MIDTOWN S2

C4 Residential Project

Lot C4 Epping Road, Macquarie Park

DA Sustainability Report

05.08.2021 V.4

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INTEGRAL GROUP

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ACKNOWLEDGEMENT OF COUNTRY

This project acknowledges the Gadigal People of the Eora Nation as the traditional owners of land at the site. It acknowledge their elders, past, present and emerging.

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The Ivanhoe Estate precinct has been rezoned by the Department of Planning and Environment as part of the Macquarie University Station Priority Precinct. Currently owned by NSW Land and Housing Corporation, its redevelopment is part of the NSW Government Communities Plus program, which seeks to deliver new communities where social housing blends with private and affordable housing, with good access to transport, employment, improved community facilities and open space.

The Midtown Precinct at Macquarie Park is set to become an exemplar master planned community and the benchmark for 21st century integrated communities; characterised by attractive and vibrant lifestyle offerings as well as diverse social, economic and housing opportunities.

Midtown is located a short walk away from both Macquarie university and Macquarie shopping centre. Macquarie is renowned for being an Innovation District and is the second largest business district in NSW, home to various top 100 ASX listed companies.

The Midtown precinct will add to this growing area offering a fully resolved master planned community with an activated Village Green which will be framed with retail offerings, community uses and an extensive network of, walkways and cycleway linkages to nearby Shrimptons creek. The entire Midtown precinct when complete, will accommodate over 3,300 market, social and affordable dwellings.

The **C4 Site**, which has been approved within the master plan super-lot of varying height ranging between 17 and 24 stories and a targeted apartment yield of 272 market dwellings along with 216 social units as part of Frasers property commitment to LAHC. Building design must respond to the site context and there should be a complying design that fits within the building envelope identified in the Masterplan. Architecturally C4 plays an important role transitioning from the urban Midtown precinct to the natural Shrimptons creek nature corridor.

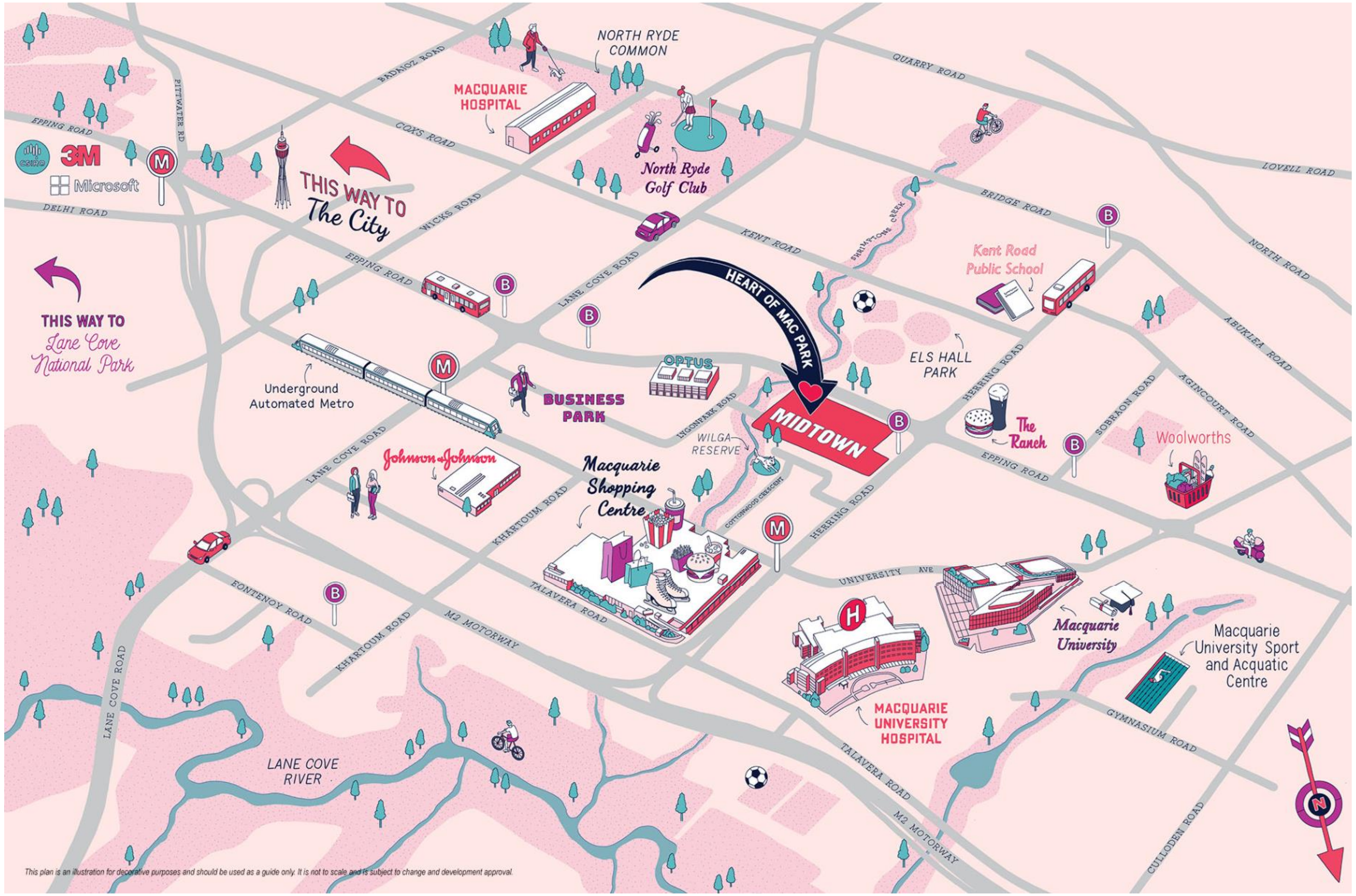


Figure 1 – Midtown map from www.frasersproperty.com.au

2. PERFORMANCE BRIEF

2.1 SEARS REQUIREMENTS

The main purpose of this report is to address SEARs ESD requirements for the project:

- Identify how ESD principles (as defined in clause 7 (4) of Schedule 2 of the regulation) will be incorporated into the design, construction and ongoing operation of the proposed development;
- Demonstrate how the development will achieve the commitments identified in the approved concept plan;
- Demonstrate how future buildings will meet or exceed the relevant industry recognised building sustainability and environmental performance standards, including any green accreditation;
- Demonstrate how the proposal incorporates measures to minimize carbon emissions from both construction/waste materials and in built, embodied design; reflecting the Government's goal of net zero emissions by 2050, and the consumption of resources, water (including through water sensitive design principles and water re-use) and energy.1

A summary table of project responses to the SEARS requirements has been provided in Section 10.

2.2 APPROVED COMMITMENTS

The precinct is targeting the following sustainability outcomes:

- Sustainability Benchmark #1: 5-star Green Star Design and As-Built v1.3;
- Sustainability Benchmark #2: 6-star Green Star Communities v1.1;
- Sustainability Benchmark #3: Integrated Infrastructure Solution

The repot describes a range of building design and urban infrastructure opportunities for the project to embed the principles of sustainability and give effect to the global, state and local policy relating to amenity, climate change and biodiversity.

It provides a framework with which the project can be made future-proof and responsive to the major challenges that Australian cities are facing.
Sustainability strategies will be presented for the following major components:

- *Architectural design*
- *Building systems design and renewable energy*
- *Materials and procurement*
- *Landscape and site water systems*
- *Offsite opportunities*
- *Transport and mobility.*

Figure 2 – Midtown Artist impression

2. PERFORMANCE BRIEF

2.3 LAND AND HOUSING CORPORATION VISION

NSW Land and Housing Corporation (LAHC) is here to serve the people of New South Wales by developing well-connected communities, preserving our environment, supporting our industries and contributing to a strong economy.

The Department of Planning, Industry and Environment brings together specialists in urban and regional planning, natural resources, industry, environment, Aboriginal and social housing and regional New South Wales.

LAHC shares a common goal to maximise the long-term wellbeing of New South Wales. they do this by protecting and improving:

- Prosperity;
- Environmental sustainability;
- Safety and security;
- Social inclusion and cohesion; and
- Attractiveness as a place for recreation and relaxation.

They strive to be a global leader in the planning and management of resources, environmental and socio-economic security, financial affordability, land use and carbon emissions.

The Department of Planning, industry and Environment cluster is responsible for delivering:

- A strong and liveable New South Wales;
- Maximum community benefit from government land and property;
- Resilient and sustainable environment and energy;
- Sustainable and productive regional industries and communities;
- Sustainable and secure water resources.

2.4 PROJECT OBJECTIVES

The ongoing challenges of increasing urban density, housing affordability and climate change mean we all share the responsibility to improve the liveability of our towns and cities and minimise the impacts of development on our natural environment.

The project will aim to achieve a high level of environmental performance for both the precinct and individual buildings through its design and materials.

By doing this, the project will improve sustainability by reducing water usage and energy costs for residents.

The project will seek to deliver new dwellings with high levels of residential amenity and which also reduce living costs through water and energy efficiency:

- ***To minimize resultant carbon emissions in both the delivery and operation of the building;***
- ***To substantially reduce the water usage in both the delivery and operation of the building;***
- ***To improve building efficiency and reduce operational costs;***
- ***To create a healthy and resilient environment for the community to live and work in, well into the future;***
- ***To demonstrate leadership in sustainable development for social and affordable housing in New South Wales through sustainability measurement tools and policy; and***
- ***To demonstrate effective use of materials to minimise waste in construction and lifestyle.***

Climate Active

NABERS

greenstar

BASIX®
Building Sustainability Index

Figure 3 – Ratings Frameworks for demonstrating leadership

3. PLANNING AND POLICY CONTEXT

3.1 SUPPORTING POLICY

The site will provide a vehicle for the advancement of the comprehensive sustainability-related policy framework in NSW; considering global, Commonwealth, State and Local government policy.

3.2 GLOBAL & COMMONWEALTH POLICY

UN Sustainable Development Goals | At least seven of the UN Sustainable Development Goals are advanced through sustainability in cities and urban renewal and the site provides a material contribution to each:

- *SDG3 – Good Health and Wellbeing* | Ensuring healthy lives and promoting the well-being for all at all ages is essential to all sustainable development.
- *SDG7 – Affordable & Clean Energy* | Ensure access to affordable, reliable, sustainable and modern energy for all
- *SDG8 – Decent Work & Economic Growth* | Promote inclusive and sustainable economic growth, employment and decent work for all
- *SDG9 – Industry, Innovation & Infrastructure* | Build resilient infrastructure, promote sustainable industrialization and foster innovation
- *SDG11 – Sustainable Cities & Communities* | Make cities inclusive, safe, resilient and sustainable
- *SDG12 – Responsible Consumption & Production* | Ensure sustainable consumption and production patterns
- *SDG13 – Climate Action* | Take urgent action to combat climate change and its impacts
- *SDG15 – Life on Land* | Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

Figure 4 – UN SDGs relevant to the project

Commitments under the Paris Agreement | Cities are critical to the global goal to reduce GHG emissions in order to hold average temperature increase to well below 2°C and pursue efforts to keep warming below 1.5°C above pre-industrial levels.

The project can provide an approach to net zero emissions, supporting competitiveness in an emissions-constrained global economy.

Smart Cities Plan | The project includes a range of liveability, housing and affordability measures in support of the Smart Cities Plan and the advancement of the City Performance Indicators.

3.3 NSW STATE GOVERNMENT POLICY

NSW Office of Environment and Heritage | The project will give effect to the NSW climate change framework.

It can provide a pathway to the NSW ambition for net zero emissions by 2050 by showcasing a GHG emissions strategy that includes electrification, on-site energy generation, off-site renewable energy procurement, incentivising fuel switching for transport options and offsetting residual emissions with a robust, future ready negative emissions strategy.

NSW Environmental Protection Agency | The site can be an urban exemplar of the Circular Economy, giving effect to the NSW Circular Economy Policy Statement.

NSW Procurepoint | Supporting and advancing the opportunities for Aboriginal and Torres Strait Islander Australians through the procurement and design approaches to the site.

Transport for NSW | The site can be an exemplar for future mobility, including active mobility, movement and place and vehicle electrification.

NSW State Environment Planning Policy – Affordable Rental Housing | The site can be a benchmark project for the Affordable Rental Housing 2009 of the NSW Government policy.

The policy's intent is to facilitate the increased supply and diversity of affordable rental and social housing in NSW. The ARHSEPP covers housing types including in-fill affordable housing, along with secondary dwellings (granny flats), boarding houses, group homes, social housing and supportive accommodation.

The policy seeks to help facilitate development carried out by LAHC and its developer partners by amending provisions for in-fill affordable housing development and LAHC's self-assessment provisions. These include:

- Increasing the maximum number of dwellings that LAHC can self-assess from 20 to 60 dwellings with a maximum height of 8.5m.
- A mixture of private, affordable and social housing in a single development.
- Consider its design guidelines 'Good design for social housing', dated September 2020 and 'Land and Housing Corporation Dwelling Requirements' dated September 2020 when self-assessing development proposals.
- Allowing LAHC to self-assess manor house and multi dwelling housing (terraces
- Expansion of the range of residential accommodation dwelling types that attract a density bonus under the in-fill affordable housing provisions to include, manor houses and multi dwelling houses (terraces).
- Expansion of the areas where the in-fill affordable housing provisions apply to include the Central Coast, Wollongong and Newcastle regions as well as Greater Sydney to better capture 'accessible areas' across the State.
- The requirement for all development under the in-fill affordable housing provisions to deliver a minimum 20 per cent of gross floor area as affordable housing.

4. FRAMING NET ZERO OPERATIONS

4.1 DEFINING NET ZERO

The World Green Building Council defines Net Zero Carbon for operating emissions as "highly efficient with all remaining energy from on-site and/or off-site renewable sources".

Many leading global frameworks have expanded the net zero definition to include embodied emissions, and to be more prescriptive in the nature of off-site renewable energy and negative emissions instruments (offsets).

The Green Building Council of Australia has defined 'climate positive' in preference to 'net zero':

1. Fossil Fuel Free
2. Highly efficient
3. Powered by renewable energy
4. Built with low-carbon materials
5. Offset with nature, i.e. re- and afforestation.

4.2 CERTIFICATION

There are a number of options for certification with Net Zero Emissions:

- Certify with Climate Active, an Australian emissions certification scheme;
- Certify with Green Star, within the framework of the Energy category (in design and as-built);
- Certify with the International Living Futures Institute (available for operations only).

4.3 FOSSIL FUEL FREE

Electrification of all building service is crucial to Net Zero Carbon ambition by eliminating the burning of fossil fuels (gas) for building services which cannot be offset by on-site renewables.

4.4 HIGHLY EFFICIENT

A global best practice benchmark for highly efficient residential dwellings is Passive House; requiring exceptional insulation and building sealing with efficient fresh-air delivery.

A best practice benchmark aligned with NSW planning policy is NatHERS: 7 star average.

4.5 POWERED BY RENEWABLE ENERGY

The project will integrate on-site renewable energy and provide mechanisms for off-site renewable energy procurement:

- For all common spaces;
- Competitively priced 100% renewable power supply for residential customers.

4.6 BUILT WITH LOW-CARBON MATERIALS

The approach to Net Zero Emissions includes consideration of embodied emissions and efforts to reduce the life-cycle impact of greenhouse gasses.

4.7 OFFSET WITH NATURE

All construction projects have some residual emissions – whether as a result of embodied emissions in the materials that are used, refrigerant impacts or residual operating emissions.

To advance to net zero whole-of-life emissions, projects must use off-site negative emissions instruments such as nature-based offset schemes (afforestation or reforestation among others).

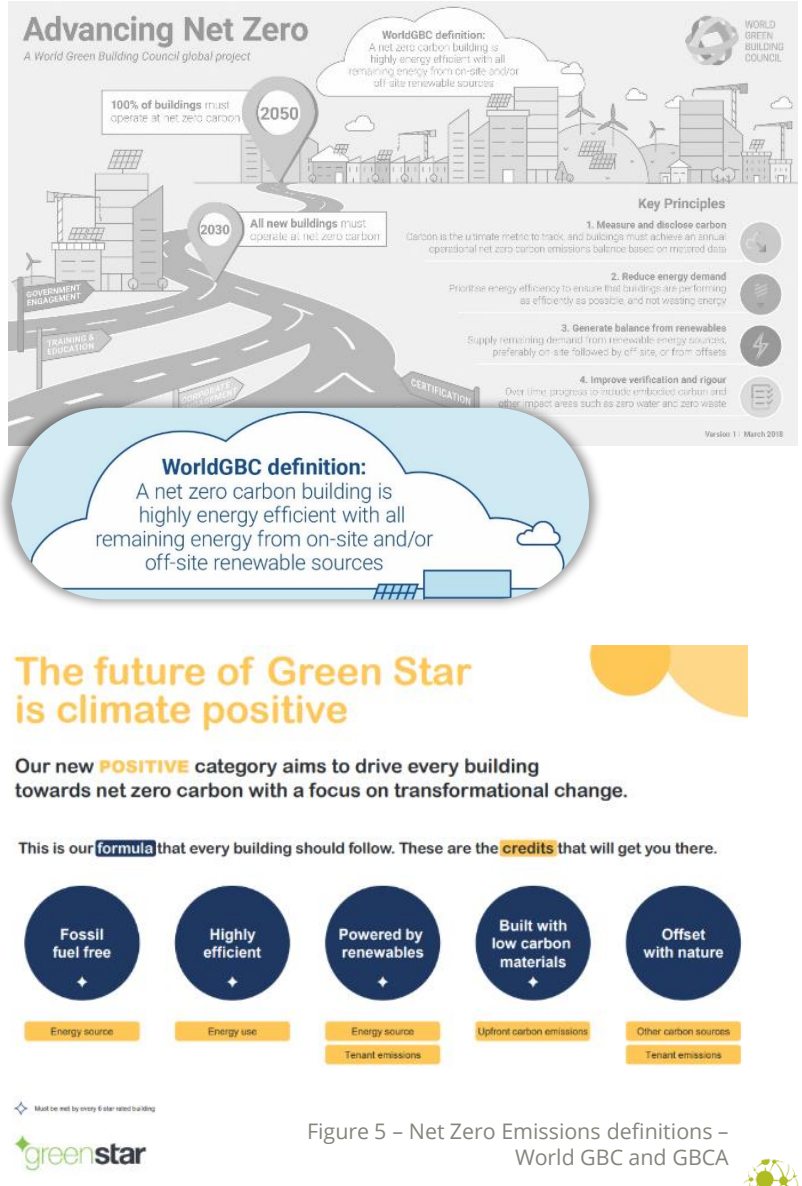


Figure 5 – Net Zero Emissions definitions – World GBC and GBCA

5. DESIGN OPPORTUNITES

5.1 PASSIVE DESIGN

There are a range of passive opportunities to reduce the resource consumption of the dwellings, provide healthy and comfortable homes for occupants and enable high-efficiency systems.

The Green Star framework provides some guidance for passive design; however the thermal comfort requirements for the project are set by the Nationwide House Energy Rating Scheme (NatHERS) and BASIX. This report identifies a level of performance based on NatHERS requirements.

Certification with the NatHERS will consider the following passive design principles.

- Natural ventilation
- Solar access
- Building fabric
- Shading

5.2 GREEN ROOFS AND WALLS

Roof-top greening will be implemented alongside renewable energy for occupant amenity, building fabric performance and heat island mitigation.

Rainwater harvesting will be implemented for re-use in irrigation and washdown.

5.3 WASTE MANAGEMENT

Smart waste collection to improve separation, recycling and spatial efficiency and organic waste management have been considered.

5.4 EFFICIENT HVAC AND DHW SERVICES

The opportunities that have been explored for efficient building services include:

- Electrification; providing systems that reduce the future reliance of the project on fossil fuels.
- Efficient HVAC and advanced commissioning for heating/cooling with mechanical ventilation to mitigate condensation risk and filter external pollutants.
- The use of slip systems throughout most apartment units will minimize required quantities for refrigerants in HVAC systems, minimizing global warming and ozone-depleting potential.
- Domestic hot water (DHW) systems will efficient, zero fossil-fuels options.
- Occupant education with a building user guide for building occupants to support optimal use of efficient buildings systems.

5.5 LIGHTING & ELECTRICAL SYSTEMS

- Direct/indirect lighting to include wall-washing in support of a healthier lit environment.
- Master switches throughout, with home automation offered as purchase upgrade.
- Common area controls such as motion sensers on common area lighting and ventilation.
- Future proof design to enable EV charging capability to be installed to dedicated parking spaces.

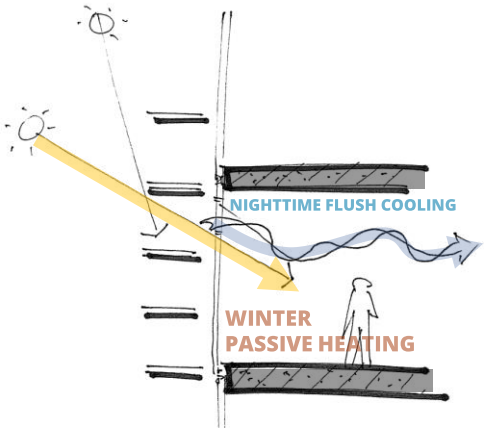


Figure 6 – Passive Design Strategies to create a comfortable environment.

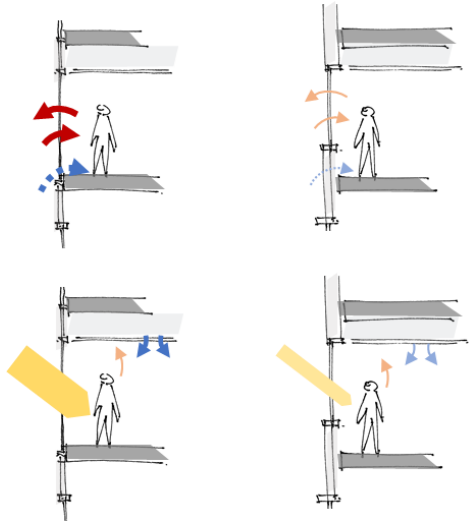


Figure 7 – Efficient Integrated systems on precinct

6. RENEWABLE ENERGY OPPORTUNITIES

6.1 RENEWABLE ENERGY AND STORAGE

On-site renewable energy generation through rooftop PV can provide the most cost-effective mitigation of GHG emissions and create a low-carbon utility grid.

Preliminary analysis indicates a plausible solar arrangement as shown in the opposite plan.

Onsite renewable energy can support shared facilities, or with an embedded network operator can be operated allocated to residents too.

On-site battery storage can support the optimization of on-site solar and also improve the reliability of power for emergency purposes during any loss of power.

Batteries are increasingly important for grid stability and the firming of renewable generation.

The precinct is targeting a 1.5MW PV System covering approximately 50% of site roof space. The balance of roof space will be green roofs and open areas.

The opposite drawing shows the PV system to be installed on the roof level..

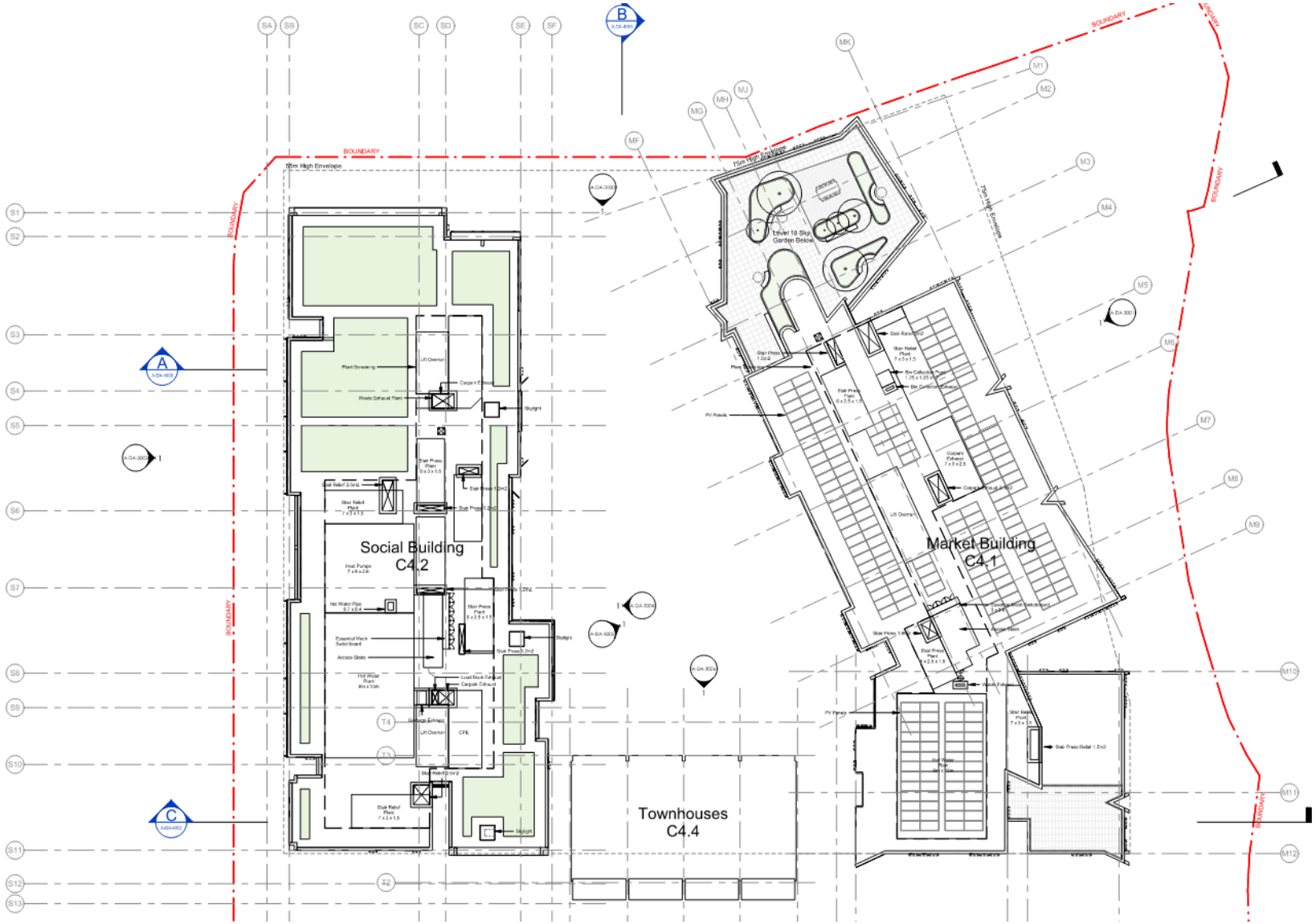


Figure 8 – Rooftop Solar PV capacity assessment

7. MOBILITY AND PUBLIC REALM OPPORTUNITIES

7.1 CLIMATE RISK

Climate risk mitigation related to heat is a necessity in Sydney.

Prolonged periods of time of extreme heat and drought will be more frequent in the future and affect health and wellbeing of the community.

Urban heat island mitigation will be supported with shading, green infrastructure and high SRI surfaces.

7.2 GREEN & BLUE INFRASTRUCTURE

Water sensitive urban design will contribute to measurable improvements to local air and water quality as well as thermal comfort in the public realm.

7.3 ACTIVE TRANSPORT

The approach to mobility will prioritize active transport options:

- Bicycles – end of trip facilities and secure storage
- Pedestrians – public spaces and intersections that are safe and amenable

7.4 FUTURE MOBILITY

The project will also consider the future of mobility:

- Electric vehicles
- Shared vehicles
- Connected & autonomous vehicles
- E-mobility.

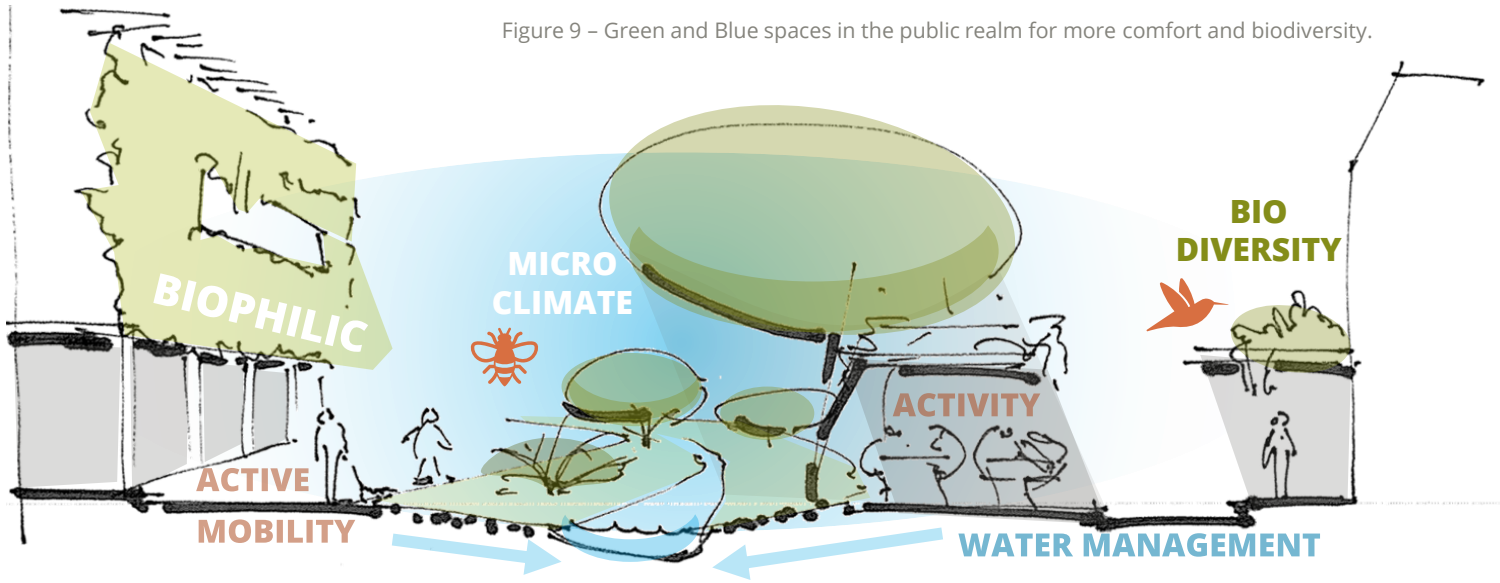


Figure 9 – Green and Blue spaces in the public realm for more comfort and biodiversity.

Figure 10 – Active Transport facilities combined with Smart Mobility to future-proof the public domain.

8. COMPLIANCE | BASIX

8.1 BASIX

BASIX applies to all residential dwelling types (Class 1, 2 and Part 4) and is an integral part of the development application process in NSW, implemented under the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 (the BASIX SEPP).

The BASIX assessment tool analyses data relating to the design of proposed dwellings. It assesses the anticipated water consumption and greenhouse gas emissions levels to determine how this scores against water and energy targets. The expected thermal performance of each dwelling is also assessed via the Nationwide House Energy Rating Scheme (NatHERS) and is included in the BASIX assessment.

The project is located in climate zone 56, and will target the following water, energy and thermal comfort targets set under BASIX:

SECTION	TARGET
Water	40
Energy – Units	25
Energy – Terraces	25
Thermal Comfort – Heating	≤ 40 MJ/m²/a
Thermal Comfort – Cooling	≤ 26 MJ/m²/a

BASIX® Building Sustainability Index NSW GOVERNMENT Planning & Environment

8.2 WATER

The Water section of BASIX aims to reduce the potable water consumption of all new residential developments.

The benchmark is 90,340 litres of water per person per year (or 247 litres per person per day), which was the average potable water consumption of a pre-BASIX home.

The project is targeting 45 BASIX Water for all apartments on average across the development, by:

- Using 5 star WELLS rated fixtures and appliances;
- Maximising the use of non-potable water for irrigation and car washing, using rainwater collected from rooftops; and
- An optimised integrated infrastructure solution

8.3 ENERGY

The Energy section of BASIX aims to reduce the greenhouse gas (GHG) emissions of all new residential dwellings.

The benchmark is 3,292 kilograms of carbon dioxide per person per year, which was the average for pre-BASIX homes. The building specification must comply with minimum BASIX energy requirements.

The project is targeting 25 BASIX Energy on average across the development by implementing:

- Energy efficient equipment;
- Solar hot water or heat pumps for all domestic hot water needs;
- Site wide 1.5 MW Solar PV system covering approximately 50% of roof spaces throughout the precinct.

8.4 THERMAL COMFORT

A detailed assessment utilising National House Energy Rating Scheme (NatHERS) accredited software is required in order to verify compliance with the BASIX Thermal Comfort requirements. Compliance with the BASIX thermal comfort section aims to:

- Ensure thermal comfort for a dwelling's occupants, appropriate to the climate and season;
- Reduce greenhouse gas emissions from artificial cooling and heating; and
- Manage peak demand for energy required for cooling and heating, thereby reducing the need for new or upgraded energy infrastructure

Under the simulation method BASIX assigns the maximum allowable heating and cooling loads to a dwelling according to the NatHERS climate regions, based on postcode. Should the modelling demonstrate both heating and cooling loads (or thermal loads) fall below the maximum allowable, the dwellings are deemed to be compliant.

The thermal loads are calculated as the amount of energy that would be required to maintain the temperature within an acceptable range and take into account the following.

- The dwelling's construction and insulation; including floors, walls, ceilings and roof; and
- The dwelling's glazing and skylights; based on size, performance, shading and overshadowing.

8. COMPLIANCE | BASIX

8.5 BASIX RESULTS

The below summarise the BASIX results from our modelling of the project. For inclusions and further detail, please refer to Efficient Living's Report on NatHERS modelling results, dated 16th July 2021 (or latest available).

Analysis

The BASIX Assessment is divided into three sections; Water, Thermal Comfort and Energy, each independently measuring the efficiency of the development.

BASIX requires a minimum target of 40% for the water section, a pass or fail for the thermal comfort section, and a minimum required target of 25% for the energy section.

Water

The proposed Development has achieved the BASIX Water Target of 40%.

The water usage of the development is calculated based on the number and efficiency of permanent fixtures and appliances such as taps, showerheads and toilet, the dish washer and clothes washing machine.

The size of the rainwater tank and number of connections may have a significant impact on your water score as does the area of gardens and lawns whether or not low water plant species are incorporated.

Energy

The proposed development has achieved the Energy target of 25% to pass this section.

The energy usage of the development is calculated based on the efficiency of fixed appliances that will be used. This includes the air-conditioning system, hot water system, lighting, exhaust fans, cook top, oven, and clothes drying facilities.

Thermal Comfort Scores

Average heating loads are 44% below allowable BASIX targets

Average cooling loads are 59% below allowable BASIX targets

8. COMPLIANCE | NatHERS

8.6 THERMAL COMFORT ASSESSMENT

Integral Group, partnered with Efficient Living have conducted preliminary NatHERS modelling.

The design elements shown in the table below were modelled following review of the final architectural documentation, and input from the design team. Where no specific information had been determined, the modelling team made conservative assumptions.

Roof and ceiling	
Concrete roof, waterproof membrane	
Plasterboard ceiling with R2.0 insulation (insulation only value) where balconies are above	
Plasterboard ceiling with R3.0 insulation (insulation only value) to soffit of concrete where roof is over	
Plasterboard ceiling, no insulation where neighbouring units are above	
External Colour	
Light (SA < 0.475	
Ceiling Penetrations	
Sealed LED downlights at a maximum of one every 2.5m^2 .Once lighting plan has been developed NatHERS certificate can be updated to improve specification.	
External Wall	
Brick veneer with R2.0 insulation (insulation only value)	
75mm Hebel wall with R2.0 insulation (insulation only value) to balcony not located on main façade	
FC cladding on metal studs and plasterboard lined with R2.0 insulation (insulation only value)	
100mm Tilt up/off form/In Situ concrete with metal studs and plasterboard lined with R2.0 insulation (insulation only value)	
Minimum 150mm structural concrete with metal studs and plasterboard lined with R1.2 insulation (insulation only value)	
External Colour	
Medium colour modelled (0.475 < SA < 0.7)	
Inter-tenancy walls	
75mm Hebel Power Panel to walls adjacent to neighbours, no insulation required for thermal comfort	
75mm Hebel Power Panel to walls adjacent to hallways, no insulation required for thermal comfort	
Minimum 150mm concrete with furring channel and plasterboard lining to all walls adjacent to lift shafts and fire stairs. No insulation required	
Walls within dwellings	
Plasterboard on studs – no insulation	
Floors	
Concrete with a minimum R1.5/2.0 insulation (insulation only value) required to units with basement below	
Concrete with a minimum R1.5/2.0 insulation (insulation only value) required where part open subfloor is below	
Concrete between levels, no insulation required	
Floor coverings	
Default floor coverings	
External Shading	
Shading as per stamped documentation	

Figure 7 – Table of assumptions by EL.

8. COMPLIANCE | NatHERS

8.7 GLAZING UPGRADES

Design changes can positively impact on thermal comfort performance.

The opposite table shows glazing upgrades applied to several units to seek design thermal comfort compliance with NatHERS targets, with option 3 being the highest spec glazing.

8.8 RESULTS

Thermal Comfort Scores

- Average heating loads are **44%** below allowable BASIX targets
- Average cooling loads are **59%** below allowable BASIX targets

For further detail, refer to Efficient Living's Report on NatHERS modelling results, dated 16th July 2021 (or latest available).

Base file	Aluminium framed single low-e: **A** – awning windows + hinged glazed doors U-Value: 5.4 (equal to or lower than) SHGC: 0.49 (±10%) **B** – sliding doors/windows + fixed glazing + louvre windows U-Value: 5.4 (equal to or lower than) SHGC: 0.58 (±10%)
Upgrade 1	Aluminium framed low-e, double glazing: **A** – awning windows + hinged glazed doors U-Value: 4.1 (equal to or lower than) SHGC: 0.47 (±10%) **B** – sliding doors/windows + fixed glazing + louvre windows U-Value: 4.1 (equal to or lower than) SHGC: 0.52 (±10%)
Upgrade 2	Aluminium framed low-e, double performance glazing: **A** – awning windows + hinged glazed doors U-Value: 2.9 (equal to or lower than) SHGC: 0.44 (±10%) **B** – sliding doors/windows + fixed glazing + louvre windows U-Value: 2.9 (equal to or lower than) SHGC: 0.51 (±10%)

Figure 8 – Table of glazing options by EL.

9. GREEN STAR INITIATIVES

The project has committed to achieving a *5-star Green Star Design and As-Built* rating for each separate building, as well as *6-star Green Star Communities* for the whole precinct.

Green Star is a comprehensive environmental rating system for buildings and communities. Green Star separately evaluates the environmental initiatives of design, projects and/or buildings based on several criteria, including energy and water efficiency, indoor environmental quality and resource conservations.

The Green Star environmental rating system for buildings was created for the property industry in order to:

- Establish a common language;
- Set a standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Recognise environmental leadership;
- Identify building life-cycle impacts; and
- Raise awareness of green building benefits.

6 STAR COMMUNITIES RATING TARGETS

Sustainable Site	Maximise the ecological value of site to be close to or exceeding existing (biodiversity, permeable surfaces, urban greening): 1. Protect the existing Turpentine Ironbark Forest 2. Maintain its functional connection to Shrimptons Creek riparian habitat through the site and with fauna crossings at road intersections. 3. Mitigating the urban heat island effect with extensive landscaped public domain, green roofs, low-SRI roofs and solar PV.
	Mitigating the urban heat island effect with extensive landscaped public domain, light coloured roofs, green roofs and solar PV.
	Employ Water Sensitive Urban Design Manage stormwater. Manage urban stormwater with water sensitive urban design including swales and permeable detention basins
Transport & Connectivity	A connected and permeable site to encourage active transport and use of public transport
	At least one bicycle parking space to be provided for each dwelling and at least 200 provided for visitors
	Provision of 50 GoGet spaces
	Electric vehicle ready
	End of trip facilities for non-residential buildings
Community Health & Happiness	To fully quantify and track tangible health and well-being metrics through programs and partnerships including Live Life Get Active and Mission Australia's Strengthening Communities amongst others.
	Public domain that encourages social interaction, has activated street frontages, is adaptable and comfortable, and is pedestrian-oriented
	A minimum 200 volunteer hours on various community activities specifically for Ivanhoe Estate.
Living Costs	Development reduces average living costs for households, and average operating costs for businesses, compared with business as usual
	Whole of life affordability strategy considering: Housing, Utilities, Food and Transit
	The CCAP Precinct report indicates in excess of a 40% reduction in living costs.
Local Economy	Integrate commercial opportunities within precinct, including spaces suitable for small business or home business operations and / or work from- home 1. Community Hub – fitted out with offices and session rooms for the delivery of MA's tenant support programs and also drop-in offices for the delivery of community services 2. Social Enterprise Space – opportunities for social enterprise development in conjunction with the community.
	The Strengthening Communities program will deliver opportunities that MA and MAH can create through the operation of the residential community such as: 1) Landscaping, 2)Common area maintenance, 3) Administration of the Community Hub, and 4) Live Work Dwellings are incorporated in buildings along the main street which will be suitable for small business or home business

9. GREEN STAR | PATHWAY TO GREEN STAR D&AB

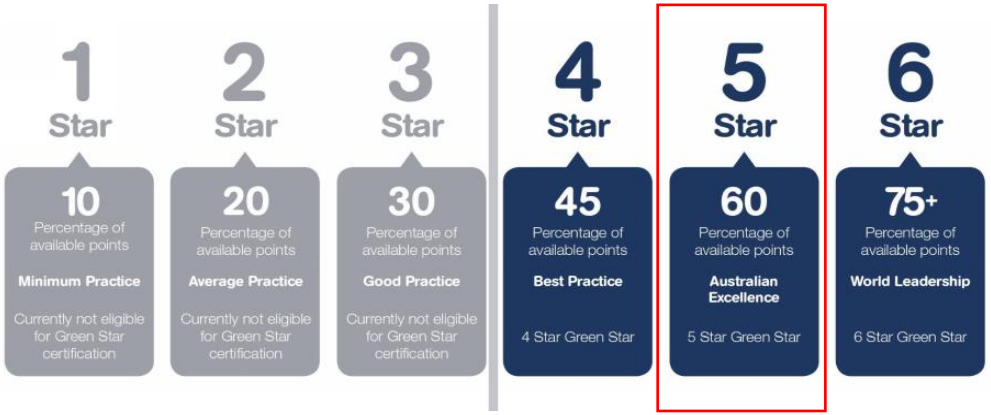
Green Star - Design & As Built Scorecard

Project: Midtwon C4 Frasers Residential Project

Targeted Rating: **5 Star – Australian Excellence**

CATEGORY / CREDIT	POINTS AVAILABLE	POINTS TARGETED
Management	14	11
Indoor Environment Quality	17	11
Energy	17	11.7
Transport	7	7
Water	6	5
Materials	12	10
Land Use & Ecology	6	4
Emissions	5	4
Innovation	10	5

	AVAILABLE	TARGETED
Core	100	64
Innovation	10	5
Total Score Targeted		**69**



Green Star - Design & As Built Scorecard

5 Star – Australian Excellence

Project:	**Round:**	Please select the round of assessment	
Targeted Rating:			

Core Points Available	Total Score Targeted
100	64

greenstar

AVAILABLE	TARGETED
100	64
10	5
	69

INTEGRAL GROUP

9. GREEN STAR | MANAGEMENT

1.1 Accredited Professional
- No special requirements to plan.

2.0, 2.2, 2.1 & 2.4 – Commissioning & Tuning
- Comprehensive commissioning processes
- Services & Maintainability review during design
- Commit to tuning process after PC

3.1 - Climate Adaptation Plan
- Develop Climate Adaptation Plan during design
- Include solutions suggested in CAP in the design

4.1 – Building Information
- Develop Operations & Maintenance manual
- Develop building log-book
- Building user information documents

6.1 – Metering and Monitoring
- Common area sub-metering requirements:
    - All floors to be separately metered
    - Metering split by all major usages
- Install automatic monitoring system
- Implement monitoring strategy
- Smart BMS required to provide data hourly/daily/monthly/annually

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Management			**14**	
Green Star Accredited Professional	1.1	Accredited Professional	1	1
Commissioning and Tuning	2.0	Environmental Performance Targets	-	Complies
	2.1	Services and Maintainability Review	1	1
	2.2	Building Commissioning	1	1
	2.3	Building Systems Tuning	1	1
	2.4	Independent Commissioning Agent	1	0
Adaptation and Resilience	3.1	Implementation of a Climate Adaptation Plan	2	2
Building Information	4.1	Building Information	1	1
Commitment to Performance	5.1	Environmental Building Performance	1	0
	5.2	End of Life Waste Performance	1	0
Metering and Monitoring	6.0	Metering	-	Complies
	6.1	Monitoring Systems	1	1
Responsible Construction Practices	7.0	Environmental Management Plan	-	Complies
	7.1	Environmental Management System	1	1
	7.2	High Quality Staff Support	1	1
Operational Waste	8A	Performance Pathway: Specialist Plan	1	1
	8B	Prescriptive Pathway: Facilities	1	0
Total			**14**	**11**

7.0 -, 7.1 & 7.2 – Responsible Construction Practices
- Best Practice EMP is minimum requirement
- Environmental Management System during construction
- High Quality Staff support practices in place: contractor programs & workshops.

8A – Operational Waste – Performance Pathway
- Waste specialist plan
- Waste streams shall be separate by landfill, co-mingled recycling and at least on other waste stream (eg. organics or e-waste).
- Provide dedicated waste storage areas adequately sized as per third-party best practice guidelines, according to waste generation and collection frequency.
- Access to waste storage areas to meet third-party best practice guidelines.

9. GREEN STAR | INDOOR ENVIRONMENT QUALITY

9 – Indoor Air Quality

- **9.1** Ventilation system complies with: minimum distances between air intakes and pollutant sources (eg. exhausts) as per ASHRAE 62.1:2013; design for easy maintenance; cleaning prior to use/occupation
- **9.2C** Natural ventilation provisions meet AS1668.4-2012 standards. Good access to outdoor air required.
- **9.3** Sources of indoor pollutants should be eliminated or exhausted directly to the outside (Eg. printers and kitchen equipment)

10 – Acoustic Comfort

- **10.3 Acoustic Separation _ Residential:**
  - Inter-tenancy walls of Discontinuous Construction and achieve airborne noise isolation of Rw + Ctr > 5.
  - Unit entry doors to have seals and achieve Rw > 30.
  - Floors to achieve Ln, w + Cl <55.
  - Compliance demonstrated through measurements.

11 – Lighting Comfort

- **11.0 Minimum:** Ensure flicker-free lighting and colour quality as a minimum.
- **11.1.1 Illuminance:** Residential spaces require general fixed lighting with good illuminance values for the entire space. Fittings have a rated colour variation not exceeding 3 MacAdam Ellipses.
- **11.1.2 Localised lighting control:** Ensure that occupants have the ability to control the lighting in their immediate environment.

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Indoor Environment Quality			**17**	
Indoor Air Quality	9.1	Ventilation System Attributes	1	1
	9.2C	Provision of Outdoor Air _ Natural Ventilation	2	2
	9.3	Exhaust or Elimination of Pollutants	1	1
Acoustic Comfort	10.1	Internal Noise Levels	1	0
	10.2	Reverberation	1	0
	10.3C	Acoustic Separation _ Residential Projects	1	1
Lighting Comfort	11.0	Minimum Lighting Comfort	-	Complies
	Illuminance and Glare Reduction	11.1.1B General Illuminance _Residential Spaces 11.1.2A Glare Reduction_Prescriptive Method	1	1
	11.2C	Surface Illuminance _ Residential Spaces prescriptive method	1	0
	11.3	Localised Lighting Control	1	1
Visual Comfort	12.0B	Glare Reduction _Blinds or Screens	-	Complies
	12.1A	Daylight _ Prescriptive Method	2	1
	12.2	Views	1	1
Indoor Pollutants	Adhesives, Sealants and Carpets	13.1.1A Paints, Adhesives and Sealants_Product Certification 13.1.2A Carpets _ Product Certification	1	1
	13.2A	Engineered Wood Products _ Product Certification	1	1
Thermal Comfort	14.1C	Thermal Comfort _ Residential Spaces	1	0
	14.2	Advanced Thermal Comfort	1	0
Total			**17**	**11**

9. GREEN STAR | INDOOR ENVIRONMENT QUALITY

12 – Visual Comfort

- **Glare reduction:** Install blinds/screens for all areas, controlled by occupants, VLT <10%.
  - Bedrooms/sleeping areas can be excluded dur to functional requirements.
  - Bathrooms can be excluded due to reduced occupational periods.
  - Any other areas must be justified for exclusion.
  - Where it is expected that blinds will be installed by the occupiers of residential units, these spaces are excluded from this minimum requirement. – FPA will be providing blinds.

- **12.1A Daylight Prescriptive Methodology**: use hand calc to determine zone of compliance (minimum 40%)
- **12.2 Views:** 60% of nominated area has a clear line of sight to high quality internal or external view.

13 – Indoor Pollutants

- Paints, Adhesives, Sealants, Carpets and Engineered Wood Products need to be certified under a recognised Product Certification Schemes or laboratory testing.

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Indoor Environment Quality			**17**	
Indoor Air Quality	9.1	Ventilation System Attributes	1	1
	9.2C	Provision of Outdoor Air _ Natural Ventilation	2	2
	9.3	Exhaust or Elimination of Pollutants	1	1
Acoustic Comfort	10.1	Internal Noise Levels	1	0
	10.2	Reverberation	1	0
	10.3C	Acoustic Separation _ Residential Projects	1	1
Lighting Comfort	11.0	Minimum Lighting Comfort	-	Complies
	Illuminance and Glare Reduction	11.1.1B General Illuminance _Residential Spaces 11.1.2A Glare Reduction_Prescriptive Method	1	1
	11.2C	Surface Illuminance _ Residential Spaces prescriptive method	1	0
	11.3	Localised Lighting Control	1	1
Visual Comfort	12.0B	Glare Reduction _Blinds or Screens	-	Complies
	12.1A	Daylight _ Prescriptive Method	2	1
	12.2	Views	1	1
Indoor Pollutants	Adhesives, Sealants and Carpets	13.1.1A Paints, Adhesives and Sealants_Product Certification 13.1.2A Carpets _ Product Certification	1	1
	13.2A	Engineered Wood Products _ Product Certification	1	1
Thermal Comfort	14.1C	Thermal Comfort _ Residential Spaces	1	0
	14.2	Advanced Thermal Comfort	1	0
Total			**17**	**11**

9. GREEN STAR | ENERGY

15B – Greenhouse Gas Emissions – NatHERS Pathway

15B.0 Conditional
- Achieve minimum NatHERS 0.5 Star rating improvement above compliance, overall as well as for each specific section.
- Extra requirements for projects targeting 5 and 6 Stars GS

15B.1 Thermal and Energy Performance
- Points awarded based on calculated on the basis of improvement in building performance for roofs, ceilings, floors and sky lights.
- The proposal has is targeting 6 Stars NatHERS rating.
- Specific requirements as per NatHERS performance targets.

15B.2.1 Lighting
- At least 10% better aggregated illumination power than the code
- Independent light switching to each room and functional area.
- Automated lighting controls systems required throughout 95% of the nominated area.

15B.2 Ventilation and Air Conditioning
- Cooling System equipment of minimum 3 Stars, AND the cooling/heating capacity of the unit does not exceed the design cooling/heating load by over 15%
- Naturally ventilated spaces to achieve *Provision of outdoor air 9.2 Credit*; cross ventilation to all apartments; AND installation of ceiling fans – This is achieved through a different range of strategies for market and affordable/social housing

15B.3 Domestic Hot Water
- Solar thermal heating system, AND
- The primary non-renewable heat source of DHW is an electric heat pump (min COP=3.5), or het recovery.

15B.2.5 Fuel Switching
- No fossil fuels are burned on-site for electricity generation, heating or cooling.
- 15% of energy demand is met from on-site renewables.

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Energy			**22**	
Green Gas House Emissions _ NatHERS Pathway	15B.0	Conditional Requirement: Prescriptive Pathway	-	Complies
	15B.1	Thermal and Energy Performance	6	0.2
	15B.2.1	Lighting	1	1
	15B.2.2	Ventilation and Air Conditioning	2	2
	15B.2.3	Domestic Hot Water	2	0.5
	15B.2.4	Appliances and Equipment	1	0
	15B.2.5	Fuel Switching	1	1
	15B.2.6	On-Site Storage	1	0
	15B.2.7	Vertical Transportation	1	1
	15B.2.8	Passive Laundry Facilities	1	0
	15B.2.9	Un-occupied Areas	1	0
	15B.2.10	Off-Site Renewables	5	5
Peak Electricity Demand Reduction	16A	Prescriptive Pathway: On-Site Energy Generation	2	1
Total			**17**	**11.7**

15B.2.7 Vertical transportation
- Minimum lift energy efficiency is Class A or B as per ISO 25745-2, AND
- Lift standby energy performance is Level 1.

15B.10 Off-site Renewables
- At least 10 points in this pathway have been achieved, AND
- A supply contract is in place to procure 100% of the building's electricity consumption through off-site renewable electricity solutions.

Minimum time of procurement: 10 years after PC.

16A – Peak Electricity Demand Reduction - Prescriptive Pathway
- On-site renewable energy sources reduces peak electricity demand by at least 15%.
- Peak Electricity demand must be calculated in accordance with AS/NZS 3000:2007, including all building end-use loads except for process loads.

9. GREEN STAR | TRANSPORT, WATER

17B – Sustainable Transport – Prescriptive Pathway

17B.1 Access by Public Transport
- Minimum 15% of people within the Greater Capital City Statistical Area can access the site by public transport within 45 min during peak hour.

17B.2 Reduced Car Parking Provision
- A reduction of car parking spaces compared to the local planning allowance. Points are awarded based on the level of the reduction and the site's access to public transport.

17B.3 Low Emission Vehicle Infrastructure

17B.3B Parking for Electric Vehicles
- 5% of parking is dedicated to electric vehicles and charging infrastructure is provided for each space. Charging infrastructure must be easily accessed by the users of dedicated electric vehicle charging spaces. **OR**

17B.3C Parking for Share vehicles
- For residential projects, dedicated and clearly designated car share spaces and vehicles are provided at the rate of 1 per 70 project occupants.

17B.4 Active Transport Facilities
- Bicycle parking and associated facilities are provided to a proportion of the building's regular occupants and visitors.

17B.5 Walkable Neighborhoods
A. Proximity to Amenities
- At least 8 amenities are within 400 m of the project.

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Transport			**10**	
Sustainable Transport	17A	Performance Pathway	0	0
	17B.1	Access by Public Transport	3	3
	17B.2	Reduced Car Parking Provision	1	1
	17B.3A	Low Emission Vehicle Infrastructure _ Parking for fuel-efficient vehicles	1	1
	17B.4	Active Transport Facilities	1	1
	17B.5A	Walkable Neighbourhoods _ Proximity to Amenities	1	1
Total			**7**	**7**

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Water			**12**	
Potable Water	18A	Potable Water - Performance Pathway	12	0
	18B.1	Sanitary Fixture Efficiency	1	1
	18B.2	Rainwater Reuse	1	0
	18B.3	Heat Rejection	2	2
	18B.4	Landscape Irrigation	1	1
	18B.5	Fire Protection System Test Water	1	1
Total			**12**	**5**

18B – Potable Water - Prescriptive Pathway B

18B.1 Efficient Sanitary Fixtures
All fixtures are within one star of specified WELS ratings:
- Taps: 6 star
- Urinals: 6 Star
- Toilet: 5 Star
- Showers: 3 Star
- Dishwashers: 6 Star

18B.3 Heat rejection
- No water is used for heat rejection. For example, by using natural ventilation.

18B.4 Landscape irrigation
- Drip irrigation, OR moisture sensors are installed; OR No potable water is used for irrigation.

18B.5 Fire Protection System Test Water
- No water is used for fire system testing, **OR** at least 80% of test water is captured and reused

9. GREEN STAR | MATERIALS

19A – Life Cycle Impacts - Performance Pathway

19A.1 + 19A.2 – Comparative Life Cycle Assessment
- A whole of building, whole of life LCA is conducted for the project and a reference building
- Additional Reporting included

20 - Responsible Building Materials

20.1 – Structural and reinforcing steel
20.1.0 – Responsible Steel Maker:
- The steel making facility has an ISO 14001 Environmental Management System (EMS) in place.
- The steel maker supplying the steel is a member of the World Steel Association (WSA) Climate Action Programme (CAP).

20.1A Responsible Steel Fabricator:
- The steel fabricator must be a member of the ASI's Environmental Sustainability Charter Group

20.2 – Timber
20.2.A – Certified Timber:
- Timber must be certified by a forest certification scheme (FSC, PEFC)

20.3 – Permanent Formwork, Pipes, Flooring, Blinds and Cables
20.3.B – Best Practice Guidelines for PVC:
- A valid audit verification certificate for each of the PVC products specified or used in the project. Show compliance against GBCA's Best Practice Guidelines for PVC.

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Materials			**14**	
Life Cycle Impacts	19A.1	Life Cycle Assessment	6	4
	19A.2	Additional Reporting	4	0
Responsible Building Materials	20.1 A	Structural and Reinforcing Steel _ Responsible Steel Fabricator	-	Complies
	B.2		1	1
	20.2 A	Timber _ Certified Timber	1	1
	20.3 A	Permanent Formwork, Pipes, Flooring, Blinds and Cables _ No PVC	1	1
Sustainable Products	21.1	Product Transparency and Sustainability	3	1
Construction and Demolition Waste	22.0	Reporting Accuracy	-	Complies
	22A	Fixed Benchmark	0	0
	22B	Percentage Benchmark	1	1
Total			**12**	**10**

21.1 Sustainable Products

> 3% Eligible products meet the following pathways for compliance: Reused, Recycled content, EPD, Third party certified, OR Stewardship Programs. A combination of pathways can be used.

22 – Construction and Demolition Waste

22.0 – Reporting Accuracy:
Waste contractors and waste processing facilities servicing the project demonstrate compliance with the Green Star Construction and Demolition Waste Reporting Criteria.
- Either show a Compliance Verification Summary issued by a Suitably Qualified Auditor, or;
- Complete a Disclosure Statement outlining how much of the Green Star Construction and Demolition Waste Reporting Criteria has been implemented.

22B – Percentage Benchmark
Demonstrate that >90% of construction and demolition waste has been diverted from landfill.

9. GREEN STAR | LAND USE & ECOLOGY and EMISSIONS

23.0C Ecological Value

Professional report confirming the site does not contain any critically endangered or vulnerable species or communities.

24 – Sustainable Sites

24.0 Previously Developed land

Demonstrate previous condition of the site by reporting that the project site was previously developed.

24.1 Reuse of Land

>75% of the site was previously developed at the time of purchase. Aerial photographs and As-built drawings as evidence.

24.2 Contamination and Hazardous Materials

Site contamination to be remediated in accordance to best practice.

25.1 Heat Island Effect

Demonstrate that at least 75% of the whole site area comprises of heat island mitigation solutions. The most applicable for this project are:

- Vegetation
- Green Roof
- Cool roof materials
- Shaded hardscaping

26 – Stormwater

26.1 Peak Stormwater Discharge

Post-development peak Average Recurrence Interval (ARI) event discharge from the site does not exceed pre-development levels.

- Roof collection & use
- Infiltration in soil
- Water retention

26.2 Stormwater Pollution Targets

- Credit 26.1 needs to be achieved in order to target 26.2
- Post-development situation meets pollution reduction targets compared to untreated runoff.
- Shown through modelling or manual calculation.

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Land Use & Ecology				
Ecological Value	23.1	Ecological Value	3	1
	24.0	Conditional Requirement	-	Complies
	24.1	Reuse of Land	1	1
Sustainable Sites	24.2	Contamination and Hazardous Materials	1	1
Heat Island Effect	25.1	Heat Island Effect Reduction	1	1
Total			**6**	**4**

CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Emissions			**5**	
Stormwater	26.1	Stormwater Peak Discharge	1	1
	26.2	Stormwater Pollution Targets	1	1
Light Pollution	1.	Light Pollution to Neighbouring Bodies	-	Complies
	2.	Light Pollution to Night Sky	1	1
Microbial Control		Legionella Impacts from Cooling Systems	1	1
Refrigerant Impacts	29.1	Refrigerants Impacts	1	0
Total			**5**	**4**

27 – Light Pollution

27.0 Light Pollution to neighbouring bodies

- All outdoor lighting complies with AS 4282:1997 Control of the obtrusive effects of outdoor lighting.

27.1 Light pollution to night sky

- Control of Upward Light output ratio (ULOR): no external luminaire has a ULOR higher than 5%.

28 – Microbial Control

28A Natural Ventilation; OR

28B Waterless Heat Rejection Systems

- Any building cooling rejection system do not use or contain water

9. GREEN STAR | INNOVATION

30 – Innovation

Pre-selected innovation credits are:

1. Affordable Housing
2. Financial transparency
3. Local procurement 1
4. Local procurement 2
5. Marketing Excellence

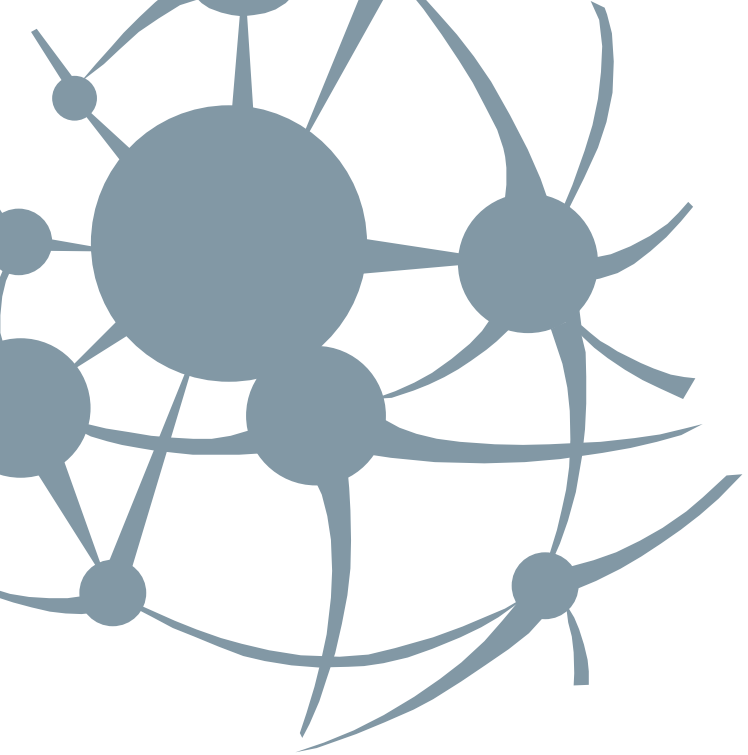
CATEGORY / CREDIT	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Innovation			**10**	
Innovative Technology or Process	30A	Innovative Technology or Process	10	
Market Transformation	30B	Market Transformation		
Improving on Green Star Benchmarks	30C	Improving on Green Star Benchmarks		
Innovation Challenge	30D	Innovation Challenge		5
Global Sustainability	30E	Global Sustainability		
Total			**10**	**5**

AVAILABLE	TARGETED
100	**63.7**
10	**5**
TOTAL	**68.7**

10. SUMMARY

The precinct is achieving the planning requirements through a series of strategies, which are captured in the summary matrix below.

PLANNING REQUIREMENT	PRECINCT PROJECT RESPONSE
Identify how ESD principles will be incorporated into the design, construction and ongoing operation of the proposed development	Incorporated through: • Architectural design • Building systems design and renewable energy • Materials and procurement • Landscape and site water systems • Offsite opportunities • Transport and mobility.
Demonstrate how the development will achieve the commitments identified in the approved concept plan:	
• 5-star Green Star Design and As-Built v1.3;	Committed to 5 stars GS D&AB v1.3. Refer to targeted pathway in Section 9
• 6-star Green Star Communities v1.1;	Committed to 6 stars GS Communities v1.1. Refer to Section 9
• Precinct wide averaged Basix 40 Energy target;	Passive design strategies, On-site renewable energy generation, efficient systems
• Precinct wide averaged Basix 45 Water target;	Water efficient fixtures/fittings, rainwater tank and reuse for landscape irrigation
• 6 Stars average NatHERS;	Passive design strategies
• NABERS 5-star water for all commercial components;	Water efficient fixtures/fittings, rainwater tank and reuse for landscape irrigation
• Carbon Neutral in operations;	• Green power procurement • 1.5 MW Solar PV System precinct-wide • Reduction in Embodied carbon • Integrated utilities infrastructure
• Materials sustainability & Waste reduction	Achieved through Green Star certification
• Sustainable transport and mobility	Achieved through Green Star certification
Demonstrate how future buildings will meet or exceed the relevant industry recognised building sustainability and environmental performance standards, including any green accreditation;	Committed to 5 stars Green Star D&AB v1.3 and 6 stars Green Star Communities
Demonstrate how the proposal incorporates measures to minimize carbon emissions from both construction/waste materials and in built, embodied design; reflecting the Government's goal of net zero emissions by 2050, and the consumption of resources, water (including through water sensitive design principles and water re-use) and energy.	• Achieved through commitment to carbon zero operations; • Green Star certifications; and • Integrated utilities infrastructure



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