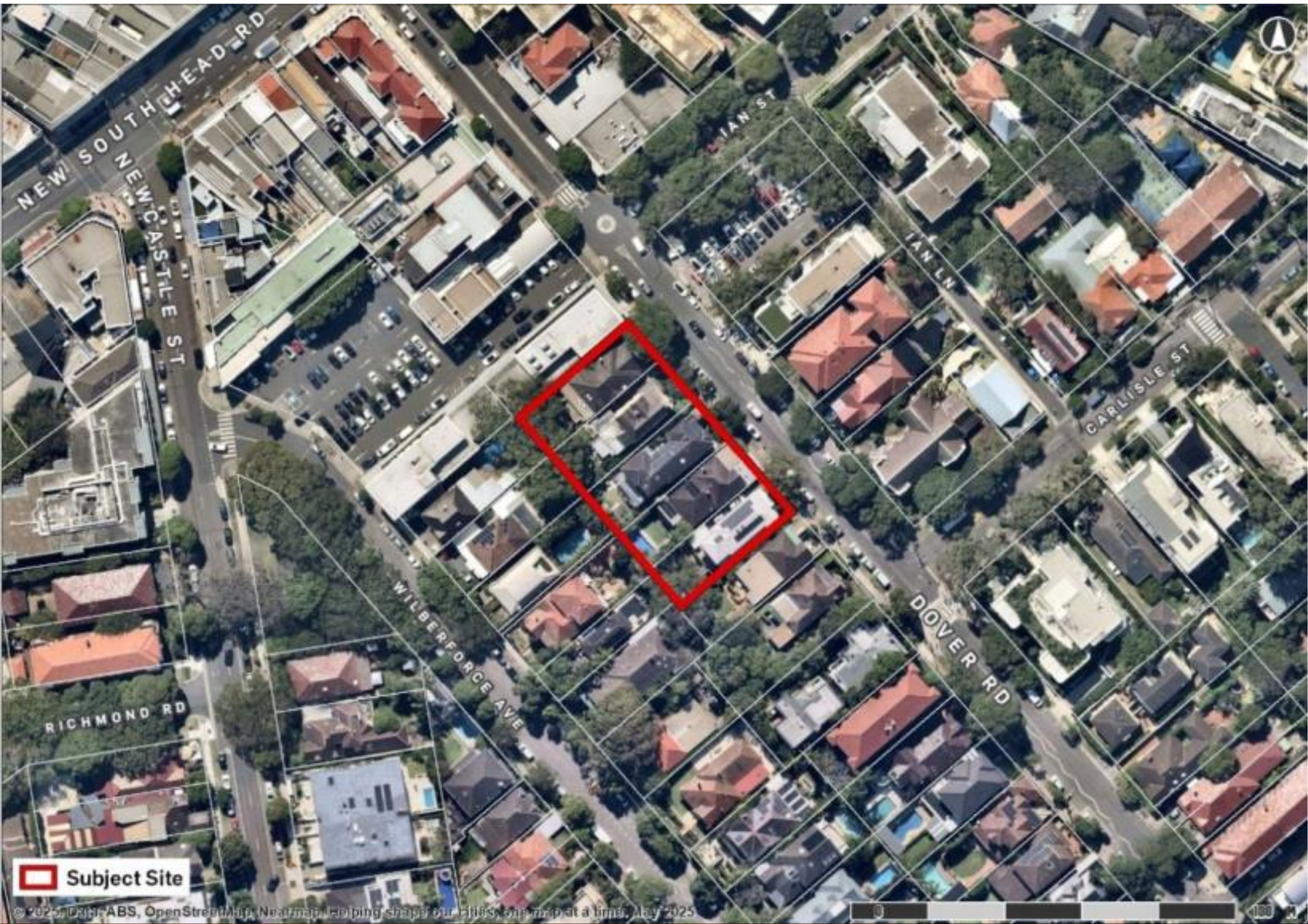

Ecologically Sustainable Design (ESD) Report

23-31 Dover St, Rose Bay NSW

10th October 2025

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Document Control

Revision	Date	Author
1.1	10 October 2025	B. Shojaei

CONTENTS

1. Executive Summary

IGS has been commissioned to prepare this Ecologically Sustainable Design (ESD) assessment report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs) and in support of the preparation of an Environmental Impact Statement (EIS) and State Significant Development Application for the proposed development to the Department of Planning, Housing and Infrastructure (DPHI). The proposed development's address is 23-31 Dover St, Rose Bay NSW.

This report has been prepared with reference to architectural plans prepared by MHNDUNION.

The principles of ecologically sustainable design will be an integral consideration throughout this development. This report summarises the ESD provisions for the development which demonstrate commitment to environmental sustainability.

The sustainability targets for the development will be achieved in an integrated and staged approach through minimising the need for energy consumption (via passive measures) and then consumption optimisation (energy efficiency) and use of renewable resources where required.

The initiatives presented in this report demonstrate a wide range of measures which will result in high levels of environmental performance and also improvement of occupants' health, productivity, comfort, and satisfaction.

Aiming at leading practice in energy and environmental targets, the project architect and building services design team will maximise energy efficiency in an integrated and staged approach as described in Table 1 below.

Table 1. Sustainability Approach

Load Reduction (Minimising the need for resource consumption e.g., energy, water, and material)	Passive Design
	Building fabric improvements
	Maximise use of natural lighting
	Maximise use of Natural ventilation
	Maximise use of native plants and species
Optimising resources consumption (energy, water & materials)	High efficiency Heating, Ventilation and Air Conditioning
	High efficiency lighting
	High efficiency hot water systems
	High efficiency appliances
	Commissioning and tuning of building services post completion
	High efficiency building control, automation and BMS
Indoor Environmental Quality	Thermal Comfort
	Acoustic comfort
	Effective Daylighting / Natural Lighting
	Natural Ventilation
	Volatile Organic Compounds (VOC) & Formaldehyde Minimisation
Material	Maximise separation and recycling of demolition and construction materials.
	Minimise use of Ozone Depleting materials
	Avoid specifying materials with environmentally sensitive content

	Participation in waste minimisation training for contractors and sub-contractors.
	Waste minimisation plan to reduce site waste to landfill.
Transport Efficiency	Sustainable transport measures & bicycle racks
Use of renewable resources (renewable energy and rainwater harvesting)	Application of Heat Pump technology
	Rainwater harvesting
Land use and Ecology	Maintaining and improving the ecological value of the land
Emissions	Insulation products with low Ozone Depletion Potential
	Refrigerants with Ozone Depletion Potential of zero
	Stormwater Management
	Light Pollution: Minimise light beams directed upwards or outside the buildings.

Benchmarking and compliance requirements:

The development will meet and outperform the following regulatory sustainability requirements:

- SEPP 2022 Sustainability and Standard Secretary's Environmental Assessment Requirements (SEARs) – ESD requirements
- NCC Section J – Energy Efficiency
- BASIX – Energy, Water and Thermal Comfort.

2. Introduction

This report has been prepared to support a State Significant Development Application (SSDA) SSD-86017721 for the site at 23-31 Dover Road, Rose Bay NSW (the site).

The Minister for Planning, or their delegate, is the consent authority for the SSDA and this application is lodged with the NSW Department of Planning, Housing and Infrastructure (DPHI) for assessment.

This report has been prepared in response to the requirements contained within the Secretary's

Environmental Assessment Requirements (SEARs) dated 13 June 2025 (SSD-86017721). Specifically, this report has been prepared to respond to the following SEARs (Table 2).

Table 2. SEARs Relevant References.

SEARs Items	Project Response
Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development.	The proposed development incorporates ESD principles in accordance with Section 193 of the EP&A Regulation through an integrated approach to design, construction, and operation. Key strategies include passive solar design, thermal insulation, natural ventilation, renewable energy, high-efficiency HVAC and lighting systems, water-sensitive urban design, low-VOC materials, construction waste minimisation, and provision for active and sustainable transport. Operational initiatives include building tuning, environmental management plans, and ongoing energy/water performance monitoring. These measures aim to reduce greenhouse gas emissions, enhance occupant wellbeing, and promote environmental stewardship. The sustainability targets for the development will be achieved in an integrated and staged approach through first minimising the need for energy consumption (via passive measures) and then consumption optimisation (energy efficiency) and use of renewable resources where required. Section 5 of this report provides specific reference to how the development is targeting these requirements.
Where relevant, provide an assessment of the development against the standards for non-residential development set out in Chapter 3 of State Environmental Planning Policy (Sustainable Buildings) 2022.	While the development is residential in nature, and not subject to the full provisions of Chapter 3 of the SEPP (Sustainable Buildings) 2022, the project voluntarily adopts best-practice sustainability strategies consistent with the intent of the policy. These include outperforming and complying with the BASIX and NCC Section J energy efficiency requirements, and the inclusion of initiatives, such as water reuse, thermal comfort design, indoor environmental quality, and use of renewable energy. Where applicable, principles of emissions reduction, resource efficiency, and future climate adaptation have been embedded in the design process.

2.1 Project Description

The application seeks development consent for an SSDA which will facilitate the redevelopment of the site for a residential flat building using the in-fill affordable housing and mid-rise housing controls in accordance with the recently introduced provisions under the State Environmental Planning Policy (Housing) 2021 (Housing SEPP).

The project seeks consent for:

- Demolition of existing buildings on site and tree removal.
- Construction of a residential flat building comprising two levels of basement car parking, eight storeys of residential dwellings, communal open space and associated landscaping. The building will include:

  – 15% affordable housing operated and used by a CHP for a period of 15 years.

  – 49 residential dwellings including 1-, 2-, 4- and 3-bedroom typology.

  – Vehicular access from Dover Road and provision for parking of 66 car parking spaces, including 6 visitor, 5 accessible, 7 motorbike spaces, and 54 bicycle spaces.

- Storage areas, utilities and service provision.

Refer to Architectural Plans prepared by MNDU appended to the Environmental Impact Statement.

2.2 The Site

The site is located at 23-31 Dover Road, Rose Bay. The site occupies five lots legally described as Lots 10/A in DP4244, Lot 11/A in DP4244, Lot 12/A in DP4244, Lot 13 in DP663078 and Lot 1 in DP105598. The site area is 2657sqm.

The site is located to the immediate east of the Rose Bay town centre in the Woollahra local government area (LGA). The Rose Bay town centre is identified as a Low-Mid Rise Centre under the Housing SEPP.

Existing development on the site includes:

- A single storey building with a large gable roof, housing the Rose Bay Family Medical Centre at 23 Dover Road. The zoning of this property is still residential.
- Two-storey rendered houses with pitched tiled roofs at 25 & 27 Dover Road
- A single storey rendered house with a pitched tiled roof at 29 Dover Road.
- A two-storey rendered dual occupancy with a pitched metal roof at 31 Dover Road.

All five lots have vehicular access from Dover Road, leading to garages. Pedestrian access is also available from Dover Road through gates in the front fences.

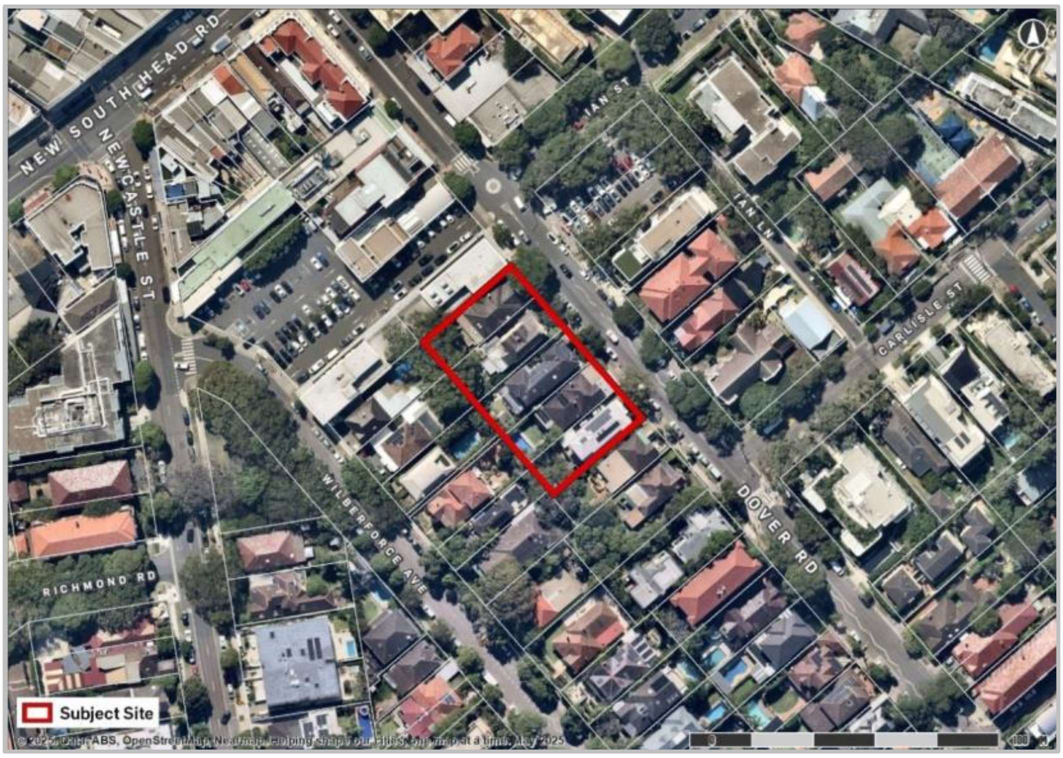


Figure 1. Subject Site - 23-31 Dover St, Rose Bay NSW.

3. Methodology

The design team recognise the importance of sustainable developments in terms of environmental preservation, occupants' health, safety, and wellbeing, as well as in terms of greenhouse gases emissions reduction.

The project architect, consultants and contractors will strive to design and construct the building based on the Environmentally Sustainable Design (ESD) principles which exceed the minimum regulatory NCC Section J requirements.

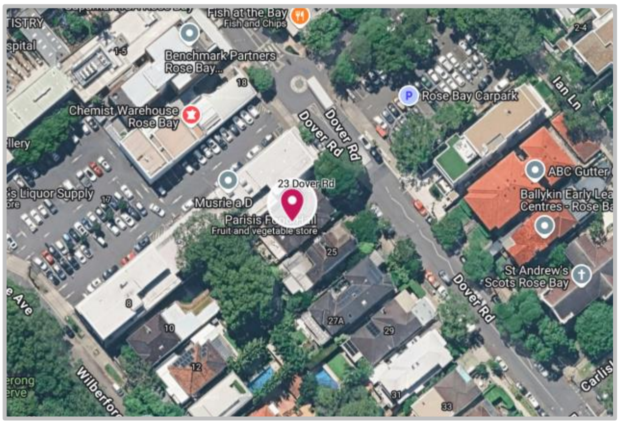


Figure 2. Location – 23-31 Dover St, Rose Bay NSW
Source: Google Map.

The facade and floor plans are designed with the vision to give occupants the very best in terms of passive heating and passive cooling. This, when combined with other energy efficiency strategies (listed later in the report) will lead to low energy demands for the tenancies and base building and therefore lower greenhouse gas emissions during the life of this development.

IGS has been commissioned to prepare this Ecologically Sustainable Design (ESD) assessment report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs) and in support of the preparation of an Environmental Impact Statement (EIS) and State Significant Development Application for the proposed development to the Department of Planning, Housing and Infrastructure (DPHI). This report has been prepared with reference to architectural plans prepared by MHNDUNION.

Natural lighting and natural ventilation will be utilised very effectively throughout the development. In addition to thermal comfort, energy and water efficiency, the proposed building design will provide sustainable and efficient operation to the occupants.

The proposed sustainable design initiatives will not only improve the building services life but are low-cost, low maintenance and reliable, especially when compared to often prohibitively complex and expensive retrofits. Furthermore, the passive design principles will facilitate a low-energy and cost-effective operation for the occupants. The following are some of the design initiatives which will improve the environmental performance of the development and deliver long term energy efficiency during the life of the building.

- Optimising the size of the mechanical plant to ensure the plant is working at its peak efficiency and minimise the capital cost of the plant.
- Having high efficiency lighting and air conditioning equipment will reduce the energy consumption of the buildings.
- Variable Speed Drives (VSD) controls the speed of pumps, fans, and other mechanical plant to ensure that they are only using as much power as it is needed.
- Commissioning of all services equipment to ensure their correct operation.
- A high-performance façade will limit the heat entering the buildings, reducing air conditioning system sizes and the energy use over the year.
- A mixed mode approach allowing the buildings to be naturally ventilated when outdoor conditions are suitable allowing significant energy reduction by not requiring the air conditioning system to operate at all times.
- Emission reductions and material optimisation.
- Maximise use of non-toxic building materials.
- Maximise use of materials that are recyclable.
- Minimise Waste in Construction.
- Minimise Waste in Operation.
- Renewable Energy generation – Heat Pump technology.

4. Benchmarking

Benchmarking and compliance requirements:

The development will meet and outperform the following regulatory sustainability requirements:

- SEPP 2022 Sustainability and Standard Secretary's Environmental Assessment Requirements (SEARs) – ESD requirements
- NCC Section J – Energy Efficiency
- BASIX – Energy, Water and Thermal Comfort.

4.1 Response to SEARs

The ESD SEAR's report is required by the Secretary's Environmental Assessment Requirements (SEARs). Table 3 identifies the SEARs and relevant reference within this report.

Table 3. SEARs Relevant References.

SEARs Items	Project Response
Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development.	The proposed development incorporates ESD principles in accordance with Section 193 of the EP&A Regulation through an integrated approach to design, construction, and operation. Key strategies include passive solar design, thermal insulation, natural ventilation, renewable energy, high-efficiency HVAC and lighting systems, water-sensitive urban design, low-VOC materials, construction waste minimisation, and provision for active and sustainable transport. Operational initiatives include building tuning, environmental management plans, and ongoing energy/water performance monitoring. These measures aim to reduce greenhouse gas emissions, enhance occupant wellbeing, and promote environmental stewardship. The sustainability targets for the development will be achieved in an integrated and staged approach through first minimising the need for energy consumption (via passive measures) and then consumption optimisation (energy efficiency) and use of renewable resources where required. Section 5 of this report provides specific reference to how the development is targeting these requirements.
Where relevant, provide an assessment of the development against the standards for non-residential development set out in Chapter 3 of State Environmental Planning Policy (Sustainable Buildings) 2022.	While the development is residential in nature, and not subject to the full provisions of Chapter 3 of the SEPP (Sustainable Buildings) 2022, the project voluntarily adopts best-practice sustainability strategies consistent with the intent of the policy. These include outperforming and complying with the BASIX and NCC Section J energy efficiency requirements, and the inclusion of initiatives, such as water reuse, thermal comfort design, indoor environmental quality, and use of renewable energy. Where applicable, principles of emissions reduction, resource efficiency, and future climate adaptation have been embedded in the design process.

4.2 National Construction Code (NCC) Section J

Section J of the NCC sets regulations for energy efficiencies for all types of buildings with respect to the building's construction, design, and activity.

The objective of the NCC Section J is to reduce the greenhouse gas emissions. Section J requires that a building, including its services, must have features to the degree necessary that facilitate the efficient use of energy.

The NCC offers two compliance methods that differ in complexity and flexibility. The two compliance methods are:

- Deemed-to-Satisfy (DTS) Compliance.
- J1V3 – Verification using a referenced building.

The Deemed-to-Satisfy Provisions in Section J of the NCC 2022 include the following 8 components.

- Part J1 - Energy efficiency performance requirements.
- Part J2 - Energy efficiency.
- Part J3 - Elemental provisions for a sole-occupancy unit of a Class 2 building or a Class 4 part of a building.
- Part J4 - Building Fabric relates to the building fabric and minimum thermal performance for constructions according to climate zone for roofs, ceilings, roof lights, walls, glazing and floors.
- Part J5 – Building Sealing – Provisions to reduce the loss of conditioned air and restrict unwanted infiltration to a building.
- Part J6 - Air-Conditioning and Ventilation – Requirements to ensure these services are used and use energy in an efficient manner.
- Part J7 - Artificial Lighting and Power – Requirements for lighting and power to ensure energy is used efficiently within a building.
- Part J8 - Heated water supply and swimming pool and spa pool plant – Restrictions for hot water supply design except for solar systems within climate zones 1, 2 and 3.
- Part J9 - Energy monitoring and on-site distributed energy resources.

The development will meet and outperform the NCC energy efficiency requirements of Part J4 report will be prepared once the design is further progressed.

4.3 Building and Sustainability Index (BASIX)

The National Construction Code (NCC) Section J deems those developments with a building class of 1 or 2 in NSW should be assessed against the BASIX rating scheme. The BASIX rating scheme investigates the thermal comfort of the building, energy consumption and water consumption.

There are three input sections: Energy, Thermal Comfort, and Water. Each of these three categories is integrated and often influences each other.

New residential developments in NSW must reduce their energy and water use, according to BASIX requirements developed by the Department of Planning, the objectives of the BASIX scheme are relative to an average development in NSW.

- 40% reduction in water consumption,
- 60% reduction in greenhouse gas emissions, depending on building height,
- Minimum thermal performance requirements for heating and cooling loads. The maximum allowable heating and cooling loads for each apartment are dependent on the glazing and floor area.

Achievement of the specified targets is demonstrated through use of a web-based prediction tool. This tool requires input of several aspects of the dwelling's design and produces a BASIX certificate and report listing all of the environmental initiatives proposed and required to achieve the mandatory performance.

A BASIX Certificate is a DA requirement and demonstrates compliance with the NSW Government's sustainability targets. The development will meet and exceed the minimum requirements:

- Water Efficiency: 40% reduction (minimum requirements under BASIX: 40%)

- Energy Efficiency: 63% reduction (minimum requirements under BASIX: 60%)
- Thermal Comfort: Will pass the thermal performance requirements under BASIX.

5. Development Location

The development will be located in Rose Bay NSW which is within the NCC climate zone 5 (Warm temperate). The climate zone map of the development is depicted in Figure 3.

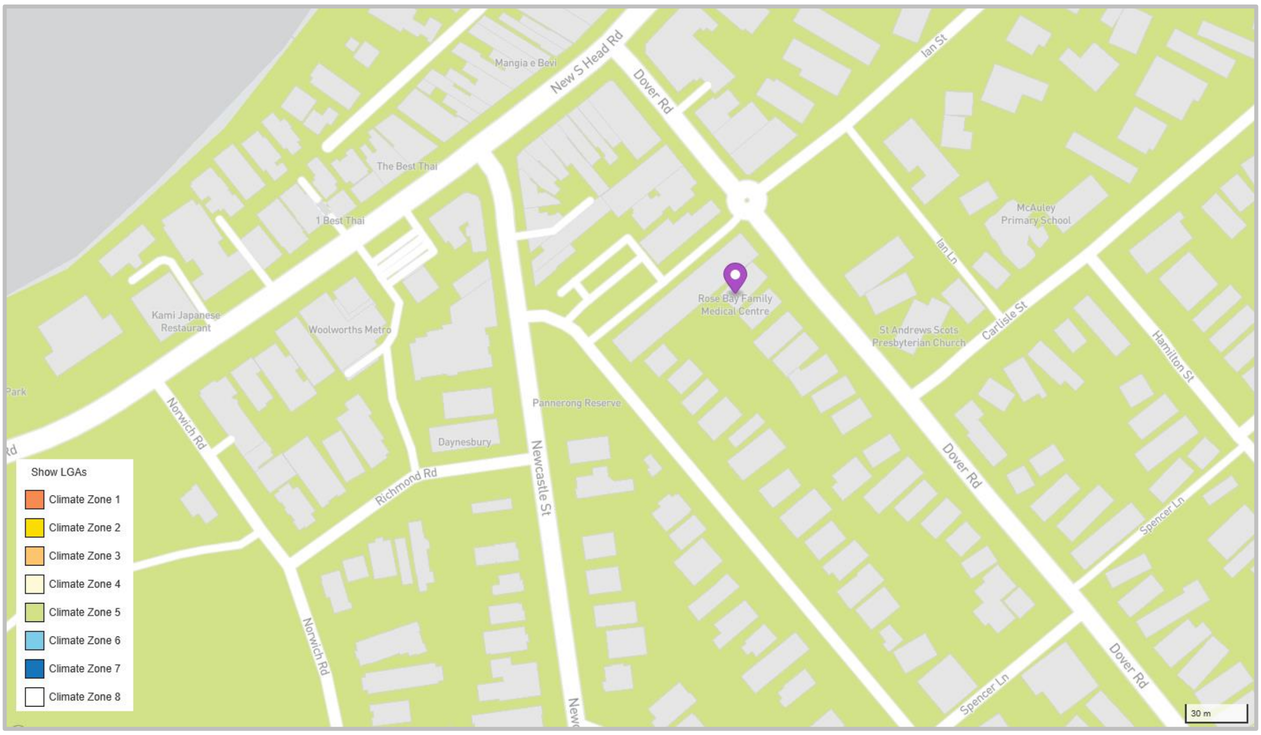


Figure 3. Climate zone map.

5.1 Information Used in Review

Our review is based on the following preliminary architectural drawings by MHNDUNION Architects (Table 4).

Table 4. Architectural drawing list.

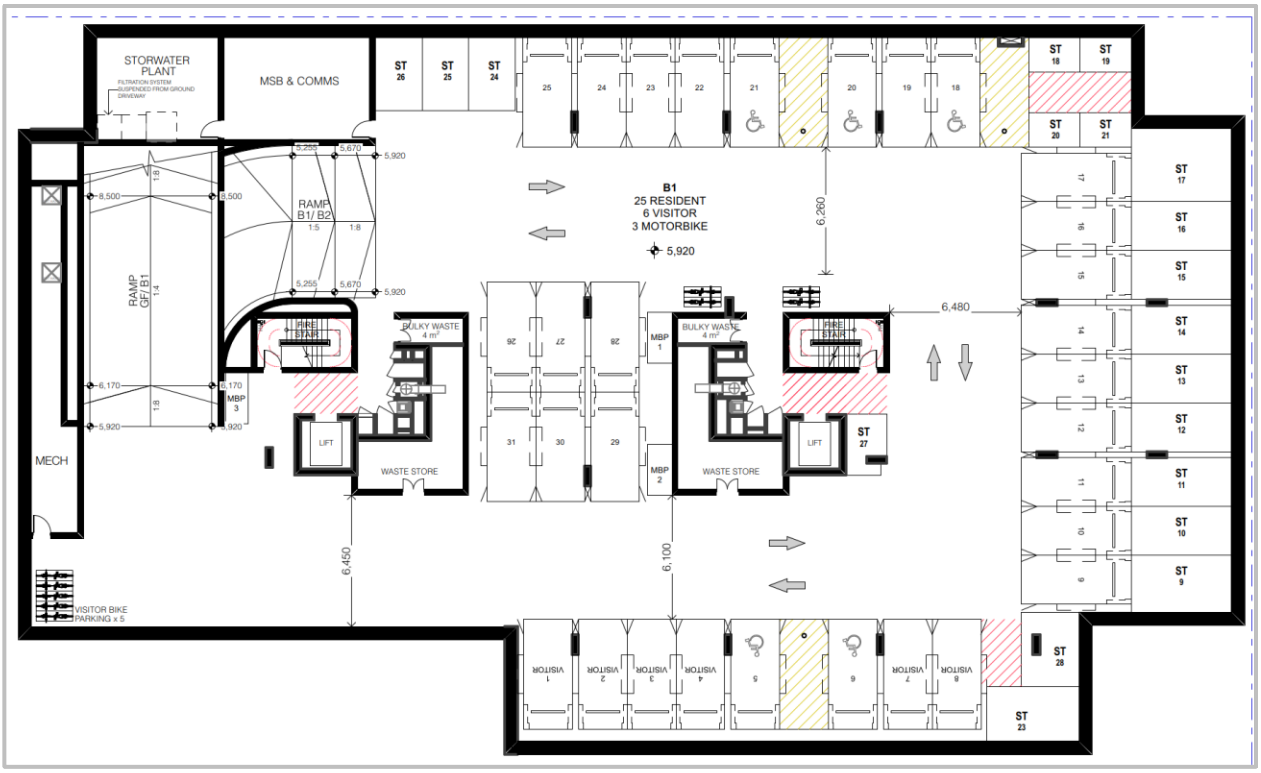
Drawing title	Drawing number
Basement 02 Floor Plan	DA 2000
Basement 01 Floor Plan	DA 2001
Ground Floor Plan	DA 2002
Level 1 Floor Plan	DA 2003
Level 2 Floor Plan	DA 2004
Level 3 Floor Plan	DA 2005
Level 4 Floor Plan	DA 2006
Level 5 Floor Plan	DA 2007
Level 6 Floor Plan	DA 2008
Level 7 Floor Plan	DA 2009
Roof Plan	DA 2010
Northeast Elevation	DA3000
Southwest Elevation	DA3001
Northwest Elevation	DA3002
Southeast Elevation	DA3003

5.2 Architectural Drawings

Selected architectural plans and elevations for the proposed development are provided below.

Basement 2 – Floor Plan

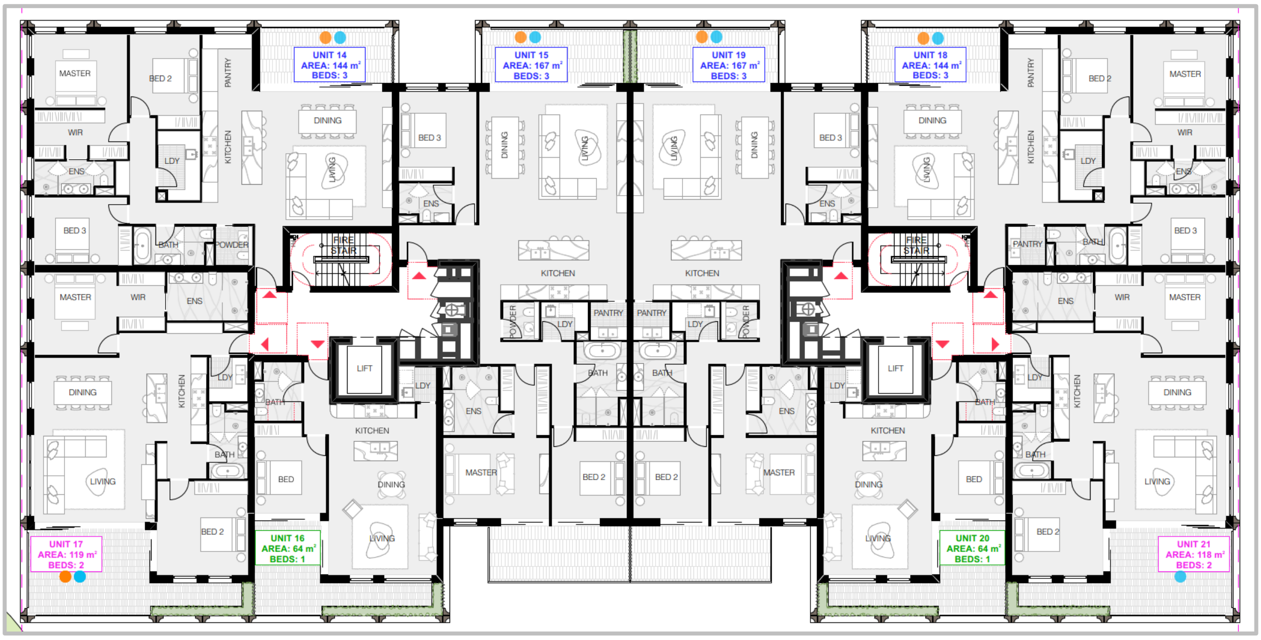
Basement 1 – Floor Plan



Ground Floor Plan

Level 1 Floor Plan

Level 2 - Floor Plan



Level 3 - Floor Plan

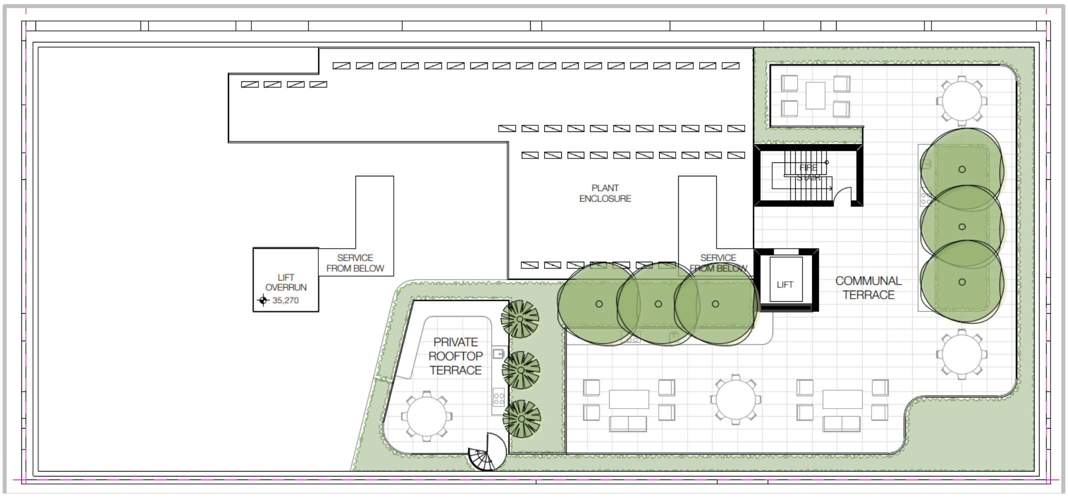
Level 4 - Floor Plan

Level 5 - Floor Plan

Level 6 - Floor Plan

Level 7 - Floor Plan

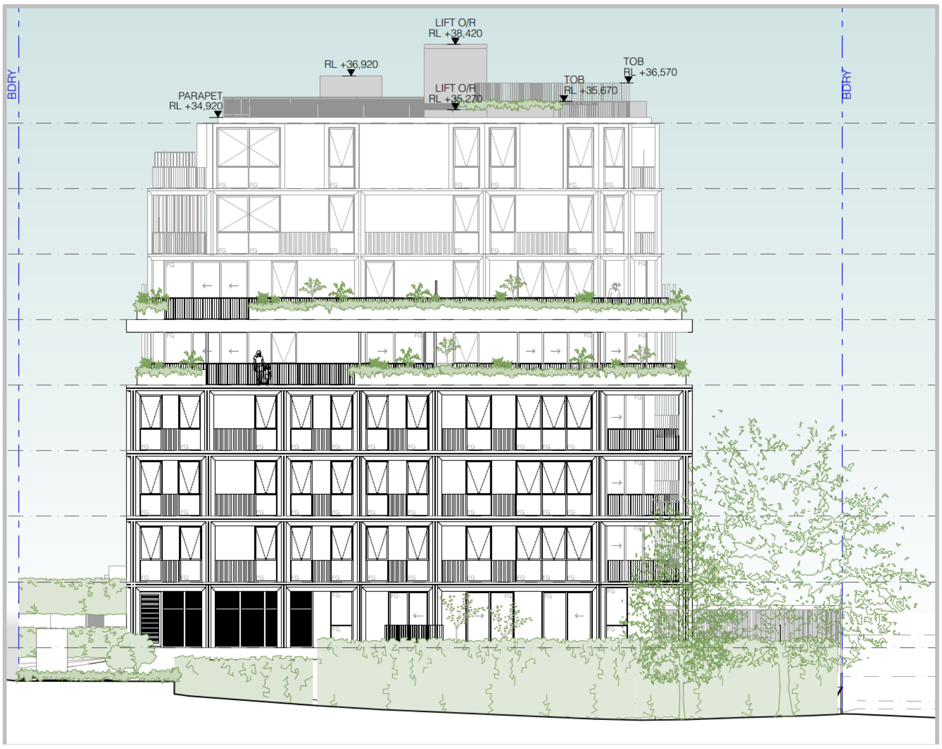
Roof Plan



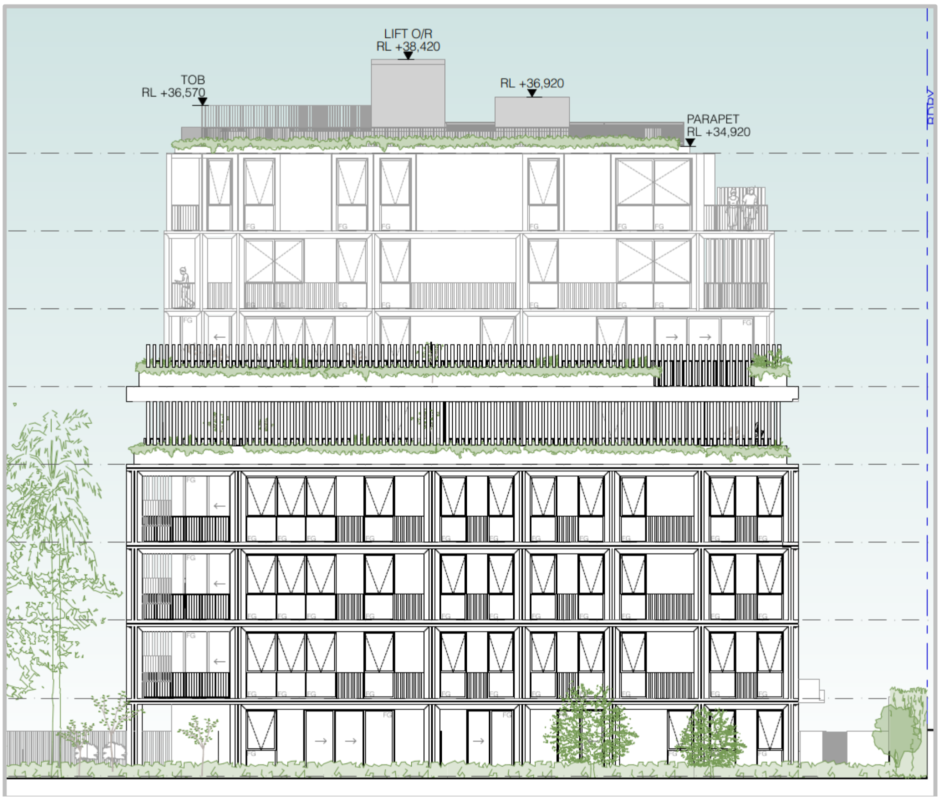
Northeast Elevation

Southwest Elevation

Northwest Elevation



Southwest Elevation



6. Ecologically Sustainable Design (ESD) Initiatives

The principles of ecologically sustainable development are an integral consideration in design and construction of proposed development and also in assessing its benefits and impacts.
The design team will focus on a wide range of ESD strategies which will result in high levels of environmental performance and an increment on occupant's health, productivity, comfort and satisfaction.

6.1 Integrated Design Approach

The integrated design process is a process by which all of the design variables that affect one another are considered together and resolved in an optimal fashion. Often referred to as holistic design, this approach considers the development as a whole with the emphasis on integrating the different aspects of building's design.

6.2 Greenhouse gas emission reduction

Greenhouse gas emission reduction is achieved in a staged approach:

- First, reduction in overall energy consumption through demand reduction, passive design and energy efficiency, then;
- Reduction in electricity and gas utility consumption by utilising waste products, rainwater harvesting and renewable energy technologies (where feasible).

The integrated response to energy proposed for this project is summarised below:

1. Load Reduction and Passive Design.
2. System Efficiency.
3. Capture Waste.
4. Renewable Energy (where feasible).

Energy consumption will be reduced through the efficient design of lighting, air-conditioning and ventilation systems, as well as energy efficient water heating and renewable energy technologies (where feasible). The development will consider Greenhouse gas emission reduction in design and operation through utilising energy conservation measures suitable for the development.

The following sections of the report outline the sustainability initiatives that will be considered and further developed by the design team during the detailed design stages.

6.3 Management

The initiatives under the management category promote the adoption of environmental principles from project inception, design, and construction phases to the operation of the building and its systems.

This category aims to highlight the importance of a holistic and integrated approach to constructing a building with good environmental performance. The following measures are some of the initiatives targeted within the management category and are subject to further design development. These initiatives aim to reduce environmental impacts at construction and operational stages as well as to maximise building performance at commissioning.

6.3.1 Commissioning Clauses

Commissioning of building systems to a high standard, with independent oversight, will ensure that a quality process is followed and provide an outside review of the practicalities of the design. An extended building tuning period should be undertaken following defects liability period to ensure that systems are performing as intended, taking into account different seasonal variables, and that any need for recommissioning is identified and carried out.

To adopt commissioning and handover initiatives that ensure that all building services can operate to optimal design potential, such as:

- Where possible, comprehensive pre-commissioning, commissioning, and quality monitoring to be contractually required to be performed for all building services (BMS, mechanical, electrical and hydraulic).

6.3.2 Building Tuning

After handover, the building owner is expected to implement tuning of all building systems and undertake full re-commissioning 12 months after practical completion.

6.3.3 Building User's Guide

To produce a Building User's / Occupant's Guide, information management that enables building users / occupants to optimise the building's environmental performance during its operation.

6.3.4 Environmental Management Plan

The contractor is expected to adhere to a comprehensive Environmental Management Plan (EMP) for the works. Contractors are recommended to be ISO 14001:2004 certified. Environmental management plans and systems should be implemented to ensure that demolition and construction activities appropriately manage and mitigate environmental impacts.

6.3.5 Waste Management System

To encourage and facilitate effective waste management once the development is in operation, sufficient spatial provision will be made to allow for the effective separation of waste from recycling. Dedicated waste recycling rooms allow space for the separation and storage of recyclable waste during the building's operation, allowing for the following waste streams to be separated:

- Glass.
- Cardboard.
- Paper.
- Organics.
- Plastics.
- Metals.

Waste management solutions are varied and dependant on the extent of commitment of the end user. Recycling, reuse, and composting are examples of waste management options.

6.3.6 Environmental Management and Maintenance

Effective environmental and waste management will be implemented throughout the demolition, construction, and operational stages of this development.

A Waste Management Plan has been prepared by MRA and supports the SSDA.

The EMP shall include a Waste Management Plan, specifying recycling targets for demolition and construction waste. It is recommended that construction and demolition contracts stipulate a minimum 90% target for diversion of waste from landfill. This may be achieved through recycling or reuse.

- Identification of appropriate waste sub-contractors for recycling, costs of collection and timing of collection service.
- Participation in waste minimisation training for contractors and sub-contractors.
- Published waste minimisation plan to reduce site waste to landfill.

Provision of separate waste skips for cardboard, timber, metal, soft plastic, polystyrene, insulation, concrete, glass, and bricks.

6.4 Indoor Environmental Quality (IEQ) Initiatives

Indoor Environmental Quality initiatives consider the wellbeing of occupants, addressing factors such as heating, ventilating and air conditioning (HVAC), lighting, indoor air quality and building attributes, all of which contribute to good indoor environmental quality.

The following measures are some of the initiatives targeted within the IEQ category for further consideration and development during detailed design.

- Improvement of outside air rate by providing at a rate greater than AS1668.2 requirements. Air-conditioning system will be installed with carbon dioxide monitoring and control to ensure sufficient outside is delivered to occupants.
- Optimisation of the air quality by improving air change effectiveness
- Maximisation of natural lighting level to the building occupants
- Minimisation of the contribution and levels of Volatile Organic Compounds (VOCs) via the use of low VOC paints, adhesives and sealants, carpets, and flooring.
- All engineered wood products to be used in the development will have low formaldehyde emission.
- High efficiency lighting system with suitable luminance levels to avoid causing discomfort and strain for the occupants. All fluorescent luminaries are to be installed with high frequency ballasts to avoid discomfort caused by low frequency flicker.
- External Views: The design allows unobstructed external views for the majority of occupied spaces.
- Internal noise level at an appropriate level to ensure the occupants' satisfaction and wellbeing.

6.4.1 Thermal Comfort

Thermal comfort can be provided by passive and mechanical means. Passive design initiatives will be considered before the design of the mechanical systems to reduce operational energy costs, with potential reductions in the air conditioning size and ongoing maintenance.

Thermal comfort is a function of the following factors:

- Radiant temperature (45% of net comfort effect).
- Air temperature and humidity (35% of net comfort effect).
- Air movement, clothing, and activity (20% of net comfort effect).

Passive heating and cooling design strategies which will improve occupant thermal comfort include:

- Roof insulation not only reduces heat gain and loss, but will also moderate radiant temperatures from the walls, floor, and ceiling.
- Building facades with high performance glazing and window frames will have a combination of external shading and high-performance glass to reduce heat transfer and radiant temperatures in proximity to the windows.

Indoor areas will be designed to be protected from excessive summer solar radiation, reducing radiant heat loads on the space, but still providing enough daylight during appropriate times of the year to improve comfort levels.

The approximate annual Dry-bulb temperature and comfort range for the site is shown in Figure 4:

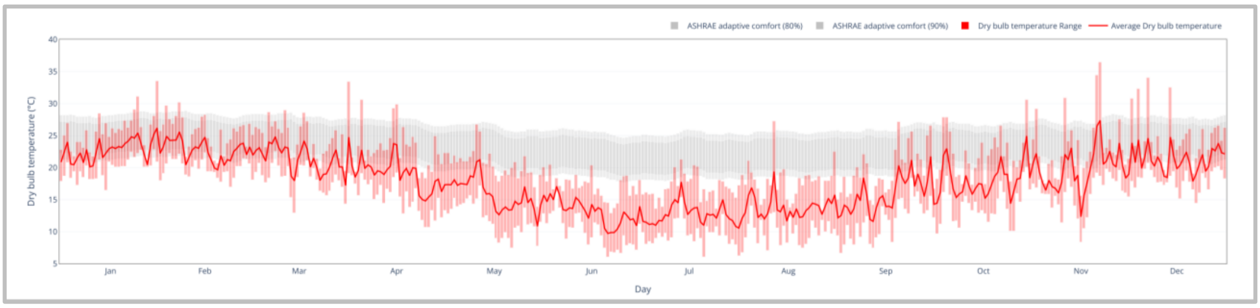


Figure 4. Annual Dry-bulb temperature and comfort range

6.4.2 Effective Daylighting / Natural Lighting

Daylighting is the architectural and services design to allow maximum daylight penetration into a building whilst minimizing heat gain and thereby reducing indoor lighting loads.

The level of natural light in the building is primarily determined by the extent and type of glazing, and the depth of the building floor plate. Extent of glazing must be optimised to allow maximum daylight, views, and winter sun, while minimising uncomfortable glare and excessive solar heat gains in summer. Glazing should be selected with a high Visual Light Transmission to maximise daylight penetration.

Daylighting strategies will be considered to allow effective control of indoor lighting levels whilst minimising power consumption for the building. High level of architectural input regarding design, orientation and external shading will be considered to effectively maximise natural lighting for the building.

Daylighting strategies combined with dimmable lighting systems will allow high control of indoor lighting levels whilst minimising power consumption for the building.

6.4.3 Volatile Organic Compounds (VOC) & Formaldehyde Minimisation

To ensure long term comfort of occupants, all due care will be taken to minimise VOC and formaldehydes used within the building. Maintaining VOC limits below the recommended levels will assist in reducing any potential detrimental impacts on occupant health arising from products which may emit volatile pollutants.

VOCs are commonly found in carpets, paints, adhesives, and sealants uses in construction and extensive exposure to VOC's can cause Sick Building Syndrome effects (eye, nose and skin irritation, headaches lethargy etc.).

Formaldehydes are found within composite wood products and extensive exposure can cause irritation to eyes, nose, and throat, lead to skin ailments and respiratory system ailments such as asthma.

Where possible, contamination of indoor air by common indoor pollutants will be minimised in this development by careful material selection, including:

- Use of low-VOC and water-based paints rather than oil-based paints, stains, or sealants, reducing indoor air contamination and consequent side-effects including sick-building syndrome and respiratory problems.
- Selection of low-VOC carpets and adhesives.
- Selection of low formaldehyde composite wood products, avoiding the carcinogenic effects of formaldehyde off-gassing.

6.5 Energy Conservation Initiatives

It is essential to ensure the building is designed and built to minimise energy consumption and reduce or eliminate greenhouse gas emission to the atmosphere. Energy performance is considered by the design team as a crucial issue.

The energy conservation initiatives aim to reduce the overall energy consumption for the project directly contributing to greenhouse gas emissions and energy production capacity.

Greenhouse reductions are achieved in a staged approach:

- Reduction in overall energy consumption through demand reduction and energy efficiency.
- Reduction in electricity and gas utility consumption by utilising waste products and renewable energy technologies.

Several strategies will be assessed and put in place to minimise energy consumption.

The integrated energy strategies being considered for the development include items which are listed in Table 5 below:

Table 5. The integrated energy strategies.

Load Reduction (Minimising the need for energy consumption)	Passive Design
	Building fabric improvements
	Maximise use of natural lighting
	Maximise use of natural ventilation
Optimising energy consumption	High efficiency Heating, Ventilation and Air Conditioning
	High efficiency LED lighting with occupancy controls
	High efficiency hot water systems
	High efficiency appliances
	Commissioning and tuning of building services post completion
	High efficiency building control, automation and BMS
Use of renewable resources (renewable energy and rainwater harvesting)	Application of Heat Pump technology

6.5.1 Passive Design

The development will utilise passive design to minimise the amount of air-conditioning required and therefore significantly reduce the building's energy consumption and greenhouse performance. A building's form, fabric and orientation will have the biggest influence on its thermal comfort and environmental performance. The following factors will be considered in the detailed stages of the design:

- Orientation.
- Shading.
- Structure.
- Insulation.
- Glazing.

Climate data for the site

The following indicative site information data can be used to inform the design team (Figure 5).

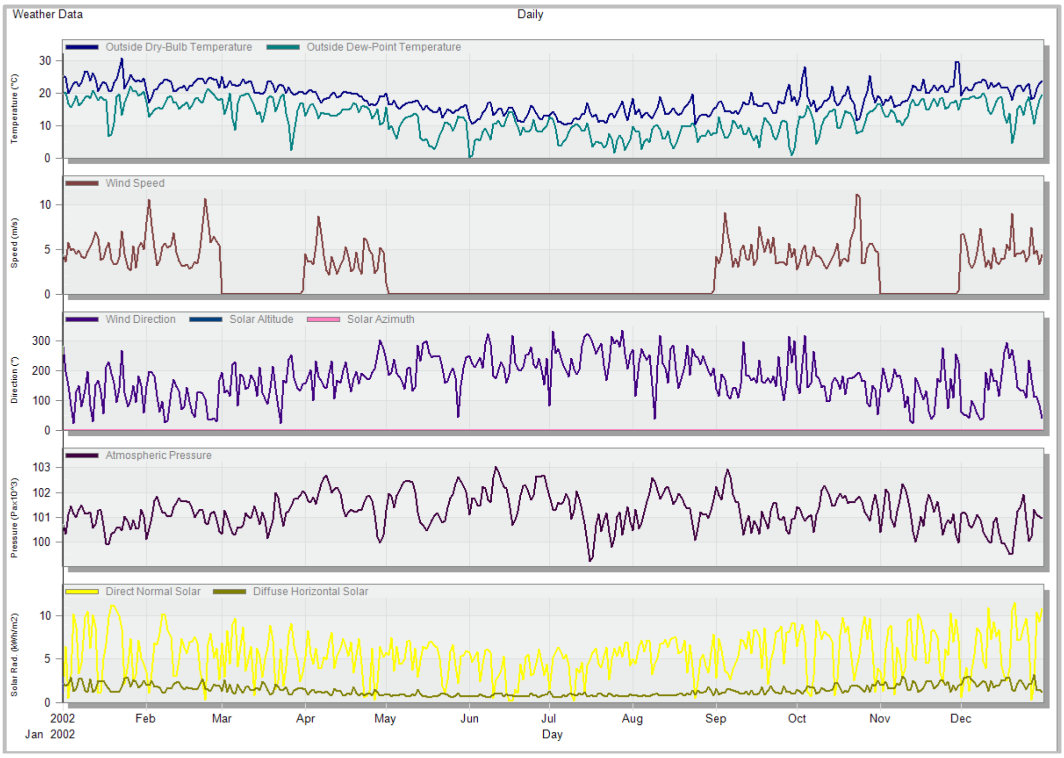


Figure 5. Climate data for the site.

Wind data based on the nearest weather station

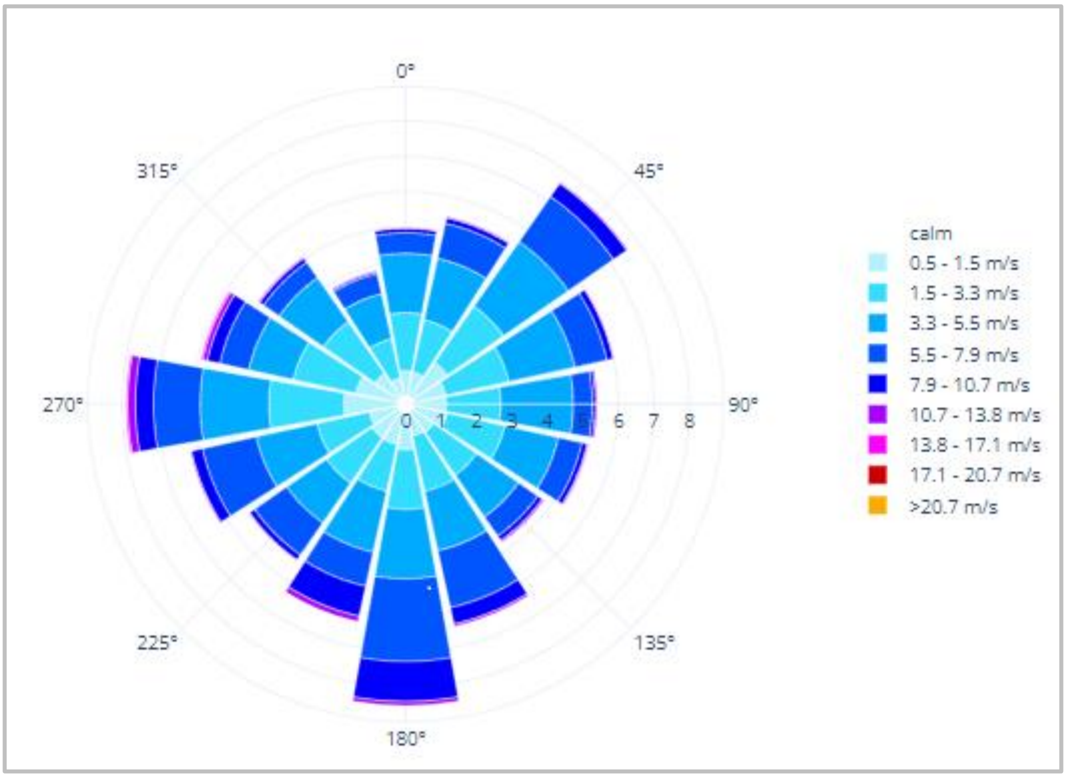


Figure 6. Wind data based on the nearest weather station

Sun path and temperature chart for the site

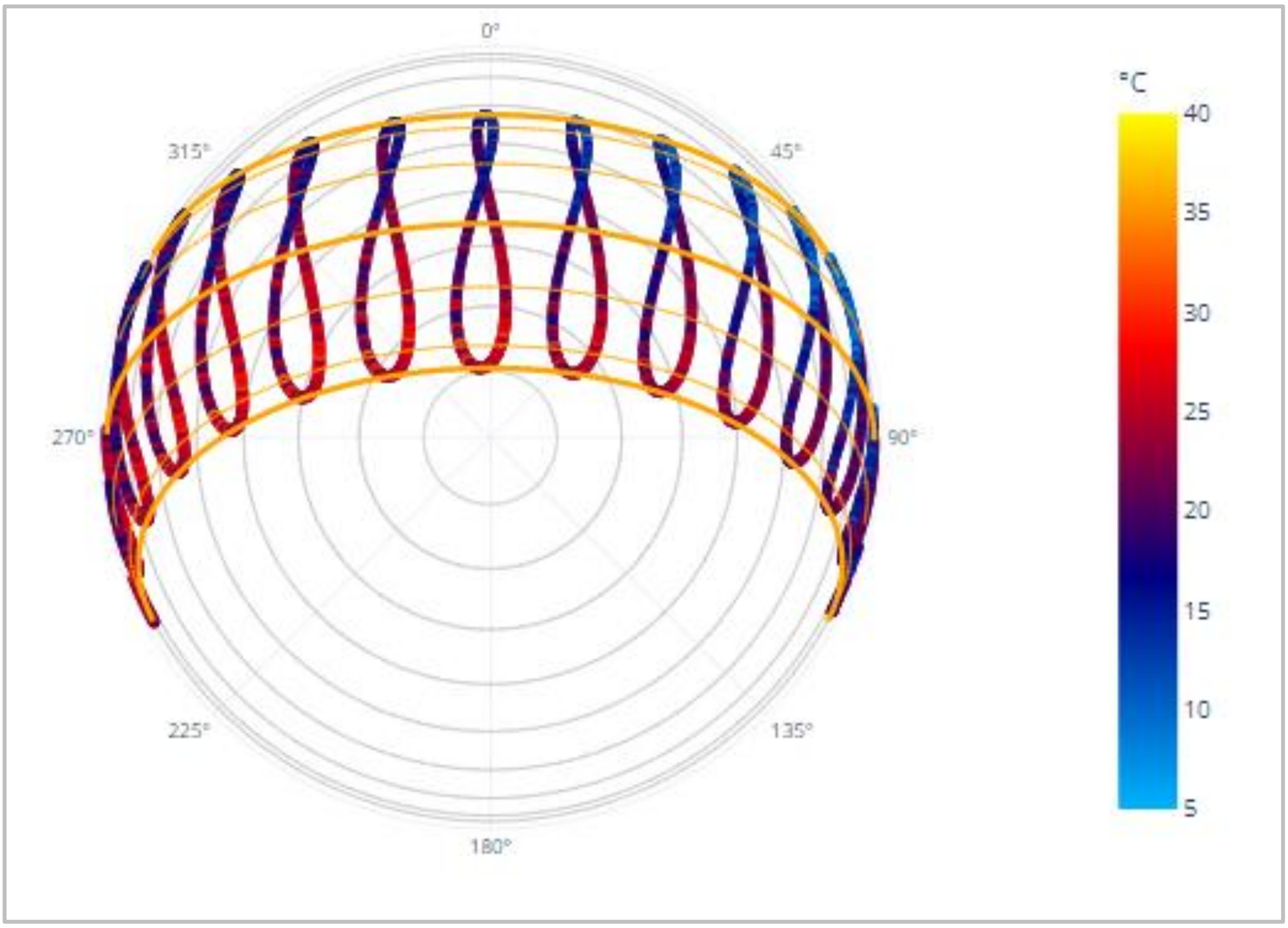


Figure 7. Sun path and temperature chart for the site.

6.5.2 Building Envelope

The building envelope will be designed to reduce heating and cooling requirements through passive design principles. The role of the building envelope is to block solar gains from penetrating the building fabric in summer while optimising daylight and minimising glare. The glazing performance and shading configuration for each orientation will be optimised to ensure that thermal comfort is achieved, and solar gains are adequate for the efficient operation of the mechanical system.

6.5.2.1 Insulation

The building envelope will be treated with the required levels of thermal insulation to reduce heat gains in hot days and to minimise heat losses in cold days through conduction. This will have significant impact on reducing energy consumption.

Insulation reduces the heat transfer between the internal and external conditions. Adequate insulation will be allowed for the ceilings, floors, and walls to reduce the heating and cooling load of the building and to reduce the ongoing operational costs. This has a twofold saving through a smaller mechanical system capacity along with operating energy consumption reduction.

All insulations installed are required to meet NCC and AS/NZ 4859.1 and the builder is required to ensure compliance, during construction.

6.5.2.2 Glazing and Window Framing

Adequate performance glass will be provided to reduce excessive heat gains in hot conditions, reducing the frequency of air conditioning use.

The following glazing parameters will be considered:

- U-Value: a measure of how much heat is passed through the glass.
- Solar Heat Gain Coefficient (SHGC)
- Visible Light Transmission (VLT): the percentage of visible light transmitted by the glass.

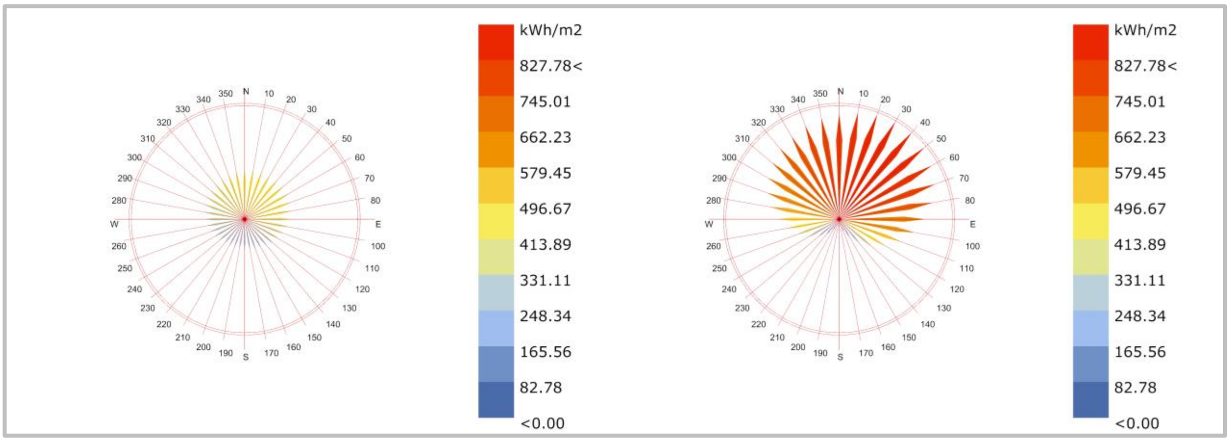
Where possible, the glazing will have a low SHGC to avoid heat gains in the summer, and a low U-value to reduce losses in the winter through the glass. The performance of the proposed glazing systems (glass and frame) is required to comply with NFRC100-2001 conditions and using the tested AFRC values.

Consideration will be given to incorporating effective shading features into the design to avoid the necessity for low shading coefficients in the glass, which usually also decrease the visible light transmission (VLT) of the glass. To maximise the natural daylight within the building, VLT should be as high as possible.

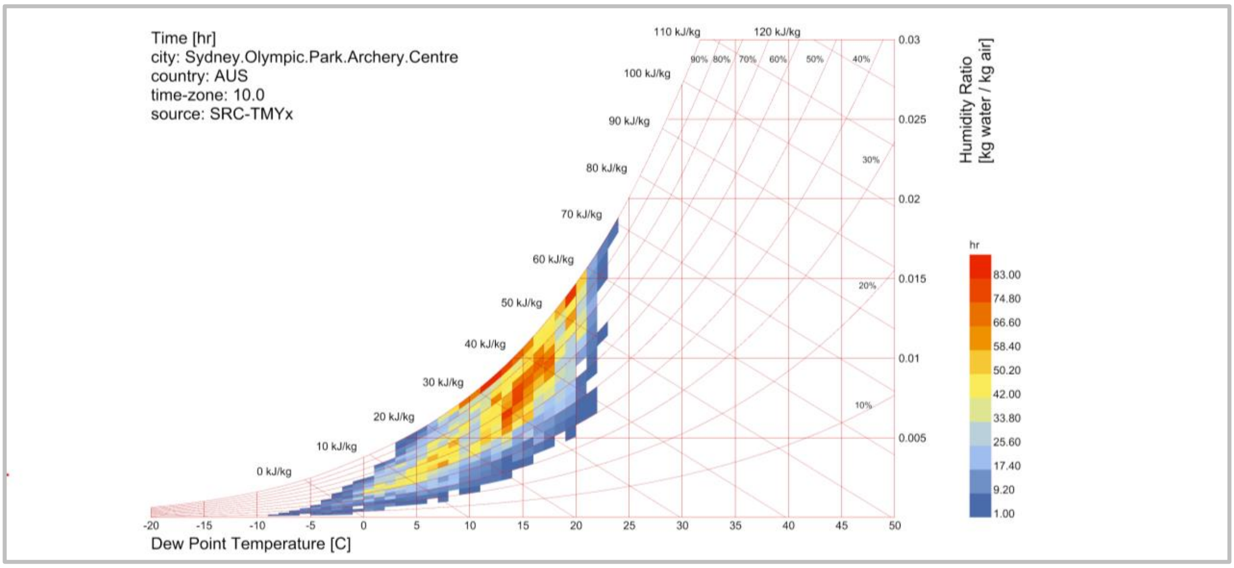
Glazing properties will be specified in conjunction with the shading arrangement on each orientation to control solar loads imposed on the mechanical systems, ensuring thermal comfort, optimising daylight penetration, and preventing glare. This strategy will effectively minimise direct solar loads whilst maximising daylight penetration and access to views.

To reduce heat losses in cold days, especially at night, the use of blinds will limit the contact between the internal air and the glass, therefore reducing heat losses by conduction.

Solar Radiation Rose



Psychrometric Chart



6.5.3 Energy Efficient Systems and Services

The mechanical and electrical design for the buildings will be developed to minimise the need for plant equipment and will be designed to be responsive to the immediate climatic conditions. Energy consumption will be reduced through the efficient design of lighting, air-conditioning, hot water, and ventilation systems. The following energy efficiency initiatives will be further investigated and where feasible incorporated in the building services design.

5.5.3.1. Efficient Artificial Lighting

Lighting efficiency is important in maintaining low energy consumption for reuse projects. Lighting consumption for a facility such as this could account between 15-25% of the estimated energy use of the facility.

High efficiency lighting and effective control initiatives such as daylight and movement sensors will be considered to reduce artificial lighting energy consumption and allow maximum advantage to be taken of natural lighting.

Lighting power density is required to meet AS1680 and NCC requirements. Energy efficiency for the internal lighting throughout the building is required to be in accordance with NCC energy efficiency requirements and the following.

- High quality LED lighting.
- Lighting control system based on smart zoning, occupancy profiles and operational hours, dimming controls and timers.

Photoelectric (PE) / Photodiode sensors or similar controls to detect when external lighting should switch on and off to reduce the energy consumption associated with external lighting where possible.

No external lighting is to be installed such that any direct light beam results into the night sky either generated from within the site. The path of any direct light's angle of incidence that is directed to the sky must be obstructed by a non-transparent surface and the lighting design and is to comply with AS4282 'Control of the Obtrusive Effects of Outdoor Lighting.

5.5.3.2. Efficient Heating, Ventilation & Air-Conditioning (HVAC)

Heating and cooling of the building accounts for a large portion of the building's energy use throughout the year. Selection of highly efficient HVAC equipment with high performance levels not only minimises energy consumption, but also reduces operational energy costs.

The design of the mechanical services will be to industry Best Practise Standards. An emphasis will be placed on providing low energy Heating Ventilation Air Conditioning (HVAC) systems and strategies. To ensure the energy efficient performance of HVAC systems specified and installed mechanical plant will be of high quality and supplied by leading industry manufacturers.

The energy efficiency of HVAC system is required to meet the minimum requirements of the National Construction Code (NCC), and relevant Australian Standards including but not limited to AS1668.1, AS1668.2, AS 1682 and AS3666.

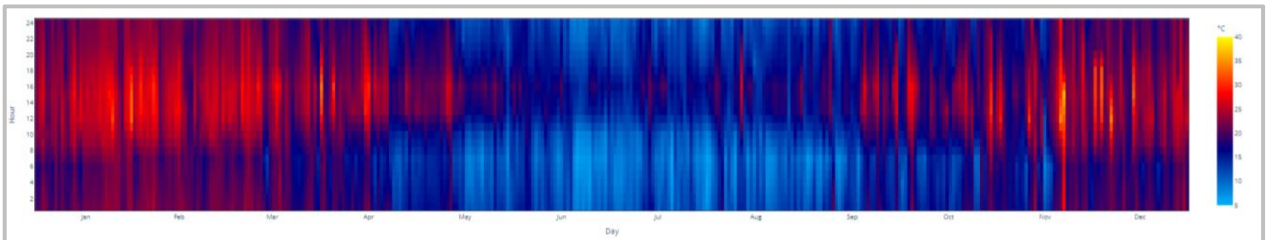
The following energy initiatives will be further considered in the detailed design phase:

- The air conditioning strategy is optimized to reduce energy consumption and maximize efficiency. For example, by moderating the amount of fresh air relative to the number of people in the space, through the use of CO2 detectors. The system will be zoned to increase the flexibility in the use of different spaces and reduce overall consumption.
- Variable speed drives will be provided to fans and pumps where feasible.
- Full outside air cycle will be provided to all air handling systems.
- Building commissioning and building tuning to be undertaken to ensure that the building systems function as required to achieve energy efficiency design targets.
- All refrigerant plant will be specified such that the refrigerant type has Zero Ozone Depletion Potential (ODP).

Common area ventilation systems are to include variable speed modes where appropriate and are to be linked to light switches where feasible to limit the extent of operation and improve energy efficiency of these areas.

The Mechanical services will be designed to satisfy the minimum NCC Section J energy Efficiency Requirements.

Heatmap Chart based on the data from the nearest weather station is depicted in Figure 8 below:



Descriptive statistics

month	mean (°C)	std (°C)	min (°C)	1% (°C)	25% (°C)	50% (°C)	75% (°C)	99% (°C)	max (°C)
Jan	22.78	2.55	16.4	18.03	21	22.6	24.4	30.16	33.5
Feb	22.67	2.48	16.9	18.04	20.78	22.4	24.32	29	30.2
Mar	21.45	2.86	12.9	15.2	19.6	21.2	23.3	28.11	29
Apr	19.16	3.66	10.7	11.7	16.8	19.3	21.2	29.7	33.4
May	15.86	3.64	7.4	8.4	13.2	15.6	18.6	24.51	26.7
Jun	13.14	3.07	6	6.72	11	13.3	15.6	19.38	20.5
Jul	12.8	2.82	6	7.67	10.5	12.5	14.9	20.06	21.3
Aug	13.71	3.28	6.2	6.9	11.7	13.4	15.9	22.67	27.3
Sep	15.83	3.84	6.6	8	13.4	15.4	18.3	25.68	27.2
Oct	17.9	3.69	9.7	10.6	15.3	17.55	20.2	27.76	30.6
Nov	19.8	4.06	8.3	10.58	17.4	19.6	22	31.48	36.5
Dec	21.26	3.04	14.4	15.6	19.1	20.8	22.8	31.66	34
Year	18	4.83	6	7.9	14.3	18.3	21.5	28.64	36.5

Figure 8. Heatmap Chart.

5.5.3.3. Hot Water Systems

High efficiency heat pump hot water systems will be used to provide the Hot Water demands for the buildings.

6.6 Net Zero Statement

Achieving Net Zero emissions is critical to meeting the NSW government's ambitious targets of reducing greenhouse gas emissions by 70% by 2035 and achieving net zero by 2050. According to the Sustainable Buildings SEPP (SB SEPP) and Section 35C of the Environmental Planning and Assessment Act Regulation, large developments such as hospitals must submit a Net Zero Statement demonstrating how the building will either be fossil fuel-free upon occupation or transition to fossil fuel-free operation by 1 January 2035.

The Net Zero requirements do not apply to the project given it is a residential land use, however, the project team have endeavoured to minimise the emissions where possible.

6.6.1 Limitations Due to Current Project Stage

At this early stage of the project, a full detailed energy assessment is not feasible. A comprehensive energy assessment requires detailed information on mechanical design, equipment specifications, building systems, and operational schedules. Without these critical data points, any full simulation or precise estimation would be premature and potentially misleading.

Therefore, this report presents a preliminary Net Zero pre-assessment based on typical energy consumption profiles for similar residential buildings, informed by industry benchmarks and best practice assumptions.

6.6.2 Net Zero Approach

Net Zero initiatives adopted for this development aim to minimise operational energy emissions through the elimination of fossil fuel use, enhancement of energy efficiency, and integration of renewable energy generation and storage systems. The key design strategies proposed for this development include:

- High-performance building envelope with enhanced insulation, shading, airtightness, and glazing.
- Electrification of heating, cooling, and hot water systems, prioritising heat pumps and electric technologies.
- Optimised HVAC and lighting systems with smart controls and sensors.
- Integration of onsite renewable energy technologies such as heat pumps.
- Provision for future transition infrastructure to enable fossil fuel systems to be fully replaced by electric alternatives by 2035.

6.7 Transport sustainability measures

The use of transport (both private and commercial) is a major contributor to environmental pollution and the excessive consumption of natural resources. The following sustainable transport principles are recommended.

- Improve amenity for active transport users (pedestrians and cyclists), with attention paid to the needs of specific user groups likely to have a greater reliance on active transport such as youths, office employees, and nearby community groups.
- Integrate transport initiatives into community engagement and communication strategies.

Given the site location of the development, the occupants will be able to take advantage of local public transport networks and available facilities around the site such as retail shops.
The following measures are some of the initiatives recommended to reduce dependence on motorised vehicles, encouraging walking, cycling and the use of mass public transport.

- **Cyclist facilities:** provision of bicycle racks; where possible adequately sized and fully equipped secure cyclist facilities with change room and showers are to be provided to promote the use of cycling to work.
- **Public Transport:** The building is close to public transport with a number of bus routes served; residents are encouraged to use mass transport to travel to work.

- **Trip Reduction:** The development is located adjacent to several local amenities, reducing the need for trips.
- **Fuel efficient vehicles:** encouraging the use of more fuel-efficient vehicles by providing adequate parking spaces at prime parking spot solely dedicated for use by small cars, car-pool participants or other alternative fuel vehicles and EV charging points.

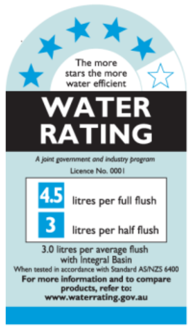
6.8 Water Conservation and Management Initiatives

The water conservation category aims to reduce the overall water potable consumption and provide effective mechanisms for recycling of water uses on site.

The approach to water efficiency for the development will focus on reducing water demand through conservation measures and water reuse systems. Water conservation strategies proposed for this project include:

- Reducing the potable water consumed within the development through demand management.
- Substituting mains water required to meet this demand by utilising alternative sources such as rainwater.

6.8.1 Demand Management



Strategies to minimise consumption include water-efficient fittings and fixtures, water-efficient appliances and low-water use air-conditioning and irrigation systems. In order to reduce the overall water consumption for this development, the following initiatives will be considered.

All water fixtures to be installed to the building are to be water efficient and where possible outperform the minimum requirements. The following criteria are provided as a guide and subject to further design development (Table 6).

Table 6. Surplus design criteria.

Water Fixtures	Hand wash basins – 5 Star WELS;
	Kitchen taps (where provided) – 5 Star WELS
	Showerheads (where provided) – 4 Star WELS or higher
	Toilets – 4 Star WELS or higher
Appliances	Dishwashers (where provided) – 4 Star WELS or higher
Air Conditioning	Minimise use of water-cooled systems
Landscape Irrigation (where applicable)	Native and water efficient species
	Sub-surface irrigation
	Rainwater usage for landscape

6.8.2 Landscape Selection

The use of native, drought-resistant planting will be considered to reduce water consumption used in irrigation. Sub-soil irrigation systems should be considered where non-native species are selected.

The landscape design prepared by Wyer and Co enhances the biodiversity in terms of landscape area and diversity of species.

6.8.3 Rainwater collection and recycling

In order to reduce the impacts of stormwater runoff from the site, the following stormwater management strategies will be considered:

- Rainwater captures from rooftops for reuse in building reducing stormwater runoff as well as mains potable water use.
- The use of permeable surfaces to be considered where suitable, allowing stormwater to seep directly into the earth and reducing stormwater flows off-site.

Collecting rainwater from roof runoff is a common way to recycle water. In addition to saving potable water, it allows preparation for times of low rainfall, so landscapes will be maintained throughout the year. It also reduces loads on storm water systems because roof runoff is not flushed into the drains. Rainwater will be collected from roof runoff and piped to storage tanks and will be used on site.

Ultra-violet (UV) treatment is the disinfection process of passing water by a special light source. Immersed in the water in a protective transparent sleeve, the special light source emits UV waves that can inactivate harmful microorganisms. This method of treatment is growing in popularity because it does not require the addition of chemicals.
Harvested water will be considered to supplement non-potable water uses such as common area landscape irrigation.

This strategy will assist to significantly reduce the potable water consumption for the facility.

6.8.4 Water consumption monitoring and reporting

Where practical, it is recommended that all major water uses within the building to be provided with water meters. This includes central services, rainwater tanks, irrigation systems, potable water, non-potable water sources.

Water monitoring will assist to identify abnormal usage patterns usually associated with leaks, helping to reduce the considerable water lost in this way. In addition, it would also allow to measure and verify the impact of any water efficiency measures implemented in the facilities.

6.9 Materials

This category aims to reduce the consumption of natural resources and encourage the reuse of materials. The various environmental and human health impacts arising from building materials are reduced when special attention is given to the selection of ecologically preferable materials.
To minimise the environmental impact of the development, preference will be given to environmentally responsible materials during the selection process, according to the following principles:

- Avoidance of ecologically sensitive products (such as scarce minerals and old-growth forest).
- Selection of materials with a low embodied energy and high recycled content.
- Low toxicity material selection.
- Low impact on the indoor environment.
- Durability, flexibility, and recyclability.
- Emissions in manufacture and composition, including greenhouse gases and ozone depleting substances.
- Waste reduction.
- Provisions for appropriate recycling storage space that facilitates recycling.

The targeted initiatives will reduce embodied energy and environmental impacts caused by the whole life cycle of building materials.

6.9.1 Reuse and Conservation of materials

Where possible reuse the building material to conserve embodied energy and water. By conserving the building fabric or structure the waste volumes are significantly reduced for the development.

6.9.2 New Materials

Material specifications for the project will consider elements of sustainability that relate to the following factors of durability, embodied energies, renewable sources content, ease of manufacturing, ability to be recycled / reused / reconditioned, maintenance, local availability, VOC content, emission production, affordability, and toxicity.

6.9.3 Operational Waste Minimisation

To encourage and facilitate effective waste management once the facility is in operation, sufficient spatial provision will be made to allow for the effective separation of waste from recycling. Dedicated waste recycling rooms allow space for the separation and storage of recyclable waste during the building's operation, allowing for the following waste streams to be separated:

- Glass.
- Cardboard.
- Paper.
- Organics.
- Plastics.
- Metals.

Waste management solutions are varied and dependant on the extent of commitment of the end user. Recycling, reuse, and composting are examples of waste management options.
The following waste streams have currently been identified:

- Office waste.
- Paper and cardboard.
- Plastics.
- PET bottles and containers, cans, and glass.
- Compostable material.
- Grease and fats.
- Cigarette butts.
- Light tubes.
- Toxic or hazardous materials.
- Foam.
- Cleaning products and other substances going down drains.
- Composting of organic waste from the restaurant, for re-use within the Greenhouse.

6.9.4 Timber

Where possible, timber will be supplied from sustainable sources including Forestry Stewardship Council (FCS) certified plantation timbers and recycled products. No timber (either solid or veneer form) will be sourced from rainforests or old-growth forests.

6.9.5 PVC Minimisation

PVC is being phased out in the European Union, as there is widespread evidence to its harmful environmental impact, particularly during disposal or fire. PVC is used in almost all electrical and data cabling and for drainage pipework. Alternatives to PVC products will be used where feasible:

- HDPE and polypropylene pipe work instead of PVC pipe for water supply and drainage systems.

- Linoleum and other natural products instead of vinyl floor coverings.
- Composite materials for electrical cabling.

6.10 Land Use and Ecology

This initiative refers to improvements through Reuse of Land or Change of Ecological Value. The site has been previously built on, and is not a Greenfield. The new development will aim to enhance permeable area and vegetation improving the ecological value of the site.

6.11 Emissions

In addition to the reduction in greenhouse emissions as a result of lower on-site energy usage, emissions to land, air and water will be minimised. The following measures are some of the initiatives targeted within the emissions category:

- Where available, thermal insulation products should be selected which have a low Ozone Depletion Potential in their manufacture and composition, reducing the impacts of insulation on the atmosphere.
- Estimated wastewater discharge to sewer will be reduced relative to a standard building through the implementation of water efficiency measures.
- Watercourse Pollution: Design that minimises stormwater run-off to and the pollution of the natural watercourses.
- Light Pollution: No light beam will be directed upwards or outside the building. External lighting will be in accordance with AS 4282-1997. This will assist to minimise interference and disturbance to neighbouring properties and wildlife.

8. Conclusion

The proposed development has been assessed against relevant statutory requirements, sustainability objectives, and environmental performance criteria. With the inclusion of the identified mitigation measures, the project is considered environmentally acceptable and consistent with the principles of Ecologically Sustainable Development.

Key mitigation measures—such as improved thermal performance, passive design, efficient lighting and HVAC systems, water-saving fixtures, WSUD integration, and construction-phase environmental controls—ensure that potential impacts are effectively managed and minimised.

Subject to the implementation of these measures, the development is expected to achieve compliance with applicable planning and sustainability frameworks and deliver positive environmental outcomes over its lifecycle and would satisfy the SEARs sustainability requirements.

9. Disclaimer

This report is prepared using the information described above and inputs from other consultants. Whilst IGS has endeavoured to ensure the information used is accurate, no responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact IGS for detailed advice which will take into account that party's particular requirements.

Computer performance assessment provides an estimate of building performance. This estimate is based on a necessarily simplified and idealised version of the building that does not and cannot fully represent all the intricacies of the building once built. As a result, simulation results only represent an interpretation of the potential performance of the building. No guarantee or warrantee of building performance in practice can be based on simulation results alone. IGS and its employees and agents shall not be liable for any loss arising because of, any person using or relying on the Report and whether caused by reason or error, negligent act or omission in the report. The draft assessment has been prepared indicatively and using the limited architectural and building services design with the view to conduct a detailed assessment once the design is further developed.

Performance of the completed building may be significantly affected by the quality of construction; the quality of commissioning, ongoing management of the building, and the way the building is operated, monitored, and maintained.