IGS INTEGRATED GROUP SERVICES

6 The Corso / 50 East Esplanade & 46-48 East Esplanade, Manly NSW

NCC Section J & Energy Performance Report

September 2019
Rev 1.2

VALUE | INNOVATION | TRUST

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Revision	Date	Author	
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1. EXECUTIVE SUMMARY

IGS has been engaged by Aspiring Properties to undertake energy performance assessments and provide an energy performance assessment report for the proposed development at 6 The Corso / 50 East Esplanade & 46-48 East Esplanade, Manly.

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

The energy efficiency 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 feasible.

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

Aiming at best practice in energy performance, the architect and building services design team will maximise energy efficiency in an integrated and staged approach:

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 lighting
	High efficiency hot water systems
	High efficiency appliances
Use of renewable resources	Application of Solar Energy or Solar thermal systems where practical

Benchmarking and compliance requirements:

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

- NCC Section J – Energy Efficiency (detailed in section 6 of this report)

Sustainability targets beyond the minimum requirements

Although not seeking formal rating certification, where feasible, the design team will also consider the sustainable design principles based on the following sustainability tool.

- Green Star Design & As Built Tool – Green Building Council of Australian

2. INTRODUCTION

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 outperforms the minimum NCC Section J requirements.

The facade and floor plans will be 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 tenants and base building and therefore lower greenhouse gas emissions during the life of this development.

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;
- Emission reductions and material optimisation.

Section 6 of this report outlines the relevant NCC Section J requirements or 'deemed to satisfy' compliance provisions.

3. BENCHMARKING

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

- NCC Section J – Energy Efficiency (detailed in section 6 of this report)

Sustainability targets beyond the minimum requirements

Although not seeking formal rating certification, where feasible, the design team will also consider the sustainable design principles based on the following sustainability tool.

- Green Star Design & As Built Tool – Developed by Green Building Council of Australian

3.1 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
- JV3 – Verification using a referenced building

Section 6 of this report nominates the minimum DTS requirements for the development. The following works were carried out in order to assess DTS compliance:

- Determine the applicable NCC Section J requirement for the climate zone and building class
- Provide recommendations to achieve compliance with DTS provisions

The Deemed-to-Satisfy Provisions in Section J of the NCC 2016 include the following 8 components.

- Part J1 - Building Fabric – Minimum thermal performance constructions for roofs, ceilings, roof lights, walls, and floors in the relevant climate zone.
- Part J2 - External Glazing – Minimum thermal performance for the glazing in the relevant climate zone.
- Part J3 - Building Sealing – Provisions to reduce the loss of conditioned air and restrict unwanted infiltration to a building.
- Part J4 – Blank in NCC 2016.
- Part J5 - Air-Conditioning and Ventilation Systems – Requirements to ensure these services are used and use energy in an efficient manner.
- Part J6 - Artificial Lighting and Power – Requirements for lighting and power to ensure energy is used efficiently within a building.
- Part J7 - Hot Water Supply – Restrictions for hot water supply design except for solar systems within climate zones 1, 2 and 3.
- Part J8 - Facilities for Energy Monitoring.

The development will meet and outperform the NCC energy efficiency requirements of Part J.

3.2 Green Star

Green Star is an environmental rating tool developed by the Green Building Council of Australia (GBCA) that has a holistic approach over a wide range of issues that covers a range of sustainability impact areas. There are various Green Star tools developed to suit a range of different building types including:

- Design and As-Built
- Office Interiors
- Performance
- Communities

Green Star rating tools use Stars to rate performance:

- 4 Star Green Star Certified Rating (score 45-59) signifies 'Best Practice'
- 5 Star Green Star Certified Rating (score 60-74) signifies 'Australian Excellence'
- 6 Star Green Star Certified Rating (score 75-100) signifies 'World Leadership'

Green Star rating tools include eight separate environmental impact categories, which have different weighting attached to each category as seen in the table below:

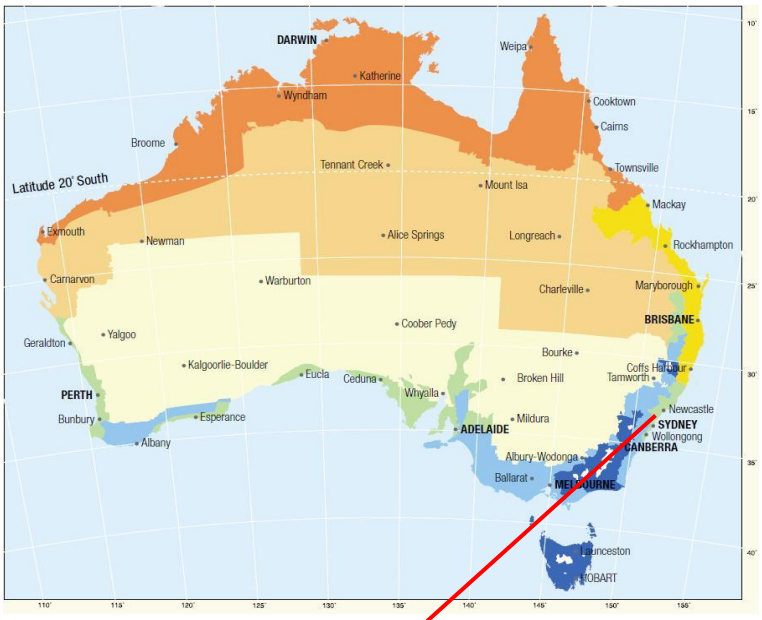
- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions, and
- Innovation

The development is not seeking a formal Green Star certification, however, where feasible, the design team will consider the sustainable design initiatives associated with Green Star.

4. DEVELOPMENT LOCATION AND NCC CLIMATE ZONE

The proposed mixed-use development is located at 6 The Corso / 50 East Esplanade & 46-48 East Esplanade, Manly NSW.

The development location is within the NCC climate zone 5 (warm temperate).



ZONE	DESCRIPTION
1	High humid summer, warm winter
2	Warm humid summer, mild winter
3	Hot dry summer, warm winter
4	Hot dry summer, cool winter
5	Warm temperate
6	Mild temperate
7	Cool temperate
8	Alpine

Location: 6 The Corso / 50 East Esplanade & 46-48 East Esplanade, Manly NSW

4.1 Information Used in Review

Our review is based on the following preliminary architectural drawings provided by Wolski Coppin Architecture.

ARCHITECTURAL DRAWINGS

DA00		COVER PAGE
DA01	F	GROUND FLOOR PLAN
DA02	E	FIRST FLOOR PLAN
DA03	E	SECOND FLOOR PLAN
DA04	E	THIRD FLOOR PLAN
DA05	E	FOURTH FLOOR PLAN
DA06	D	ROOF / SITE PLAN
DA07	C	THE CORSO ELEVATION
DA08	C	EAST ESPLANADE ELEVATION
DA09	E	V1 -50 EAST ESPLANADE SE ELEVATION
DA10	D	V2 -46 - 48 EAST ESPLANADE NW ELEVATION
DA11	E	SECTION A-A
DA12	D	SECTION B-B
DA13	E	SECTION C-C

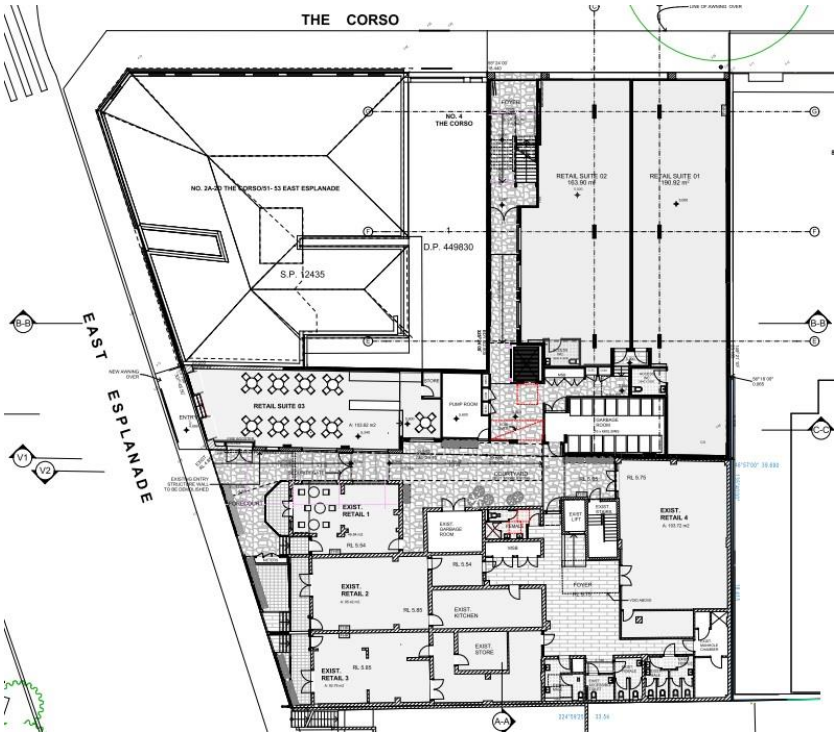
COMPLIANCE DRAWINGS

SA01	B	SITE ANALYSIS
SA02	C	VIEW LOSS ANALYSIS
C01	C	GFA CALCULATIONS
C02	B	DEMOLITION PLAN
F01	C	THE CORSO FINISHES
F02	C	EAST ESPLANADE FINISHES
F03	C	50 EAST ESPLANADE SE FINISHES
F04	C	46-48 EAST ESPLANADE NW FINISHES
SH01	B	SHADOW DIAGRAM: 9am 21 June
SH02	B	SHADOW DIAGRAM: 12noon 21 June
SH03	B	SHADOW DIAGRAM: 3pm 21June
SN01	B	SIGNAGE 01
SN02	B	SIGNAGE 02
NP01	B	SITE PLAN (NOTIFICATION PLAN)
NP02	B	ELEVATION 01(NOTIFICATION PLAN)
NP03	B	ELEVATION 02(NOTIFICATION PLAN)

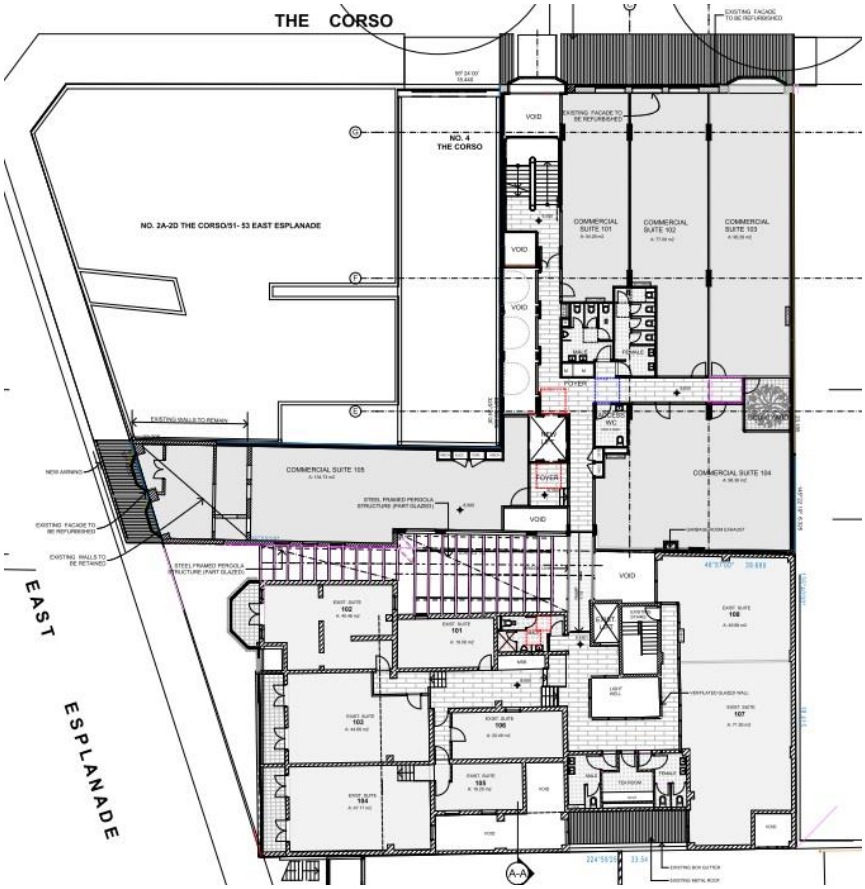
4.2 Architectural drawings

Selected architectural drawings are provided in the following section.

Ground floor plan:

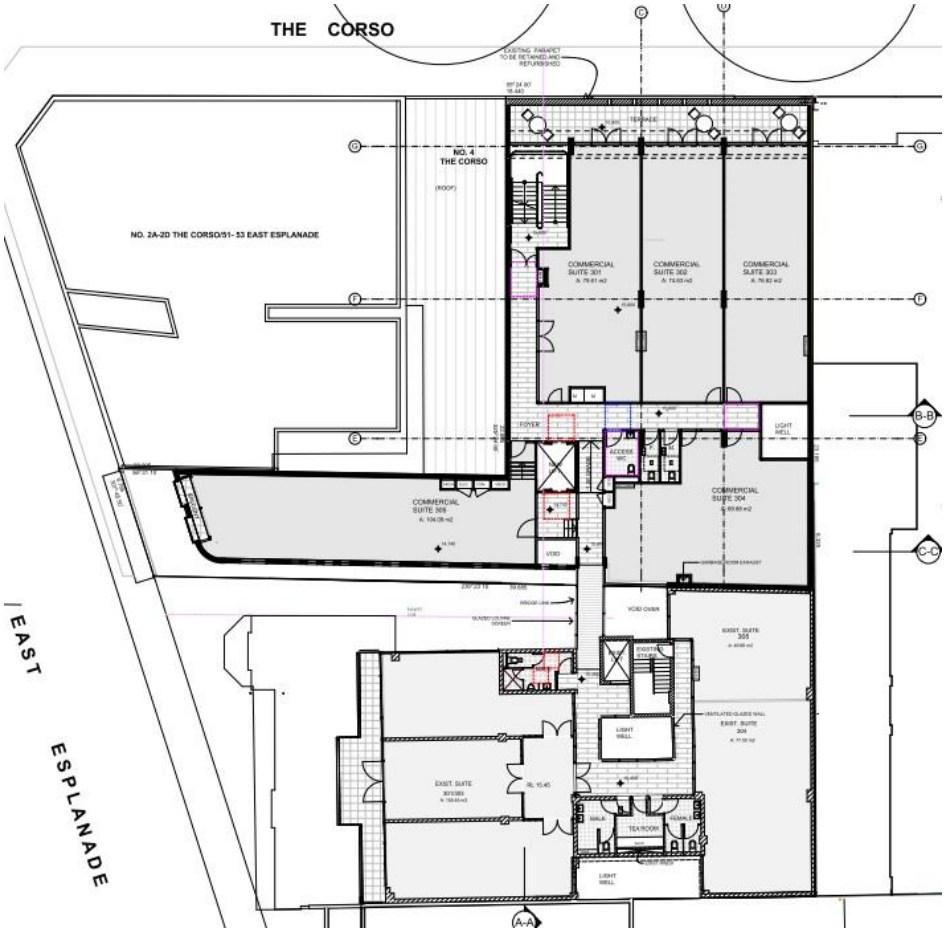


First floor plan:

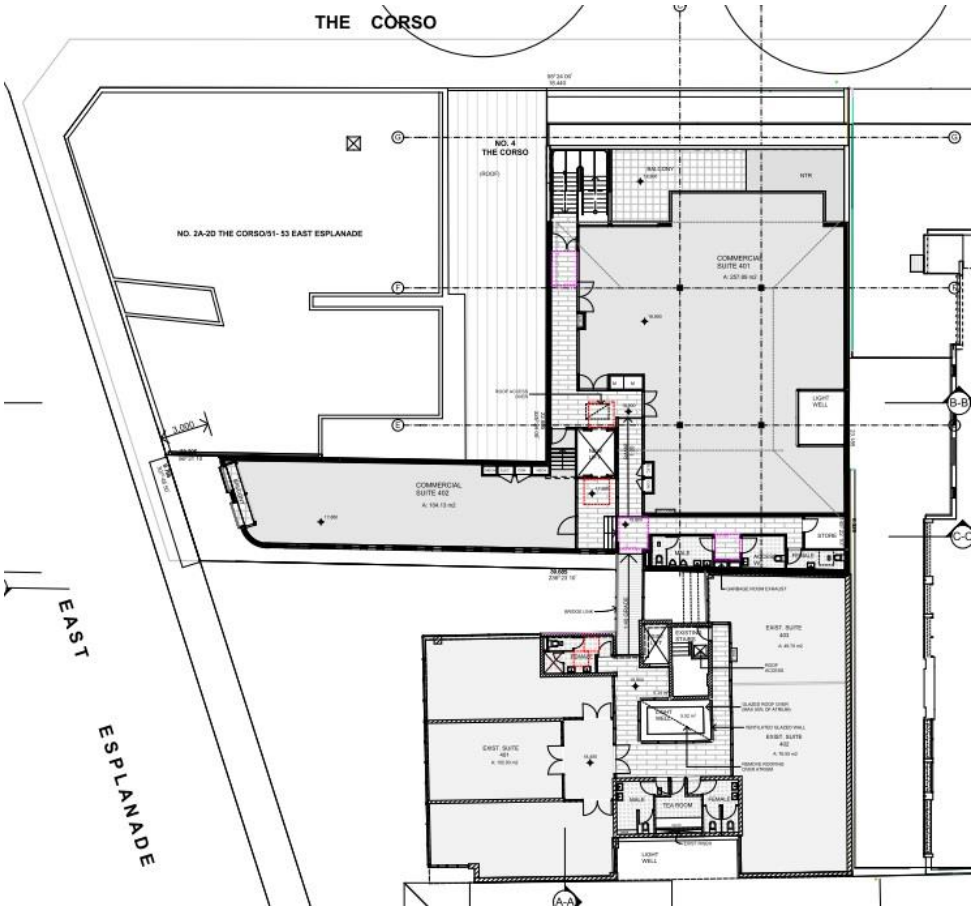


Second floor plan:

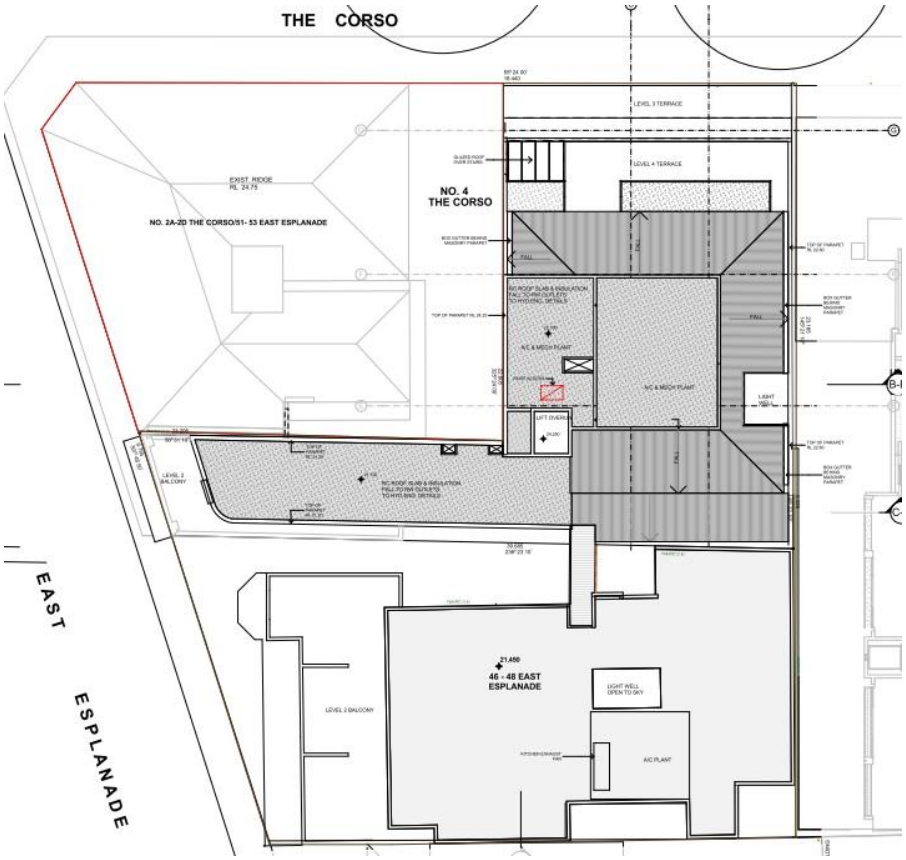
Third floor plan:



Fourth floor plan:



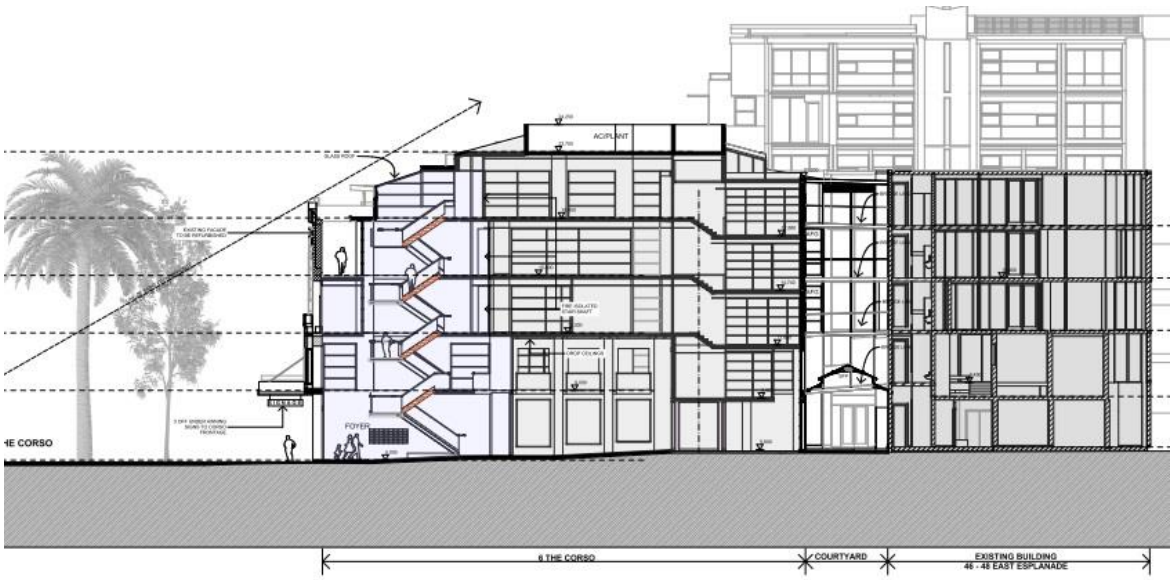
Roof plan:



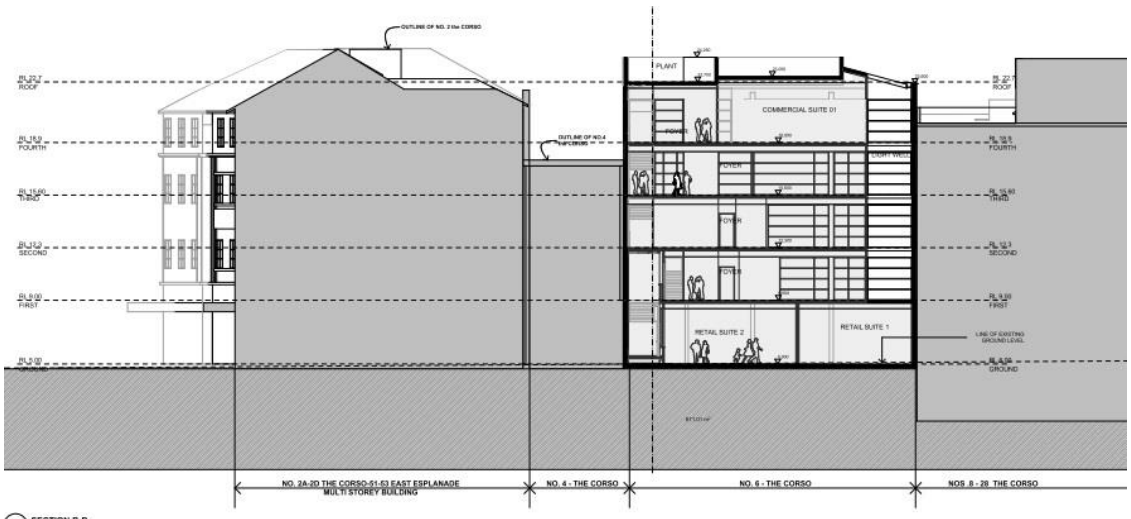
The Corso elevation:

THE CORSO ELEVATION

Section AA:

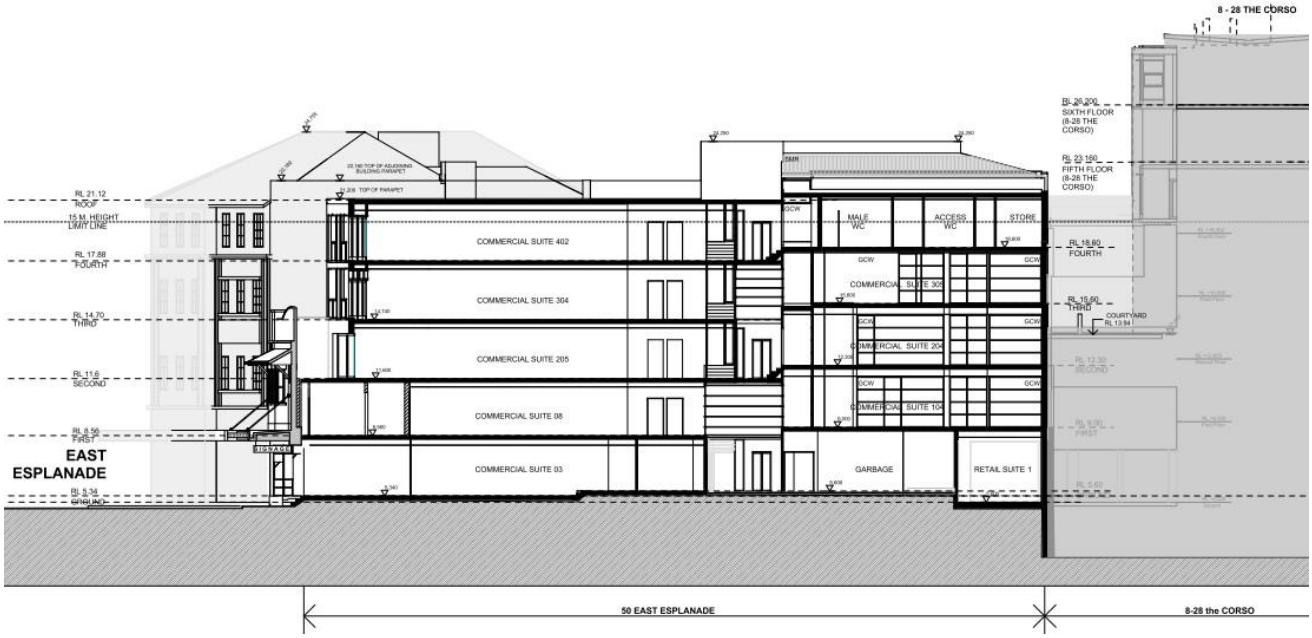


Section BB



SECTION B-B

Section CC:


8 - 28 THE CORSO
RL 26.200
SIXTH FLOOR
(8-28 THE CORSO)
RL 23.190
FIFTH FLOOR
(8-28 THE CORSO)
RL 21.12
ROOF
15 M. HEIGHT LIMIT LINE
RL 17.88
FOURTH
RL 14.70
THIRD
RL 11.6
SECOND
RL 8.56
FIRST
RL 3.16
GROUND
EAST ESPLANADE
COMMERCIAL SUITE 402
COMMERCIAL SUITE 304
COMMERCIAL SUITE 205
COMMERCIAL SUITE 06
COMMERCIAL SUITE 03
MALE WC
ACCESS WC
STORE
COMMERCIAL SUITE 305
COMMERCIAL SUITE 204
COMMERCIAL SUITE 104
GARBAGE
RETAIL SUITE 1
RL 15.60
FOURTH
RL 15.60
THIRD
COURTYARD
RL 13.94
50 EAST ESPLANADE
8-28 the CORSO

5. 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.

5.1 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.

5.2 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.

5.3 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.

- Involvement of a Green Star Accredited Professional as part of the design to prepare the necessary ESD guidelines. The ESD consultant from IGS is a Green Star Accredited Professional.
- Commissioning Clauses: 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).
- 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;
- 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;
- 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.

5.3.1 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.

5.3.2 Environmental Management and Maintenance

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

The aforementioned 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.

5.4 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 efficient 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.

5.4.1 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.

5.4.2 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.

5.4.3 Natural Ventilation

The Natural Ventilation mode is a fundamental aspect of the energy and the indoor environmental strategies. It is anticipated that when exterior conditions are suitable, occupants will utilise the operable windows and doors to the facade which will provide natural ventilation.

The proposed building design reflects this intention by sizing the window openings to allow effective natural ventilation, restoring thermal comfort. The design of the window, when open will allow the introduction and extraction of air through operable windows.

The materials specification of the windows and doors shall consider issues relating to durability, aesthetics and integration with other façade elements. The final selection of the glass and window system will be subject to detailed design phase of the project.

5.4.4 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.

VOC’s 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.

5.5 Energy Conservation Initiatives

The building will be 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 an essential design principle.

The energy conservation initiatives will 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.

The integrated energy strategies considered for the development include:

Load reduction	Passive Design
	Mixed mode AC systems
	Maximise use of natural lighting
	Energy efficient equipment
	Water efficiency in hot water systems
Building Services System Efficiency	High Efficiency in Heating, ventilation and Air Conditioning
	High efficiency LED
	High efficiency hydraulic services
	High efficiency appliances
Renewable Energy	Solar PV (if deemed feasible by the design team)

5.5.1 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. The 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

5.5.2 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.

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.

The thermal insulation requirements will be compliant with the minimum NCC Section J requirements.

Glazing and Window Framing

Adequate performance glass will be provided to reduce excessive heat gains in hot conditions, increasing periods when natural ventilation will be able to restore thermal comfort, and therefore 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) are 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.

The glazing performance requirements shall comply with the minimum NCC Section J requirements.

5.5.3 Energy Efficient Systems and Services

Where practical, the building envelope will be designed to maximise use of natural ventilation and Economy Cycle to minimise the energy consumption related to Heating, Ventilation and Air-conditioning.

The mechanical and electrical systems for the building 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.

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 where applicable;
- 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.

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), Green Star provisions where feasible 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:

- Where appropriate, mixed mode ventilation will be used as an effective way to reduce air condition periods when natural ventilation is sufficient to maintain comfort conditions inside the space.

- 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.
- Car park ventilation system controlled by Carbon Monoxide (CO) sensors and variable speed drive fans through the Building Management System.
- 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).

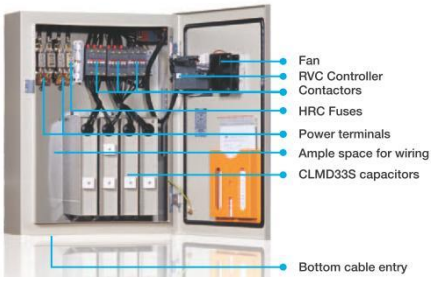
When outside conditions are not favourable for the natural ventilation mode of operation, the mechanical system shall deliver thermal comfort when spaces are occupied.

Manually operable windows will allow bedrooms and living rooms to be naturally ventilated when external temperature conditions are favourable. During periods when external temperature conditions prevent the opening of windows or during hot nights when acoustic issues will limit the opening of windows, a dedicated reverse cycle heat pump refrigerant

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.

Power Factor Correction

To reduce maximum kVA demand on the electricity grid and lower the demand charges, power factor correction units will be provided at the main switch board(s) in accordance with the NSW Installation and Service Rules.



The power factor correction units proposed will improve the power to a factor of 0.98 or higher.

Monitoring & reporting

To enable effective monitoring and tracking of energy and water consumption, sub-metering will be considered for systems with major energy use, to help identify areas of inefficiency with potential for improvement.

Metering is to be provided throughout the building and central services for all major building plant and equipment. An effective monitoring system is to be provided to monitor energy and water consumption throughout the building as required.

Ongoing reporting may allow the building manager to set goals for energy consumption reductions and attributed energy costs to particular uses. By monitoring energy, losses and wastage can be identified, therefore improving the overall performance of the building in operation. This initiative is subject to further design development and review.

5.6 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.

Given the site location of the development (Manly), the occupants will be able to take advantage of local public transport networks (i.e. bus ad ferries) 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 abundant number of bus routes served; building occupants are encouraged to use mass transport to travel to work.

- **Trip Reduction:** The development is located adjacent to a number of 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.

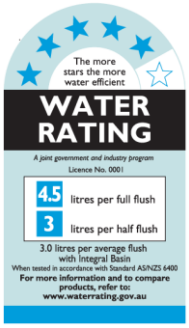
5.7 Water Conservation and Management Initiatives

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.

5.7.1 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. The following criteria are provided as a guide and subject to further design development.

Water Fixtures	Hand wash basins – 6 Star WELS;
	Kitchen taps – 6 Star WELS;
	Showerheads (where applicable) – 3 Star WELS or higher;
	Toilets – 4 Star WELS or higher;
Appliances	Dishwashers – 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

5.7.2 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.

5.7.3 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.

5.8 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.

5.8.1 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.

5.8.2 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.

Where feasible the materials specified for this project are to consider the above environmental measures through a comparison between different product types and manufacturers where possible. The design team is to adopt this approach in assessing suppliers and products for the development. Interiors finishes will consider the concentration of Volatile Organic Compounds with products for adhesives, paints, carpets and floor sealants. The design team will work with suppliers and contractors to identify opportunities to reduce the level of VOC's within products and finishes.

5.8.3 Materials with Ozone Depletion Potential

Selection of insulation will be targeted to minimise Ozone Depletion Potential (ODP).

5.8.4 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.

5.8.5 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.

5.9 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.

5.10 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;
- Where feasible, refrigerants will have an Ozone Depletion Potential of zero; and integrated refrigerant leak detection will ensure early identification of leaks;
- Estimated wastewater discharge to sewer will be significantly 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

6. NCC SECTION J - DEEMED-TO-SATISFY PROVISIONS

NCC 2016 requires that Class 2 to 9 buildings to achieve efficient use of energy. This requirement is defined in Volume 1 of the NCC 2016 under Section J and is titled “Energy Efficiency”. There are eight Deemed-to-Satisfy subsections, J1 to J8, which focus on separate aspects of energy efficiency. These are:

- Part J1 - Building Fabric – Minimum thermal performance constructions for roofs, ceilings, roof lights, walls, and floors in the relevant climate zone.
- Part J2 - External Glazing – Minimum thermal performance for the glazing in the relevant climate zone.
- Part J3 - Building Sealing – Provisions to reduce the loss of conditioned air and restrict unwanted infiltration to a building.
- Part J4 – Blank in NCC 2016
- Part J5 - Air-Conditioning and Ventilation Systems – Requirements to ensure these services are used and use energy in an efficient manner.
- Part J6 - Artificial Lighting and Power – Requirements for lighting and power to ensure energy is used efficiently within a building.
- Part J7 - Hot Water Supply – Restrictions for hot water supply design except for solar systems within climate zones 1, 2 and 3.
- Part J8 - Facilities for Energy Monitoring

This report acknowledges that the NCC 2019 has been released and is currently in effect, however, based on the information provided by the Australian Building Construction Board (ABCB), *a 12-month transition period ending 30 April 2020 available in relation to the energy efficiency provisions in Section J. During this time, either the new NCC 2019 provisions or those from NCC 2016 may be used*. On this basis, the transitional BCA 2016 Section J provisions are being utilised for this development. It is required that the client confirms this with the certifier / planning authority prior to the construction since the minimum requirements under NCC 2019 Part J may be different.

6.1 National Construction Code – General Definitions

6.1.1 Envelope

This term is not limited to the building’s outer shell, but also includes parts of a building’s fabric that separate a conditioned space or habitable room from the exterior of the building or a non-conditioned space.

For example, the floor between a plant room and an office space may be part of the envelope, rather than the outer shell. A non-conditioned space may be included within the envelope under certain circumstances.

6.1.2 Glazing

The glazing definition needs to be read in conjunction with the definition of a window and roof light. It can include a glazed door. For the purposes of Section J, the glazing provides an aperture by which light and energy can flow into or from the conditioned space. Glazing includes the glass and any frame system.

6.1.3 Conditioned space

A conditioned space is one likely to be air-conditioned rather than one that is air-conditioned. In some cases, chilled and hot water may be reticulated through duct risers as part of the building design to enable conditioning to be provided as part of a later fitout. A conditioned space may include a ceiling or under-floor space that is open to the conditioned space such as a space separated by only a perforated or grille ceiling or floor where the space is a supply air or return air plenum.

6.2 Part J1 – Building Fabric Requirements

6.2.1 Overview

Section J part J1 outlines the minimum requirements of building envelope. The envelope is defined by the NCC as parts of a building's fabric that separate a conditioned space or habitable room from the exterior of the building or a non-conditioned space.

6.2.2 Part J1.1 – Application

The deemed-to-satisfy provisions of Part J1 apply to the building elements forming the envelope of a Class 2 to 9 building. Part J1 is therefore applicable to all works within retail areas of this development.

6.2.3 J1.2 Thermal Construction General

All insulations installed are required to meet J1.2 and AS/NZ 4859.1. Builder is required to ensure compliance, during construction.

Care should be taken when installing insulation to ensure a continuous envelope between a conditioned space and either the outside environment or a non-conditioned space.

Insulation is required to be fitted tightly to each side of framing members but need not be continuous over the framing member. The total R-value requirements for roof, walls and floors are calculated for parts of the roof, walls or floor that are clear of any framing members.

The installation of insulation should not interfere with the safety or performance of domestic services and fittings such as heating flues, recessed light fittings, transformers for low voltage lighting, gas appliances and general plumbing and electrical components. This includes providing appropriate clearance as detailed in relevant legislation and referenced standards such as for electrical, gas and fuel oil installations. Low voltage lighting transformers should not be covered by insulation and be mounted above the insulation rather than on the ceiling. Expert advice may also be needed on how much bulk insulation can be placed over electrical wiring.

Addition of insulation to other building elements may alter the fire properties of those elements. Re-testing or re-appraisal of these elements may be required.

For reflective insulation to achieve its tested R-value, the airspace adjoining the insulation needs to be a certain width. This width varies depending on the particular type of reflective insulation and the R-value to be achieved.

Where the width of airspace is to be achieved in a wall cavity or the like, care should be taken to ensure compliance with all other applicable NCC provisions. For example, the provisions relating to weatherproofing masonry may require a greater width of cavity.

The R-value of bulk insulation is reduced if it is compressed. The allocated space for bulk insulation is therefore required to allow the insulation to be installed so that it maintains its correct thickness unless exempted such as at wall studs. This is particularly relevant to wall and cathedral ceiling framing whose members can only accommodate a limited thickness of insulation. In some instances, larger framing members or thinner insulation material, such as polystyrene boards, may be necessary to ensure that the insulation achieves its required R-value.

6.2.4 J1.3 Roof and Ceiling Construction

Roof and ceiling construction works are required to meet J1.3 requirements. For roof and ceiling constructions that form part of the building envelope in the proposed development the NCC

minimum thermal resistance is 3.7m^2 K/W (assuming a roof solar absorptance value of not more than 0.6).

To achieve NCC compliance and further improve the thermal performance of the building, **it is recommended that minimum total roof insulation of R3.7 be installed as part the roof/ceiling construction.**

6.2.5 J1.4 Roof Lights

Based on the architectural drawings provided, no roof lights are proposed to the conditioned areas, section J1.4 is therefore not applicable.

Should this not be the case, the roof lights must meet the following criteria:

Roof light shaft index (see Note 2)	Constant	Total area of *roof lights* serving the room or space as a percentage of the *floor area* of the room or space			
		Up to 2%	More than 2% to and up to 3%	More than 3% and up to 4%	More than 4% and up to 5%
Less than 0.5	*SHGC*	Not more than 0.83	Not more than 0.57	Not more than 0.43	Not more than 0.34
	Total U-Value	Not more than 8.5	Not more than 5.7	Not more than 4.3	Not more than 3.4
0.5 to less than 1.0	*SHGC*	Not more than 0.83	Not more than 0.72	Not more than 0.54	Not more than 0.43
	Total U-Value	Not more than 8.5	Not more than 5.7	Not more than 4.3	Not more than 3.4
1.0 to less than 2.5	*SHGC*	Not more than 0.83	Not more than 0.83	Not more than 0.69	Not more than 0.55
	Total U-Value	Not more than 8.5	Not more than 5.7	Not more than 4.3	Not more than 3.4
2.5 and more	*SHGC*	Not more than 0.83	Not more than 0.83	Not more than 0.83	Not more than 0.83
	Total U-Value	Not more than 8.5	Not more than 5.7	Not more than 4.3	Not more than 3.4

Notes:

1. The total area of a roof light serving the space as a percentage of the floor area of the space must not exceed 5%.
2. The roof light shaft index is determined by measuring the distance from the centre of the shaft at the roof to the centre of the shaft at the ceiling level and dividing it by the average internal dimension of the shaft opening at the ceiling level in the same units of measurement.
3. The total area of roof lights is the combined area for all roof lights serving the room or space.
4. The area of a roof light is the area of the roof opening that allows light to enter the building.
5. The thermal performance of an imperforate ceiling diffuser may be included in the Total U-Value and SHGC of the roof light.
6. If the roof lights is required for compliance with NCC Part F4, it must
   (i) Have an area not more than 150% of the minimum area required by F4.6; and
   (ii) Have transparent and translucent elements, including any imperforate ceiling diffuser, with a combined performance of not more than: SHGC: 0.29 and U-Value: 2.9

7. The performance requirements of the total glazing system (glass + frame) must be demonstrated under NFRC100-2001 conditions and using the tested NFRC values in compliance with the NCC.

6.2.6 J1.5 Walls

External Wall Construction

All wall construction that form part of the building envelope within the development shall be designed and constructed to meet J1.5.

NCC compliance shall be achieved with a minimum thermal insulation of R2.8 for external walls separating conditioned and non-conditioned zones.

Internal Wall Construction

All internal wall constructions that form part of the building envelope separating conditioned and non-conditioned spaces in this climate zone are required to achieve a minimum thermal resistance of 1.8 m^2 K/W. This is assuming that the mechanical ventilation of the space is more than 1.5 air changes per hour.

NCC compliance shall be achieved with a minimum thermal insulation of R1.8 for internal walls separating conditioned and non-conditioned zones.

6.2.7 J1.6 Floors

There are no requirements for floor insulation for the floors which are concrete slab on ground (without an in-slab heating or cooling system).

NCC compliance shall be achieved with a minimum thermal insulation of R2 for all floors that are above or below a storage or a plant room (i.e. floors that are separating a conditioned and non-conditioned space).

6.3 Part J2 – Glazing

6.3.1 Overview

Buildings that are two-storey or greater in height will require each level to comply with the NCC requirements in Part J2. The NCC method of glazing analysis considers the area of the glass and orientation on a level by level basis.

The Australian Building Codes Board (ABCB) provides the NCC Glazing Calculator for determining the amount of glazing permitted on each storey of each building façade using proposed types of glass for the development.

Part J2 requires established minimum glazing system performance requirements, which vary depending on the climate zone and the orientation and shading of the glazing. The glazing conductance (U-value) and Solar Heat Gain Coefficient (SHGC and shading) are assessed together and calculated for each façade orientation. These are then added together to give an Air Conditioning Energy Value. To comply this must be less than the Energy Index target.

The calculation involves various factors and is typically undertaken using the glazing calculator developed by the Australian Building Codes Board (ABCB).

6.3.2 Application of Part J2 Glazing

The Deemed-to-Satisfy Provisions of this Part apply to elements forming the envelope of a building other than a sole-occupancy unit of a Class 2 building or a Class 4 part of a building.

The Deemed-to-Satisfy provisions of Part J2 are therefore applicable to the development and all the glazing works to the conditioned areas are to comply.

J.2.1 Application of Part	Applicable to all glazing works within the development.
J2.2 Blank	Not applicable.
J2.3 Blank	Not applicable.
J2.4 Glazing	Applicable to all sun-shades and glazing works to the conditioned spaces.
J2.5 Shading	Applicable to all external shading devices.

6.3.3 Glazing Performance

A detailed glazing schedule is not yet available for the development. Glazing calculations for the development shall be calculated and complied with once the architectural design is further developed. The performance of each type of glazing system (glass and frame) must be demonstrated under AFRC conditions and using the tested AFRC values.

6.4 Part J3 – Building Sealing

Part J3 of the NCC 2016 contains the requirements of the Deemed-to-Satisfy compliance for building sealing. The purpose of this subsection is to ensure that additional heating and cooling loads will not be introduced through building leakage.

Clause 3.1 – Part J3 is applicable to this development.

Clause J3.2 refers to chimneys and flues.

Clause J3.3 refers to roof lights.

A. A roof light must be sealed, or capable of being sealed, when serving a conditioned space;

B. A roof light required by (A) to be sealed, or capable of being sealed, must be constructed with—

i. an imperforate ceiling diffuser or the like installed at the ceiling or internal lining level; or

ii. a weatherproof seal; or

iii. a shutter system readily operated either manually, mechanically or electronically by the occupant.

Clause J3.4 outlines that a seal to restrict air infiltration must be fitted to each edge of doors, openable windows or the like that separate conditioned spaces from non-conditioned spaces or external areas. This provision is not required for windows complying with Australian Standard AS2047, louvred windows or doors, and fire doors. The seal required may be a foam or rubber compressible strip, fibrous seal or the like. The main entrance to the development must have an airlock, self-closing door, revolving door or the like.

Clause J3.5 outlines that any miscellaneous exhaust systems must be fitted with a sealing device such as a self-closing damper when serving a conditioned space or habitable room.

Clause J3.6 outlines for the conditioned areas that the roofs, walls floors and any openings such as for doors and windows must be constructed to minimise air leakage. The construction must enclose conditioned spaces by close fitting internal lining systems at the ceiling, wall and floor junctions or by sealing through caulking, skirting, architraves, cornices or the like. The requirements of this clause do not apply to openings, grilles and the like necessary for smoke hazard management.

Clause J3.7 outlines that if evaporative cooling is used, the system must be fitted with self-closing non-return dampers.

All services consultants and contractors shall design and build to ensure compliance with Part J3 of the NCC Section J and all subsections associated therein.

6.5 Part J4

Part J4 of the NCC 2016 (formerly known as Air Movement) is blank and therefore not applicable to this development.

6.6 Part J5 – Air Conditioning and Ventilation Systems

Part J5 of the NCC outlines the performance requirements for air conditioning and ventilation systems to ensure these services operate in an efficient manner.

All services consultants and contractors shall design and install the air conditioning and ventilation systems to ensure compliance with Part J5 of the NCC Section J and all subsections associated therein.

6.7 Part J6 – Artificial Lighting and Power

Part J6 of the NCC outlines the performance requirements for illumination power density and the efficient use of lighting power and controls.

All services consultants and contractors shall design and install the artificial lighting systems to ensure compliance with Part J6 of the NCC Section J and all subsections associated therein with regards to power.

6.8 Part J7 – Hot Water Supply

Part J7 of the NCC outlines the provisions for the energy efficient use of hot water supply systems.

Clause J7.2 of Part J7 states that a hot water supply system for food preparation or sanitary purposes must be designed and installed in accordance with Section 8 of AS/NZS 3500.4.

All services consultants and contractors shall design and install the Hot Water supply systems to ensure compliance with Part J7 of the NCC Section J and all subsections associated therein.

6.9 Part J8 – Facilities for Energy Monitoring

Part J8 of the NCC outlines the provisions of facilities for energy monitoring. Facilities for energy monitoring shall be provided in accordance to Part J8 of the NCC.

A building or sole-occupancy unit with a floor area of more than 500 m2 must have the facility to record the consumption of gas and electricity.
A building with a floor area of more than 2,500m2 must have the facility to record individually the energy consumption of:

i. air-conditioning plant including, where appropriate, heating plant, cooling plant and air handling fans; and
ii. artificial lighting; and
iii. appliance power; and
iv. central hot water supply; and
v. internal transport devices including lifts, escalators and travelators where there is more than one serving the building; and
vi. other ancillary plant.

All services consultants and contractors shall design for access for maintenance and facilities for monitoring to ensure compliance with Part J8 of the NCC Section J and all subsections associated therein.

7. 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. This 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. Building fabric inputs require verifiable manufacturer data to confirm thermal properties.

This report is intended as a guide to assist with the application of the NCC Section J. It should be read in conjunction with the NCC and specific applications may vary during the design development of the project.