



Section 4.55(1A) Modification to SSD-70283710: 1 Crescent Street, Holroyd

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ESD Vision and Summary of Initiatives

The proposal will support the supply of cost efficient and environmentally efficient housing for the 'Central' city of Sydney. Thermally efficient apartments, able to transition to net zero carbon emission in operation, and with measures to reduce urban heating.

This Ecologically Sustainable Development Report has been updated to support a Section 4.55(1A) application to modify SSD-70283710. The modification principally relates to the internal reconfiguration of Buildings 1, 2 and 3, including revisions to the approved dwelling mix, an additional 81 apartments, and associated changes to fenestration and balconies.

The modification does not materially change the approved development's ESD strategy, commercial uses, building heights, site-wide floor space ratio, car parking provision, public open space or principal building-services strategy. The sustainability initiatives and commitments established for the approved development therefore remain applicable, subject to updated BASIX, NatHERS and apartment-design assessments for the modified Buildings 1-3.

Solar/PV arrays for onsite renewable energy (BASIX)

A combination of measures to reduce urban heating included across project

Strong passive design elements leading to >7 star NatHERS average rating for apartments (BASIX)

Healthy indoor environments

Future options available to provide 100% renewable electricity for base building electrical services

Seeking options for high levels of construction waste recycling and additional waste streams in operation

Potable water savings achieved through efficient water fixture and appliance selection; rainwater capture utilised for landscape irrigation (BASIX)

Net Zero Statement and NABERS Agreement to Rate for commercial office spaces (Sustainable Buildings SEPP)

Infrastructure provisions made to transition from gas to electric services in the future supporting NSW Government 'Net Zero' policy

Provision for future uptake of 100% EVs (residential spaces) and battery services (NCC 2022)

Environmental management plan to be established for construction and seeking key materials options with certified Environmental Product Disclosures

Image Source: Woods Bagot

1 Crescent Street, Holroyd

Ecologically Sustainable Development Report

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1. Introduction and Project Information



Image Source: Woods Bagot

1. Introduction and Project Information

Introduction and Purpose of report

This ESD Report has been updated by Efficient Living on behalf of Tiberius (Holroyd) Pty Ltd to support an application under section 4.55 (1A) of the Environmental Planning and Assessment Act 1979 to modify SSD-70283710 for the approved mixed-use precinct at 1 Crescent Street, Holroyd. **(the site)**.

SSD-70283710 was approved by the Department of Planning, Housing and Infrastructure on 31 March 2026. The proposed modification principally comprises the internal reconfiguration of Buildings 1, 2 and 3 to revise the approved dwelling mix, resulting in an additional 81 apartments, together with associated changes to fenestration and balconies.

This report should be read in conjunction with the Section 4.55(1A) Modification Report prepared by Urbis, the updated architectural plans prepared by Woods Bagot, the updated BASIX Certificates and supporting technical documentation submitted with the modification application.

The purpose of this updated report is to confirm the continued applicability of the approved ESD strategy and to identify any sustainability outcomes requiring reassessment as a consequence of the proposed modification. The modification does not alter the approved commercial component, overall ESD framework, building heights, site-wide floor space ratio, car parking numbers, public open space strategy or principal servicing approach.

Updated BASIX, NatHERS, solar-access and natural cross-ventilation assessments have been undertaken separately for the modified residential layouts and should be read with this report.

The proposed changes extend beyond minor refinements which can be accommodated via a Submissions Report. As a result, a combined Submissions and Amendment Report has been prepared and consent sought from DPHI to amend the SSDA as per section 37 of the *Environmental Planning and Assessment Regulation 2021* **(the Regulation)**.

Section 2 of the report provides a summary of responses to relevant Ecologically Sustainable Development (ESD) SEARs. This includes:

- SEAR 1 considering relevant ESD related regulations and controls predominantly in relation to the Sustainable Buildings SEPP).

- SEAR 9 that requires a response to key ESD factors including a response to EP&A Regulation ESD principles; meeting or exceeding industry ESD standards; minimising green house gas emissions, energy, water and material resources

Additional reports/documents required under the Sustainable Buildings SEPP are also submitted with the proposal including:

- A 'Net Zero Statement' for the commercial office space development proposed classified as large commercial development under the SEPP
- A 'NABERS agreement to rate' for the commercial office space development proposed classified as large commercial development under the SEPP
- A NABERS embodied emissions materials form required for non-residential development under the SEPP

Structure of this report

The report has been structured into key ESD categories as indicated in the SEARs CI 9, and as required in the general sustainability categories as set out in the Sustainable Buildings SEPP. Each category details the ESD measures included in the proposal and an assessment of the performance of this measure against regulatory requirements and industry benchmarks where applicable. The categories include:

- Energy and carbon efficiency
- Water efficient design
- Responsible materials and waste management
- Reducing urban heating
- Human wellbeing and indoor environmental quality

Methodology to identify ESD measures and outcomes

Efficient Living uses a combination of industry benchmarks, reference projects and comparative project data, together with industry recognised modelling tools, to assess the strength of ESD measures proposed. It should be noted that a wide cross section of ESD factors are considered with both qualitative and quantitative measures.

Ultimately the proposed ESD measure is assessed against the performance and detail required under key planning policy requirements at a State level, and as relevant Local level.

Where relevant comment and reference to published Australian standards and sustainability rating schemes (such as GBCA Green Star) is made. Efficient Living also relies on its experience across multiple NSW proposals to provide opinion on whether the proposed ESD measure meets 'industry benchmarks' which can be subjective.

The ESD report also recommends further detail and specification outcomes as the project moves into detailed design and tender processes that accompany construction phases. ESD outcomes can not be finally determined until the detailed level of design and final construction package of works is agreed.

We note that the proposal is weighted approximately 94% to residential floorspace and 6% to commercial floorspace making residential ESD outcomes the central focus of the report.

Proposed modification

The proposed Section 4.55(1A) modification principally comprises:

- reconfiguration of the internal layouts of Buildings 1, 2 and 3;
- revision of the approved dwelling mix, resulting in an additional 81 apartments;
- an increase in Stage 1 residential yield from 651 to 732 apartments;
- an increase in total project yield from 1,374 to 1,455 apartments;
- associated changes to building fenestration and balconies;
- and consequential amendments to approved plans and selected consent conditions.

The modification does not alter the approved building heights, site-wide FSR, commercial land uses, retail uses, car parking numbers, bicycle parking numbers, public open-space framework or overall development footprint.

1. Introduction and Project Information

Property Details

The land to which this SSDA relates is located at 1 Crescent Street, Holroyd (the site).

The site comprises an irregularly shaped allotment with an area of 37,877 m² and has a primary frontage to Crescent Street to the south and a frontage to Woodville Road to the east. The northern boundary of the site adjoins the Holroyd Sportsground with the M4 Motorway beyond.

The site is located in the Cumberland Local Government Area (LGA) and is currently vacant and cleared after WesTrac ceased

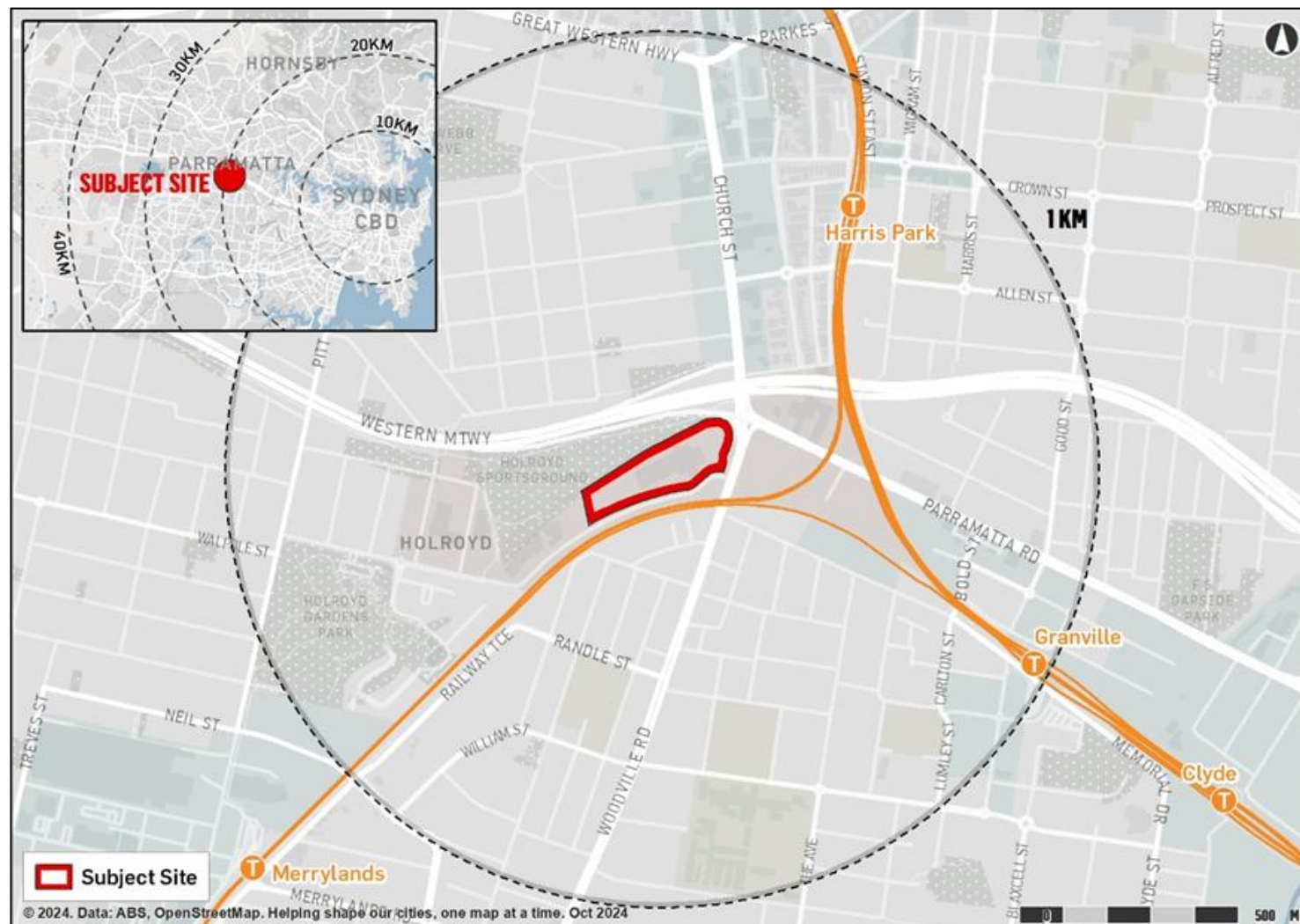
operations of an industrial facility at the site in early 2018. The site contains existing scattered pockets of landscaped vegetation, predominately located along the site's southern and eastern boundaries to Crescent Street and Woodville Road.

The site is bounded by Parramatta Road/Church Street/Woodville Road intersection to the north east, Woodville Road to the east and Crescent Street to the south. The northern frontage of the site faces the Holroyd Sportsground and the M4 Motorway beyond. It is noted that the eastern portion of the site

fronting Woodville Road has been identified for potential future acquisition by Transport of NSW for future planned intersection upgrades to Woodville/Parramatta Road/M4.

The site is located near a number of heavy rail stations including:

- Harris Park train station (743m)
- Granville Train Station (1.1km)
- Merrylands Train Station (1.2km)
- Parramatta Train Station (1.4km)



Regional context of Site—Urbis 2024



Local context of Site—Urbis 2024

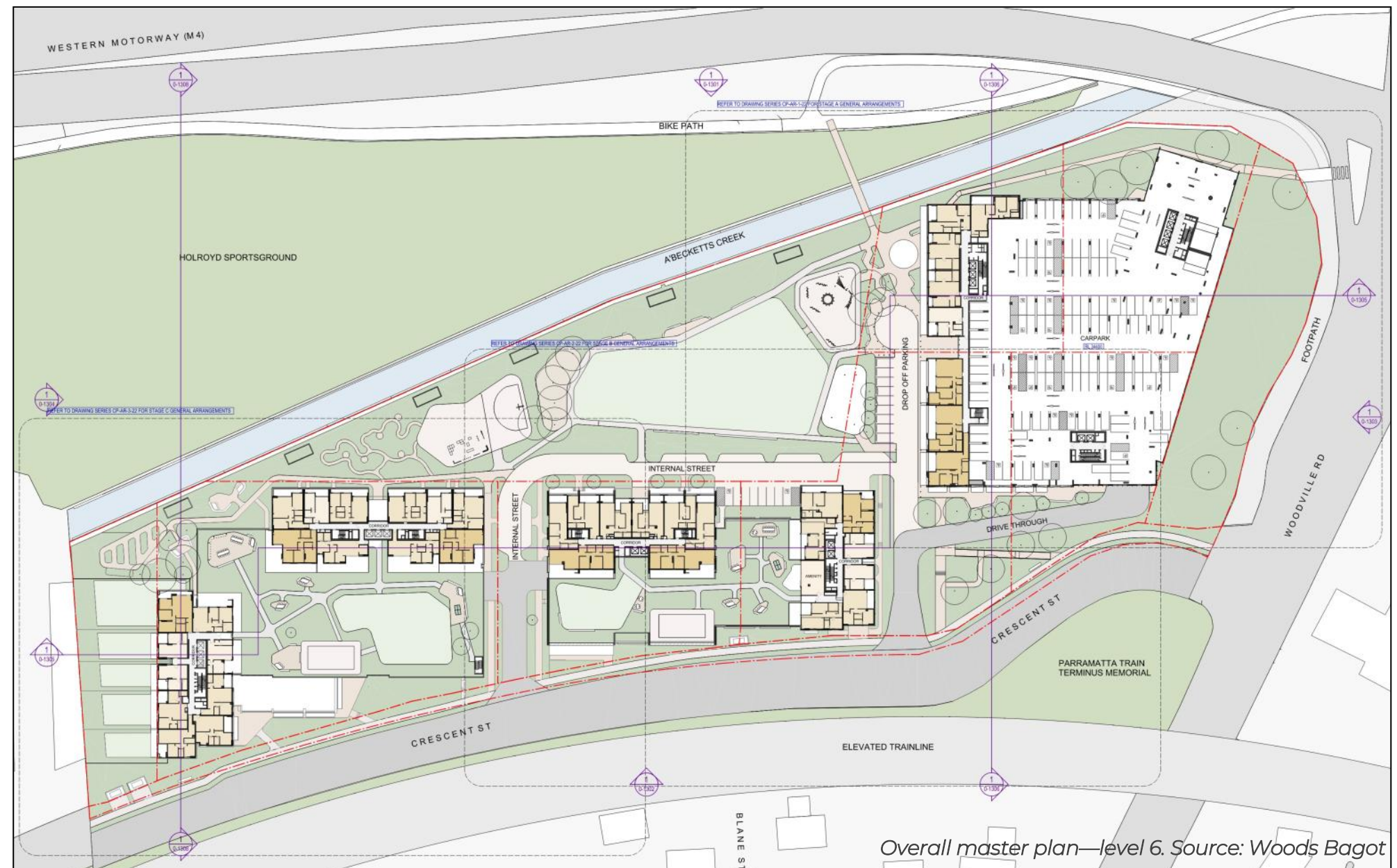
1. Introduction and Project Information

Proposed development

The vision for the project is to deliver a new mixed-use precinct that fosters a dynamic live-work-play lifestyle. This precinct will feature a diverse range of housing options, including affordable housing, all complemented by expansive public open spaces. Retail and commercial uses will also be integrated, establishing a new, local destination that encourages community engagement and interaction.

The proposal broadly seeks approval for an SSDA for a mixed-use precinct with public open spaces comprising the following components:

- Site establishment works, tree removal, site preparation, earthworks and excavation, services augmentation, and remediation works.
- Development of seven residential buildings comprising four shop top housing buildings and three residential flat buildings as outlined below:
 - ◆ Buildings 1-3 are integrated with an eastern mixed-use podium building, while Building 4 is situated above mixed residential / commercial space, offering shop-top housing.
 - ◆ Buildings 5-7 consist of residential flat buildings.
- Delivery of 15% of the total floor space as affordable housing to be distributed across each of the 7 residential buildings.
- Approximately 134,208m² total floor space comprising:
 - ◆ Approx 2,496m² retail GFA and 2,710m² commercial GFA.
 - ◆ Approx 20,203m² of Affordable Housing GFA
 - ◆ Communal amenity facilities for residents.
 - ◆ Building services areas.
- Activation of Crescent Street through a mix of amenity areas and pockets of open space.
- Shared car parking for Buildings 1-3 and the commercial and retail tenancies within the podium.
- Shared car parking for Buildings 4 to 7 on the lower ground levels and within the above ground parking structures adjoining Buildings 5 and 6.



- The widening of Crescent Street and upgrades to Crescent Street and Woodville Road intersection.
- Landscaping and accompanying place making works including:
 - ◆ Public open space, hard and soft landscape works.
 - ◆ Ground and rooftop communal open space.
 - ◆ Publicly accessible through-site links.
 - ◆ At grade car parking for the park, forecourt and retail areas.
- Vehicle access via a new internal publicly accessible road and vehicle accessway.
- New pedestrian footpaths and access arrangements to the site.
- Café tenancy within park-side structure.
- Staged completion of a public park.

2. Project Responses to SEARs

SEARs REQUIREMENTS	Project response (and reference to relevant report section)
1. Statutory Context - Address all relevant legislation, environmental planning instruments (EPIs) (including drafts), plans, policies, guidelines and planning circulars. - Identify compliance with applicable development standards and provide a detailed justification for any non-compliances.	The report primarily considers Issue 9 of the in-fill affordable housing SEARs. In addition the report also considers ESD principles, objectives or controls from the following State strategies and policies: - Sustainable Buildings SEPP and Housing SEPP (ADGs) - NSW Government Net Zero Plan - Greater Sydney Region Plan - Eastern City District Plan The report also considers future project compliance with key National Construction Code (NCC) Section J Energy Efficiency requirements as is mandatory for components of this project type.
9. Ecologically Sustainable Development (ESD) - Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are be incorporated in the design and ongoing operation of the development - The precautionary principle - Inter-generational equity - Conservation of biological diversity and ecological integrity - Improved valuation, pricing and incentive mechanisms	The precautionary principle - The project demonstrates a commitment to minimising environmental impact by meeting required regulations, implementing urban heat reduction measures, considering resource conservation measures and with human health and wellbeing measures. In combination these initiatives deliver the concept behind a precautionary approach to approving development based on potential future or uncertain impacts. Inter-generational equity - The project delivers development that both minimises and provides resilience for future human activity through environmental change but also seeks to provide a mix of housing outcomes, through apartment sizes and market price points but also through Affordable Housing provision, deemed necessary for the future generations living in Sydney. Conservation of biological diversity and ecological integrity - The renewal strategy for the site seeks to include the use of local endemic species in landscape and minimise environmental impacts (such as carbon emissions, stormwater volume and quality controls) such that the post development outcome has no greater diversity or ecological impact than the current state of the site. Improved valuation, pricing and incentive mechanisms - The sustainability and environmental measures for the project are being incorporated in the early design and cost plan for the project to ensure the most economic pathways are identified through design and construction. Further, the specification of materials and equipment will strongly consider the most efficient operations and maintenance outcomes which are anticipated to also match the most efficient environmental outcomes for the apartment complex operation (for example use of PV arrays to minimise the long term financial and environmental cost of electricity).

2. Project Responses to SEARs

SEARs REQUIREMENTS	Project response (and reference to relevant report section)
9. Ecologically Sustainable Development (ESD) - Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards. - Demonstrate how the development minimises greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	The environmental performance initiatives and outcomes for the project (Sections 4-8 of this report set out these categories) have been determined based on satisfying regulation and meeting industry sustainability benchmarks. The proposed ESD initiatives incorporate measures to reduce carbon emissions and consumption of energy, incorporate onsite renewable electricity supply, conserve water and minimise resource consumption and embodied carbon emissions in materials. The project is also set up to allow simple transition to all electric operation, allowing net zero carbon outcomes, when required. The primary performance benchmarks satisfying SEARs include: Minimising carbon emissions and energy (Section 4) - meeting regulatory requirements and industry benchmarks - Scope 1 and 2 CO2 emissions for the combined project of c.58% savings against reference or average building outcomes; options are also included to potentially reduce major Scope 3 CO2 emissions - Sustainable Building SEPP 2022 BASIX energy score of 63% and average strong NatHERS thermal performance rating of greater than 7 stars (refer BASIX certificate and report) —exceeding increased thermal performance regulation benchmarks commenced in 2023 - On site renewable electricity from BASIX compliant 195kW rooftop solar/PV array - Provisions for future transition to net zero carbon emissions in operation; future options to source 100% renewable electricity to electric services - Net Zero Statement and NABERS agreement to rate (NABERS Energy 5.5 stars) provided for commercial office spaces - Options sought to reduce upfront carbon emissions in materials with an emphasis on concrete (subject to commercial feasibility) - Provision for 100% EV parking spaces for residential (NCC 2022) allows transition away from ICE vehicles saving on average over 270 tCO2pa Water conservation (Section 5) - meeting regulatory requirements and industry benchmarks - Reduce potable water demand to meet the Sustainable Building SEPP BASIX requirements through water efficient appliances and fixtures—achieves BASIX score of 40% (refer BASIX certificate and report) - Alternative water source/rainwater tanks (15KL) used for landscape, landscape utilises palette of low water use species and efficient irrigation methods Responsible materials and waste management (Section 6) - Options sought to maximise reuse of construction waste; implement waste streaming to support operational phase recycling outcomes - Procurement strategy to seek options for key materials with Environmental Product Disclosures and low environmental impact

2. Project Responses to SEARs

SEARs REQUIREMENTS

Project response (and reference to relevant report section)

9. Ecologically Sustainable Development (ESD)

- Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.
- Demonstrate how the development minimises greenhouse gas emissions (reflecting the Government’s goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.

Climate change resilience (Section 7)

- Future detailed design review process for building systems and drainage to consider increased extreme rainfall events, storm events and heat wave events for operational performance in these extremes
- Heat island mitigation steps including high reflection horizontal hard surfaces, planned canopy and green cover and attention to preventing building reflection to the ground level—over 75% of site contributes to mitigating urban heating

Human health and wellbeing (Section 8)

- Acoustic and lighting (and daylighting) outcomes and products tailored for healthy and comfortable living environments recognising acoustic impacts of rail

The proposed Section 4.55(1A) modification principally relates to internal residential reconfiguration within Buildings 1–3 and associated façade amendments. The modification does not alter the fundamental land uses, approved building heights, site-wide FSR, commercial component, car parking provision, public open-space strategy or principal ESD framework established under SSD-70283710.

Updated BASIX, NatHERS, solar-access, natural-ventilation and waste assessments have been prepared to reflect the modified dwelling mix and apartment yield. Subject to implementation of the updated commitments identified in these documents, the modified development will continue to satisfy the applicable ESD requirements and maintain the sustainability strategy established for the approved development.

3. State and Local Strategies and Policies

Key State ESD related strategies and policies

Sustainable Buildings SEPP

For residential development the proposal meets the requirements of the BASIX conditions for thermal performance, energy/carbon reductions and potable water reductions.

For the majority of the non-residential development, such as retail floor space, the proposal includes measures considering the general sustainability requirements including waste management, energy efficiency and management, improved passive design, generation and storage of renewable energy and reduced potable water consumption. A NABERS Embodied Emissions Material Form will also be provided with the proposal.

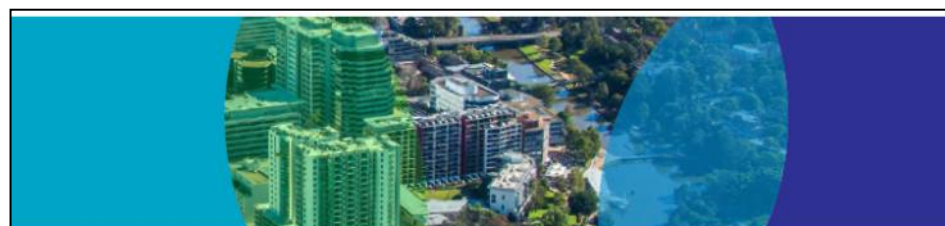
In addition the commercial office space component of the development (c. 2,710 sqm) will qualify as 'large commercial development' under the SEPP and as such the following are provided with the proposal:

- A Net Zero Statement quantifying how the commercial office development can operate as net zero emissions
- A NABERS agreement to rate at 5.5 stars for energy and 3 stars for water

Housing SEPP—NSW Apartment Design Guide (ADG)

The objectives, design criteria and design guidance are considered especially in relation to design criteria including:

- Sunlight to habitable rooms (70% of apartments to receive 2 hours, <15% receive no sunlight)
- Natural cross ventilation to at least 60% of apartments
- Apartment and room sizes, window requirements, room depths for habitable rooms, balcony provision and size



Directions for sustainability



A city in its landscape

- Planning Priority C13
Protecting and improving the health and enjoyment of the District's waterways
- Planning Priority C14
Creating a Parkland City urban structure and identity, with South Creek as a defining spatial element
- Planning Priority C15
Protecting and enhancing bushland, biodiversity and scenic and cultural landscapes
- Planning Priority C16
Increasing urban tree canopy cover and delivering Green Grid connections
- Planning Priority C17
Delivering high quality open space
- Planning Priority C18
Better managing rural areas



An efficient city

- Planning Priority C19
Reducing carbon emissions and managing energy, water and waste efficiently



A resilient city

- Planning Priority C19
Adapting to the impacts of urban and natural hazards and climate change

Greater Sydney Region Plan

Various objectives of this plan require targeted ESD outcomes including Objective 27 Biodiversity is protected, urban bushland and remnant vegetation is enhanced; 30 Increased tree canopy; 33 Low carbon city; 34 Energy and water flows are captured, used and reused; 35 More waste is recycled; 36 People and places adapt to climate change; 37 Exposure to natural and urban hazards is reduced; 38 Heatwaves are managed.

Central City District Plan

Consistent with the Greater Sydney Region Plan targeted ESD outcomes are required for C17, tree canopy and green landscape improvement, C19, reduced carbon emissions and efficient use of energy, water and waste, C20, adaptation and resilience to climate change.

Net Zero Plan

The Net Zero Plan Stage 1: 2020-2030 is the foundation for NSW's action on climate change and goal to reach net zero emissions by 2050.

NSW Government Net Zero Plan

The NSW Government targets (NSW Climate Change Policy Framework—Net Zero Plan) for 70% reduced emissions by 2035 and net zero by 2050 also shape the ESD initiatives for the proposal.

National Construction Code (NCC) Section J Energy Efficiency

Section-J of the National Construction Code 2022 focuses on "energy efficiency of buildings". Section J is a minimum performance target for standard buildings and specifies minimum performance targets known as deemed-to-satisfy (DTS) requirements, for building fabric and services.

The report considers Section J measures that will be required for compliance with the detailed design and construction certificate for the proposal.

Provision for infrastructure that can support EV charging equipment, battery provision and minimum areas for PV array provision are included in these requirements.

4. Energy Efficiency and Low Carbon Emissions

Passive design Initiatives to reduce energy use

With thoughtful planning, a well-designed building can be passively heated, cooled, and ventilated for most of the year in temperate NSW climates. This approach minimizes reliance on mechanical heating, ventilation, and air-conditioning (HVAC) systems, which are only needed when outside temperatures are too extreme to be controlled passively.

Proposed outcomes meeting regulatory requirements and industry standards

- NatHERS average ratings of 7.4-7.8 stars for apartment buildings (minimum 6 stars per apartment) exceeding upgraded BASIX thermal performance requirements that commenced in 2023
- Cross ventilation and solar access for apartments at a minimum meet ADG requirements of 60% and 70% respectively
- Building shell outcomes for commercial floor space to meet Section J DTS or future JV3 performance provisions

Strong NatHERS ratings for apartments

The buildings achieve strong NatHERS thermal performance ratings generally from 7.4-7.8 (please refer to final NatHERS certificate provided). This outcome exceeds the upgraded requirements of the Sustainable Buildings SEPP 2022. (commenced in 2023).

This performance is driven by strong building design elements including:

- Reduced glazing ratios in the façade
- Use of balconies and façade overhangs to create positive shading outcomes to glazing
- Attention to protecting key living areas from orientations that reduce thermal performance

Compliance with NCC 2022

The project will comply with the latest NCC 2022 Section J inclusions for building fabric and energy requirements. This will include the commercial/retail spaces and any common residential spaces that may be conditioned.

Cross Ventilation

The building floor plates have been designed to maximise the number of dwellings achieving natural cross ventilation.

Please refer to the DA Design Report for detail.

Opportunities to naturally ventilate the commercial/retail areas will be investigated as the design progresses. As the commercial/retail premises are at ground level, acoustics will need to be considered for any naturally ventilated strategy of these floors.

Solar Access

The floor plate of the buildings have been designed to maximise solar access. Solar access provides daylight which means electric lights can be left off during the day but also provide passive heating during the winter months, meaning that the heating system has less work to do, and less energy is consumed heating the spaces.

Please refer to the DA Design Report for detail.

Strong daylight outcomes are expected for the commercial/retail tenancies given the large floor to ceiling windows proposed. These details will be resolved as detailed design of this floor space is resolved before a construction certificate is issued.



Typical Levels—strong solar access outcomes at least meeting 70% ADG compliance of 2 hours per day

(Source : Woods Bagot)

4. Energy Efficiency and Low Carbon Emissions

Service and appliance initiatives to reduce energy use and carbon emissions

Proposed outcomes meeting regulatory requirements and industry standards

- BASIX Energy outcome of 63% meeting increased Sustainable Building SEPP/BASIX Energy standards introduced in 2023
- Net Zero Statement and NABERS Agreement to Rate for the commercial office floor space component of the project
- A/C efficiency target of > 3.5 ACOP
- NCC provision for battery charging and for future EV charging to 100% of residential car spots, and E bike charging
- Commercial floor space to meet NCC 2022 Section J energy efficiency requirements

Mix of electric and gas services—future transition to all electric provisioned in infrastructure planning

The buildings will be serviced for energy with gas for residential hot water and residential and retail (café and restaurant) cooktops and with electricity for all other services.

Transition to all electric services, anticipated at the end of the useful life of the gas services (or as required), will be made possible by:

- Provision of a hard wired circuit to each cooktop able to connect an electric induction cooktop in the future (that can be used in the interim for the gas cooktop)
- Provision for space to replace centralised gas boiler hot water systems with electric heat pump systems (that require more space provision for hot water tanks)
- Provision for additional substation capacity that will support all electric services in the future without the need for an upgrade

Consideration has also been given to the total electrical demand requirement, including for future high uptake of EVs, and how this will be managed with active load management systems and catered for through substation sizing.

Hot Water Systems

Hot water systems can be responsible for 10-15% of total apartment building CO2 emissions.

Initially, centralised gas boiler systems are planned for the buildings with high level of insulation for the hot water ring mains. Hot water services to the commercial office floor space areas will be provided by localised electric boilers.

The community pool heating will also be serviced with a gas hot water heater, whilst noting that space has been provided to replace this system with an electric heat pump system when required.

Air conditioning services

With strong passive design, reflected in the strong project NatHERS ratings, space conditioning is only responsible for about 5 -8% of total apartment building CO2 emissions.

Air conditioners will be single phase with ACOPs targeted at 3.0-3.5 for cooling and 3.5-4.0 for heating (BASIX requirements). Opportunities to improve further on these efficiency levels will be considered in the procurement process.

Final HVAC services to commercial and retail floor space will be determined in detailed design noting that commercial and retail floor space makes up under 6% of total proposed floorspace.

Appliances

Appliances and related other electrical demand average approximately 35% of total CO2 emissions in a modern apartment building.

The following star ratings are recommended for key domestic appliances subject to final clarification of BASIX requirements.

- Dishwashers - minimum 4 star (BASIX requirement)
- Clothes Dryers - minimum 8 star (BASIX requirement)

Lighting

Lighting can use up to 10% of an apartment of a building's electricity consumption, therefore efficient luminaires and lighting control systems are critical in order to optimise the building's energy efficiency. The following measures will be implemented:

- LED lighting to be specified throughout with opportunities to reduce typical NCC minimum compliance energy use to be targeted in detailed lighting design (normally achieved through ongoing improvement in LED technologies)
- Common area lighting to have motion and daylight sensors with further zoned lighting controls for car park areas.

Commercial floor space will also utilise efficient lighting outcomes in line with NCC 2022 Section J. At detailed design, a lighting design specification for commercial floorspace will be incorporated seeking to provide LUX outcomes for activities consistent with AS1680 rather than targeting exceedance of these standards (through application of additional efficiency mechanisms).

Lifts

Lift use can be responsible for over 10% of total apartment building CO2 emissions.

The lifts will incorporate PMS motor and regenerative drive technology and will target a Class A energy efficiency rating under ISO 25745.

Car park ventilation

Common area ventilation can be responsible for over 10% of apartment building CO2 emissions.

As the car parking is above ground, a significant amount of natural cross ventilation will be possible for car park levels. This provides an opportunity to greatly reduce the operational energy normally required for mechanical ventilation.

Other ventilation, such as to switch rooms, plant rooms and communal bathrooms, will be either interlocked to light switching or controlled through a building management system.

4. Energy Efficiency and Low Carbon Emissions

Electric transport services to reduce carbon emissions

Electric transport

Electric vehicles are anticipated to experience high adoption over the coming decades with NSW Government Strategy to increase EV sales to over 50% by 2030-31¹. When serviced with renewable electricity this mode of transport provides an effective net zero in operation outcome for travel.

Provision for electric cars is the major item to consider followed by power access and storage for the fast growing use of e-bikes and e-scooters.

Electric car provisions

Final detailed electrical system design will cater for a high uptake of electric cars and bikes.

Consistent with NCC 2022, dedicated distribution boards to support EV charging on each parking level will be provisioned together with an active load management system that allows future connection of all parking spots within an achievable total electrical demand level for the project.

Consideration of a charger provision and tariff system/model so that individual apartments are provided with an accurate electricity bill for their usage is also recommended. This service is most often provided by specialist EV charging entities.

- Residential parking bays will require that 100% of spots are provisioned for future charging capacity to allow 12kWh to be provided from 11pm—7am daily
- Commercial parking bays will require future charging capacity to allow 12 kWh from 9am-5pm daily
- Distribution boards must sized and equipped to allow future installation of a 7kW (32A) type 2 EV charger for 100% of residential spaces and 10-20% of commercial spaces

Any shared car service parking spots and service provider procurement should also plan for shared EVs to further provide zero net carbon outcomes for car based transport.

E-bike and e-scooter provisions

Provision of standard GPOs with access from bike storage racks and other storage areas (potentially for e-scooters) will be provided to facilitate charging of these mobility devices.

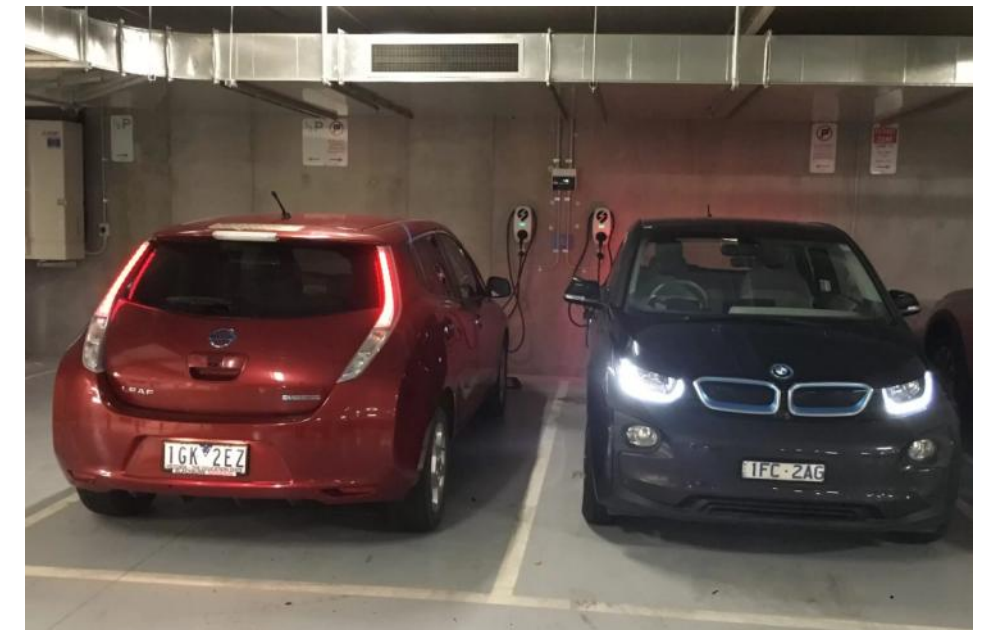
The future of Electric Vehicle batteries integrated with building electricity demand

Batteries in EVs theoretically store enough energy to run a moderate home for 4-5 days or apartment for 5-7 days. Technology is under development to allow the energy in EV batteries to be accessed by homes, and potentially apartment buildings, to help reduce peak demand and otherwise supplement demand throughout the day as required.

When fully developed this energy management system may be able to greatly reduce the buildings peak demand and therefore help reduce the required substation size requirements for 'all electric' buildings.

In the future this could well mean that EVs support transition of buildings, with fossil fuel inputs such as this proposal, to become all electric buildings with inherent capability to reduce peak usage.

By providing the core network of electrical circuits with higher capacity, and switchboard spaces for EVs and batteries, in line with NCC 2022 Section J9, future implementation will be simplified.



Example of EV charging provision image from <https://evse.com.au/blog/apartmentevcharger/>



Modern buildings are providing charging options for e-bikes and e-scooters

¹ NSW Electric Vehicle Strategy 2023 (revision)

4. Energy Efficiency and Low Carbon Emissions

Renewable energy sources and energy management

Proposed outcomes meeting regulatory requirements and industry standards

- Solar/PV arrays will be provided aligned to the final BASIX requirement— anticipated to total 195 kW capacity (150kW Phase 1 buildings, 15kW Phase 2 buildings and 30kW Phase 3 buildings)
- Roof space has been identified to allow potential future expansion of this system if the body corporate, or any commissioned embedded energy network operator, wishes to pursue this option
- Provision for future battery system integration in line with NCC2022 Section J

Incorporation of solar/PV arrays

Total PV arrays of 195kW will be provided compliant with BASIX requirements. Please refer to the BASIX certificate and report provided with the proposal.

The diagrams on the following page indicate the additional potential roof space on buildings 1,2, and 3 that can be utilised in the future if a larger system is desired by the buildings body corporate, which may also include commissioning of an embedded network operator. These spaces have been identified after removing the required areas for:

- On roof systems including future provision for electric heat pump hot water storage and systems
- Roof top communal areas
- Sensible set backs from the roof edge

Available roof space for PV arrays on buildings 4, 5, 6 and 7 has also been identified in the architectural plans.

The total space identified, and left clear for future potential PV arrays, will exceed the 20% of roof area required under NCC 2022 Section J9.

Building energy management

Building systems will be set up with sufficient sub meters to allow detailed monitoring of consumption patterns and equipment performance.

For commercial spaces this is a requirement of NCC 2022 Section J.

With the required break down of sub meters and logged hourly consumption patterns this will allow active building energy management and the future data required to achieve a NABERS rating is required.

Investigation of a centralised battery system

In future detailed design, an area will be identified in close proximity to the main switchboard to allow future potential installation of batteries as required in NCC 2022 Section J.

The building body corporate/potential embedded network operator will ultimately determine if a shared community battery is worthwhile given the specific demand profile, and PV production profile,

Ultimately the potential to utilise 'two way' EV batteries linked to the building system (discussed on the preceding page) will determine if a stationary battery system is also warranted.

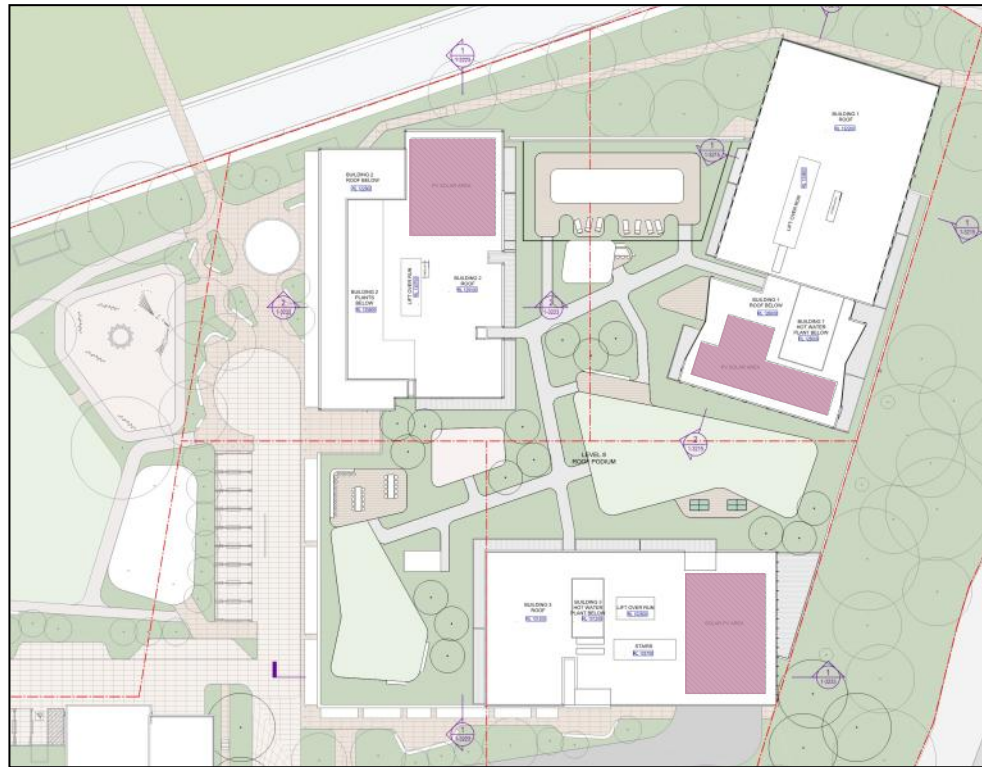
RENEWABLE ENERGY SOURCES AND ENERGY MANAGEMENT



INCORPORATION OF SOLAR/PV ARRAYS

PROVISION FOR FUTURE BATTERY SYSTEM INTEGRATION

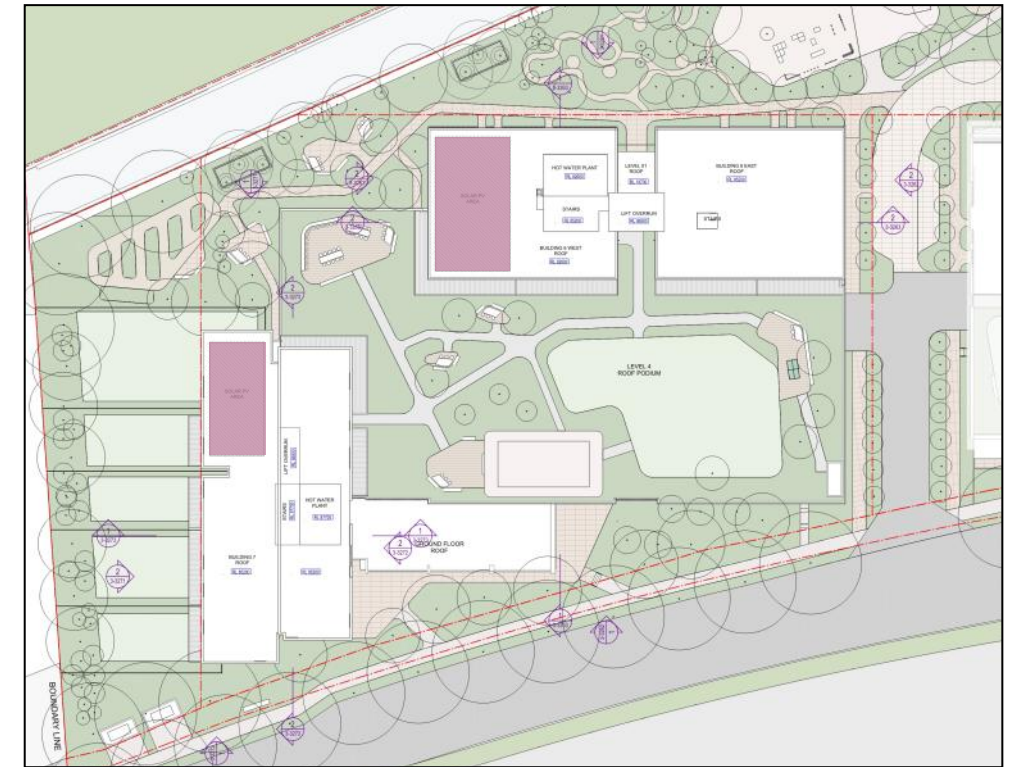
4. Energy Efficiency and Low Carbon Emissions



*Approximately 137sqm space for PV panels on Building 1
Approximately 171sqm space for PV panels on Building 2
Approximately 200sqm space for PV panels on Building 3*



*Approximately 140sqm space for PV panels on Building 4
Approximately 196sqm space for PV panels on Building 5*



*Approximately 213sqm space for PV panels on Building 6
Approximately 132sqm space for PV panels on Building 7*

Hatched areas on the roof plans in Figure above identify available roof area for PV panels on buildings 1,2 and 3 anticipated to be the first phase of development.

The total space available is in the order of 508sqm with detailed design of roof equipment and PV panel rows required to confirm a final outcome.

This space can be utilised for initial 195 kW PV arrays compliant with BASIX requirements, and in the future by the respective body corporate, potentially in partnership with an embedded network operator for the buildings.

Buildings 4,5,6&7 will also benefit from identified roof space for future PV array installation—including for a minimum 45kW in line with BASIX requirements.

4. Energy Efficiency and Low Carbon Emissions

Summary of carbon emission reduction measures

Boundary and Scope of carbon emissions considered

- The most relevant boundary for considering CO₂ reduction measures are the activities carried out in building operations—predominantly residential activities (c. 94% of floorspace) with a small amount of commercial activities (c. 6% of floorspace).
- Scope 1 CO₂ emissions for the project are produced from gas consumption in centralised gas hot water units and gas cooktops, refrigerant leakage from heat pump systems is also a source of emissions but is considered minor in the context of this project.
- Scope 2 CO₂ emissions, the major source of emissions, come from electricity sourced to power building systems and appliances.
- Significant Scope 3 CO₂ emissions, embodied carbon in key buildings materials and carbon emissions related to cars stored in the building for transport are also considered.

Operational carbon emissions—reduce energy use

Passive design reducing mechanical energy requirement

- NatHERS average rating of 7.4-7.9 stars exceeding the new upgraded BASIX 2022 benchmark
- Commercial floor space to comply at a minimum with NCC 2022 Section J building fabric provisions

Energy efficient systems and appliances

- Air conditioning with heating ACOP > 3.5
- 8 star clothes dryers to apartments
- Energy efficient light, lift and ventilation systems to common areas
- Commercial office floor space serviced with all electric systems and with a NABERS 5.5 star Agreement to Rate

Operational carbon emissions—future ability to replace fossil fuels with renewables

Transition from Scope 1 fossil fuels

- Gas hot water and cooktops (residential and retail premises) can be transitioned to electricity at the end of the equipment's useful life due to space and infrastructure provisions
 - Substation capacity is available to switch gas HW and cooktops to electric induction when required
 - Additional space for electric heat pump hot water storage reserved on roof tops
 - Suitable amp capacity circuits for future electric cooktops installed
- Commercial office premises to have no Scope 1 carbon emissions (noting other commercial retail premises may have gas services primarily for cooking)

On-site renewable electricity

- A total PV array system has been committed at 195 kW capacity (Phase 1, 2 and 3), in line with BASIX requirements
- Roof space identified to expand the PV array systems if required by the future body corporate

Offsite renewable electricity

- The future body corporate(s) will be able to specify renewable electricity contracts for base building services, including through third party embedded network operators as relevant

Operational carbon emissions—energy management

- Energy metering in place to allow monitoring and optimisation of core systems
- Provision for future battery storage, if feasible, to manage peak loads and also consideration of how future EV battery integration may occur

Reduced upfront embodied carbon emissions

Work by the GBCA (GBCA Think Step ANZ Embodied Carbon and Embodied Energy in Australia's Buildings 2021) can be used to identify the key building materials responsible, on average, for embodied carbon emissions:

- Steel 46%
- Concrete 44%

Through avoidance of basement car parking the project saves on embodied emissions when compared with a typical basement car parking building. This is driven by avoiding reinforced concrete used for piling and shoring substructure for basements.

Concrete embodied emissions could be further reduced by targeting certified low carbon concrete mixes (for example the Boral Envisia range of concrete). A combination of recycled materials, reduced concrete and other additives allow concrete, across strength grades, with reduced carbon emissions of 30-60%.

It is proposed that the tender phase for building contractors include a requirement for tender submissions to provide material options that would achieve reduced embodied carbon emissions, and clarify differences in relation to increased cost, structural integrity and delivery risks (if any). Based on this analysis the project proponent will be able to make an informed decision on the feasibility to implement a reduced embodied emission strategy.

Provide for EVs to replace fossil fuel vehicles

As a minimum the developer will meet NCC 2022 requirements to include future provision for 100% of residential car spots to be EV charger capable in the future (Type 2 charger @ min 7kW).

Annual CO₂ emissions amount to on average 2.22 tCO₂pa per car (for a car driven 15,000 Km/pa) so the potential for saved emissions by providing for low or no emission EVs is substantial.

4. Energy Efficiency and Low Carbon Emissions

Summary of carbon emission reduction outcomes

Target savings in operational carbon emissions

Residential component - operation (est. BASIX outputs)	Proposal case (TnCO ₂ pa) - Scope 1 & 2	Base case (TnCO ₂ pa) - Scope 1 & 2
Common area services	865	
Heating and cooling (& ventilation)	291	
Hot water	788	
Cooking	349	
Lights	127	
Appliances and other	1176	
Residential total	3597	9352
Renewable electricity onsite (195kW) BASIX compliance	-176	
Residential CO ₂ pa reduction	63%	
Non residential component - operation		
Office/retail/restaurant - assumed NCC 2022 compliant	919	919
Buildings total	4341	10272
Buildings total CO ₂ pa reduction	-58%	
Potential Scope 3 CO ₂ emission savings		
Potential concrete with 50% reduced embodied CO ₂ emissions (upfront saving) if commercially feasible in procurement	8501	
Potential CO ₂ savings p.a. with future 100% EV uptake	3730	

Notes:

- Residential assumptions utilize working BASIX engine results for the project at the time of the report (proposed case and base/reference case) —final outcomes will vary according to final 'as built' building specifications and final BASIX certificate requirements
- Commercial emissions use average sqm electricity usage from 2022 Commercial Building Baseline Study,
- Carbon intensity from grid assumed at 0.65kgCO₂/kWh
- Potential carbon emission savings in lower embodied carbon concrete utilize 'GBCA Think Step ANZ Embodied Carbon and Embodied Energy in Australia's Buildings' to estimate a per apartment materials average and carbon intensity—note that undercroft car parking will reduce concrete intensity in the project compared to an average basement car parking solution. This outcome is subject to acceptable commercial feasibility to procure the low embodied emission concrete product.
- Potential carbon emission savings for EV uptake assume avoided CO₂ emissions from typical ICE vehicle (2.2 tonnes CO₂ pa—NTC 2022, CO₂ Emissions Intensity for New Australian Vehicles 2021)
- Final CO₂ emissions outcomes will vary from averages depending on final design, systems and materials selections for the buildings

Integrated water management plan

Water resources will be managed to deliver three clear objectives for the redeveloped site as an integrated water management plan.

- Reduce the demand for potable water through water efficient fixtures and an alternative water supply—in particular recognising the large green landscaped areas proposed
- Reduce negative stormwater volume impacts within and leaving the site (please refer to the project Stormwater Management Plan (SMP))
- Reduce negative stormwater quality impacts within and adjacent to the site (please refer to the SMP)

Proposed outcomes meeting regulatory requirements and industry standards

- BASIX Water outcome of 40% across buildings meeting compliance and average industry standards (as observed by Efficient Living in contemporary apartment projects)
- Best practice WELS water efficiency levels for taps, toilets and shower roses
- Landscape strategy utilising mainly low water demand and indigenous plant species to reduce irrigation demand

Water efficient fixtures and fittings

Water efficiency in the project will be underpinned by efficient fixtures and fittings. Timed tap flow mechanisms will also be incorporated in communal and commercial areas. The following WELS water ratings will be achieved in the top quartile of efficiency for apartment, common and commercial areas:

- Shower roses—flow rates of 6-7.5L/min 4 star
- Toilets 4 star
- Taps 5 star
- Urinals 8 star (with consideration of waterless urinals)
- Dishwashers minimum 4 star

Rainwater tanks

The project will incorporate rainwater storage at a minimum to meet BASIX requirements. Total storage capacity of minimum 15kL will be installed (in Phase 1 and 2 buildings) for application to landscape irrigation and car washing. The high efficiency water fixtures and low water demand green landscape strategy lead to a small rainwater tank requirement to meet a BASIX 40% potable water saving.

Water sensitive urban design

Water efficient landscape design

The landscape design balances a communal grass area for active recreation (higher water demand for irrigation) with extensive areas of naturalised gardens (able to be much lower water demand).

Water efficient plant selection

The detailed landscape design for the site will include a balanced use of native and low water demand/ drought tolerant plant species.

Over 80% of plants utilised will be indigenous or native representing the typical mix experienced in the communities of the Parramatta River region.

Please refer to the Arcadia Landscape Plan for the proposal.

Water efficient irrigation methods

Any soft landscape areas in need of regular irrigation will be equipped with under surface drip irrigation to avoid evaporation losses and ensure moisture is directed at root areas. Irrigation control sensors will be installed across significant irrigation zones so that irrigation does not occur in times of existing sufficient moisture levels.

5. Water Efficient Design



WELS shower label certifying 6.5 L flow rate—consistent with this proposal

6. Responsible Materials, Construction and Waste

Lower impact materials and 'circular' waste management

Options will be sought in tender phases to identify and supply materials with certified environmental performance. In addition options will be sought from the building contractor to maximise waste recycling outcomes.

Proposed outcomes meeting regulatory requirements and industry standards

- Options sought to maximise construction waste recycled
- Environmental Product Disclosures (EPDs) options sought for key materials
- EMS and EMP required for head building contractor (ISO 14001)

Supporting responsible materials in the building structure and envelope

The detailed design and tender phases for the project will require options for products that follow good practice in respect to measuring environmental impacts and reducing these impacts. Products with a certified EPD will be sought where available.

The GBCA defined Good Practice products with a Responsible Product Value >10, as detailed at <https://new.gbca.org.au/green-star/rating-system/responsible-products-framework/#responsible-structure>, is a valuable resource to consider in this process.

Building contractor tender responses will be required to provide options for building materials alignment or otherwise with recognised responsible materials ratings schemes as set out by the GBCA.

Key building processes to be considered in detailed design would include:

- Design allowing sub structure and super structure to utilise environmentally certified concrete, steel and other major components
- Façade design also considered to support use of responsible glazing, panel and shade structures etc

Responsible construction

The tender requirements for building contractors will require that the head contractor has an environmental management system under AS/NZS ISO 14001 and will develop and Environmental Management Plan for the project advised to all sub contractors.

Construction waste recycling

Options will be sought for construction and demolition waste management maximising recycling outcomes.

Spoil management for the proposal will be carefully managed given the known presence of contamination in the ground.

Designing in Waste Sorting and Storage Facilities

The proposed increase in apartment yield has been reviewed by the project waste consultant. The updated waste assessment confirms that the additional operational waste and bin requirements can be accommodated within the approved waste -management arrangement and existing central collection facilities.

The project will provide adequately sized waste storage areas in the basement with separation of major waste streams according to Cumberland Council services.

A separate waste streaming area for e-waste should also be considered for occasional removal as required.

A garden organics composting/recycling area onsite should also be considered in the final landscape plan.

A Waste Management Plan by Elephant's Foot Consulting will be developed for the project guiding the final sizing and location of facilities and providing a guide to future building operators.



7. Urban Heat Management

Future proofing

The modification does not alter the approved landscape, public open-space, deep-soil or tree-canopy strategy. The urban-heat mitigation measures established for the approved development therefore remain applicable.

Proposed outcomes meeting regulatory requirements and industry standards

- Over 75% of horizontal surfaces to minimise urban heating effects
- Heat reflection from building to street level mitigated through high proportion of ground level green landscape

Urban heating resilience and mitigation

Over 75% of total site horizontal surfaces (excluding the area of proposed PV arrays) have been targeted for reduced urban heating outcomes including:

- High green landscape site coverage at ground level and podium levels
- Increased tree canopy, providing shade to hard surfaces and natural cooling (tree canopy increased by c.3,800 sqm subject to final outcome on eastern deep soil zone potentially subject to future transport uses)
- Final colours for the roof, podium hard surfaces and ground level hardscape surfaces will be specified to achieve low solar absorptance/high solar reflectivity.
 - Roof initial SRI of target minimum 82
 - Hardscapes initial SRI of target minimum 35

Highly reflective glazed facades (and other façade materials such as glass faced spandrels and some metal finishes) can have a large influence on the ground level microclimate by pushing/reflecting solar radiation down to this level.

The proposal includes high proportions of green landscape (canopy cover and/or garden beds) at most of the base of most northern and western facades to mitigate this impact.



The sum of soft landscaped areas, shaded hardscapes, and light coloured roofs and non-road hardscapes make up more than 75% of the site area for the proposal helping to mitigate heat retention

8. Human Wellbeing and Indoor Environmental Quality

Human wellbeing initiatives

Proposed outcomes meeting regulatory requirements and industry standards

- All NCC and Australian Standards for air quality, light and acoustic comfort will be met
- Cross ventilation outcomes for minimum 60% of apartments meeting the ADG guidelines
- Internal materials and fixings will be selected based on certification of low toxicity as measured by VOC off gassing and formaldehyde content
- Delivery of 15% of the total floor space as Affordable Housing to be distributed across each of the 7 residential buildings.

Air quality

For commercial and retail premises outdoor air flow will at least meet the AS 1668.2:2012 requirement with opportunities to exceed this performance standard recommended.

Natural cross ventilation outcomes, as measured by the ADGs, are achieved by at least 60% of apartments.

Acoustic Comfort

An acoustic study has been carried out by Engineering Lab, and should be referred to, establishing requirements for satisfactory acoustic outcomes for building occupants according to the activity they are undertaking.

For residential apartments the strategy and design and inclusions will ensure that:

- Maximum acceptable internal noise levels are achieved in bedroom and living room areas considering local rail and road noise
- Acoustic separation insulation levels between apartments will be targeted to meet NCC minimum requirements

Lighting Comfort

To further enhance the health and wellbeing of residents the project has considered daylighting outcomes through design and will target lighting fixture selection that enhances human comfort.

- Daylighting outcomes are enhanced by the ADG guidelines for window sizing and room depths.
- LED globe modulation, or flicker, should be reduced and target compliance with the international recommendation IEEE 1789-2015.
- LED lighting colour outputs should be accurate, and reflect natural colour outcomes, as measured by a CRI greater than 85 (luminaires should quantify the CRI level)
- LED temperature should target lower levels (2700k-3000k) in bedrooms with brighter (4500K-6500K) in living and kitchen areas with dimming function

Inclusive homes and spaces

15% of total project GFA will be dedicated as Affordable Housing to be managed through a Community Housing Provider.

146 apartments are provisioned as 'adaptable' which means these apartments can be easily modified for use by people using wheelchair mobility.

Communal Facilities and Spaces

The proposal provides multiple communal outdoor and indoor spaces for residents and workers that are inclusive, safe, flexible and enjoyable.

Outdoor spaces, as included in the landscape plan, include adult, youth and junior gym spaces, multiple passive relaxation zones and a large grass kickaround area with amphitheatre seating.



Quality communal spaces create strong community connection—proposed on the extensive podium areas in the proposal



Key abbreviations/glossary

ESD: Ecologically Sustainable Development or often Environmentally Sustainable Development

COP: 'Co-efficient of performance' used to measure conversion of electrical energy into heating or cooling energy

GFA: Gross floor area

ACOP: 'Annualized co-efficient of performance' also used to measure conversion of electrical energy into heating or cooling energy but typically adjusted for local climate conditions

NatHERS: National Home Energy Rating Scheme—note only refers to thermal performance of the home

BASIX: Building Sustainability Index measuring thermal, total energy and water efficiency in the home—part of the Sustainable Buildings SEPP 2022

EV: Electric vehicle

PV/solar array: Solar panels using photo voltaic technology to convert solar radiation into electricity

IEQ: Indoor environmental quality usually referring to air, noise and light quality in the building

DA/SSDA: Development Application/ State Significant Development Application'

SEPP: State Environmental Planning Policy

LEP: Local Environmental Planning Policy

DCP: Development Control Plan

CC: Construction certificate

SEAR: Secretary's Environmental Assessment Requirement issued to support a SSDA

ADG: NSW Apartment Design Guide setting apartment design standards in the NSW Housing SEPP

VOC: 'Volatile organic compound' that is a chemical gas release from typically internal building surfaces and materials

HVAC: Heating, ventilation and air conditioning—also includes cooling processes

Section J: The energy efficiency section requirements of the National Construction Code

GBCA: Green Building Council of Australia—the owner of Green Star ratings for buildings and communities

NABERS: National Australian Built Environment Rating Scheme—providing ratings from actual water and energy consumption in buildings

WELS: Water efficiency labelling and standards scheme

GEMS: Greenhouse and Energy Minium Standards

MEPS: Minimum Energy Performance Standards (under GEMS)

EPD: Environmental Product Disclosure providing transparent information on environmental impacts

Emission scopes – A mechanism for classifying different sources of carbon/GHG emissions used in carbon accounting. There are three 'scopes'

Scope 1 covers direct emissions from on-site fuel combustion (e.g. diesel, natural gas and LPG).

Scope 2 covers indirect emissions from the consumption of purchased electricity, steam, heating and cooling.

Scope 3 covers indirect emissions from activities not owned or controlled by the reporting organization, including production of fuels, electricity transmission losses, embodied carbon in construction and maintenance (including materials and products) tenant energy consumption, waste treatment, water treatment and travel to/from the building.

(adopted from Net Zero Technical Note—DPE 2023)