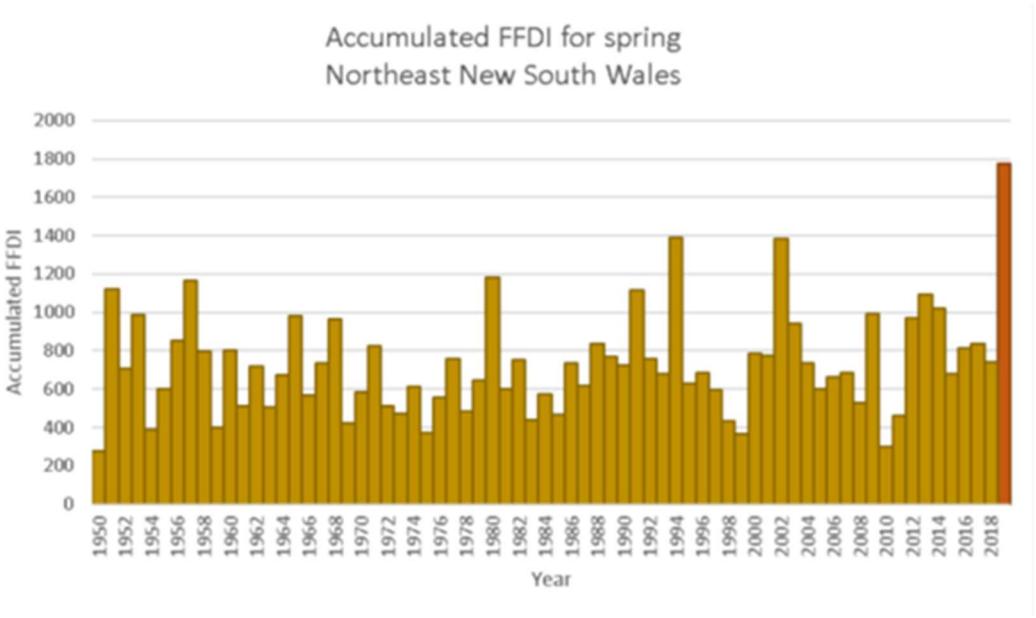
Bushfire

Severe fire weather conditions are more likely to occur in summer and spring months, with the frequency of very high and extreme fire danger days projected to increase.

Fire weather is a measure of fuel dryness and abundance, as well as weather conditions i.e. hot, dry, and windy. CSIRO has estimated fire risk into the future based on the McArthur Forest Fire Danger Index (FFDI). This index uses 'drought factor' to estimate fuel dryness and inputs meteorological conditions. It does not consider ignition by natural (e.g. lightning) or human causes.

The sum of daily FFDI values over a year illustrate the area's general fire weather risk. Based on baseline values centred on 1995 (1981-2010), in the Sydney Airport weather station region, this variable is projected to increase by 7% by 2030 and 39% by 2090 under the RCP8.5 scenario. Increased bushfire risk is also indicated by the annual number of severe fire danger days (FFDI > 50). The baseline number of severe fire days in the same region is 1.1 days. Based on RCP8.5 and CESM model, this number is projected to increase to 1.5 days in 2030, and 2.5 days by 2090. (CSIRO & BoM, 2015)

In spring of 2019 NSW experienced extensive fires that burnt the largest area in modern record, with 7% of NSW affected by the fires (NSW Department of Planning, Industry and Environment, 2020). The accumulated spring FFDI for Northeast NSW presented in the figure below shows a gradual annual increase, however the number has significantly jumped in 2019.

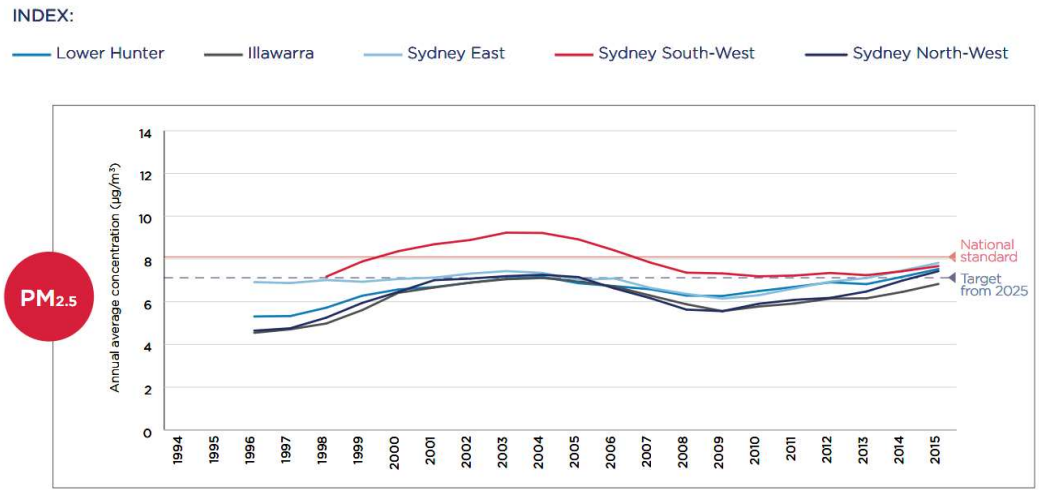


Accumulated FFDI for spring in Northeast NSW between 1950 and 2019 (BoM, 2019)

Air Quality

Historic modelling of air quality across the Sydney and Greater Sydney region does not indicate any discernible upward or downward trend between years 1994 – 2015, with more exceedances occurring in bushfire and dust storm affected years.

During the 2019 bushfires, westerly winds blew smoke from inland bushfires towards Sydney and blanketed the city in thick smoke, resulting in poor air quality. In Sydney, 33 days of hazardous levels of air quality were recorded due to the bushfires (Environment, Energy and Science Group, 2020). This also impacted indoor air quality, as fine particles from the smoke could enter through structural leaks or cracks in the façade. Such severe indoor and outdoor air quality impacted the health, productivity and comfort of affected people (Manansala, 2020).



Trends in Average Annual PM2.5 concentrations for 1994 – 2015 (EPA & Office of Environment and Heritage, 2016).

Pressures on future air quality include population growth, urbanisation and increase in energy and transport demand. Changes in climate are likely to affect future air quality in NSW. For instance, changes to rainfall, temperature and weather patterns (including fire weather) may increase the frequency of dust storms and bushfire-

related events, leading to higher air pollution emissions. Higher air temperatures may result in increases in the occurrence and geographical extent of exceedances of ozone standards (EPA & Office of Environment and Heritage, 2016).

Summary

The changes in climate variables detailed above have the potential to impact the Precinct in the following ways:

Temperature

- Heat stress and decreased summer outdoor activities
- Increased water and energy consumption during warmer months
- Buildings required to have higher thermal efficiency and shading
- Increased potential for diseases and pests
- Roads and some materials are sensitive to sustained high temperatures
- Reduced water quality
- Increased risk of network power failure (brown and black outs)
- Increased transport to site by private vehicles

Relative Humidity

- Reduced water vapour in the atmosphere effects the production of clouds and precipitation.
- Increases evaporation rates impacting the wellbeing of humans and plants and their capacity to retain hydration

Pan Evaporation

- Increased evaporation will compound lower rainfall and extenuate drought conditions

Rainfall

- Reduced water security and availability
- Higher water costs and restrictions
- Reduced water quality and higher stormwater contamination
- Reduced availability of water resources for green spaces and wildlife
- Increase in dust storms and air pollution

Extreme daily rainfall

- Increase in the magnitude of rainfall, surge, and storm events
- Increased incidences of flooding
- Increased storm damage to buildings, roads, powerlines, and recreational spaces
- Higher maintenance and insurance costs
- Blackouts and lack of road access from extreme weather

- Decreased access to site or facilities

Bushfire

- Reduced air quality in external and internal environments

Sea-level rise

- Changes in ground water levels affecting overground structures or infrastructure