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SUSTAINABLE DESIGN ASSESSMENT REPORT

PROPOSED APARTMENTS

CLAREMONT TERRACES – STAGE 2

PREPARED BY

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CONTENTS

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1 OVERVIEW

EMERGEN has developed a sustainable design report on the proposed multi-level residential development at Shenton Road, Claremont WA 6010 in consultation with Hillam Architects.

The purpose of this report is to support the development application by identifying the principles incorporated in the design that meet sustainable objectives and targets for the site. The initial assessment is based on preliminary documentation with the outcomes subject to change during design development.

1.1 STATE PLANNING POLICY SUMMARY

EMERGEN (a division of CADDS GROUP), in collaboration with the design team (Hillam Architects) has developed a sustainable design strategy aligning with ***State Planning Policy 7.0,*** which focuses on the Design of the Built Environment - specifically, Principle 5: Sustainability.

This report serves the vital purpose of bolstering the development application by articulating the sustainability principles and commitments for the project site. We acknowledge the significance of State Planning Policy 7.0 in promoting sustainability within the built environment. Good design, as outlined in the policy, is not only about aesthetics but also optimises the sustainability of our built surroundings, yielding positive outcomes on environmental, social, and economic fronts.

Our approach to sustainable landscape and urban design adheres closely to the established water-sensitive urban design principles, ensuring minimal adverse impacts on existing natural features and ecological processes while promoting green infrastructure at all scales of the project. Furthermore, our strategy for sustainable built environments embraces passive environmental design measures tailored to local climate and site conditions. This includes careful consideration of optimal orientation, shading, building envelope, and natural ventilation, ultimately reducing reliance on energy-intensive heating and cooling technologies. This, in turn, results in reduced energy consumption, decreased resource usage, and lowered operating costs throughout the project's lifecycle.

2 TARGETS

The design team will utilise a structured approach to a sustainable outcome for the design and construction of the development including the following Sustainable Targets.

Table 1: Sustainability Targets

DESCRIPTION	GOAL	SUSTAINABILITY COMMITMENTS
STRUCTURE DESIGN EFFICIENCY	Integrate passive solar design principles into optimising solar access in winter and shading in summer.	• Enhance solar passive performance by incorporating shading devices on north, east, and west-facing windows to reduce summer heat gain and improve visual interest.
ENERGY EFFICIENCY	Enhance energy performance by reducing consumption through efficient design and the use of renewable and low-energy systems.	• Efficient LED Lighting and controls. • **20%** reduction in lighting power when compared to NCC DTS • For Class 2 units, above **60%** of the combined living and bedroom area of each unit have high level of daylight (above 160 Lux). • Provision for solar photovoltaic (PV) system to supply renewable energy. • NCC 2022 compliant building fabric. • All units meet the minimum NatHERS energy efficiency requirement of 6 stars for sole occupancy and average of 7 stars, based on the NCC 2022. • Energy efficient condenser clothes dryers
WATER EFFICIENCY	Water efficient fixtures and Landscaping.	• High WELS Ratings • Water sensitive urban design, drip irrigation.
URBAN ECOLOGY	Reduce impacts of heat island effect	• Light roof colour (SRI ≥ 0.64). • Incorporate vegetation and green spaces around the building to provide shading and reduce surrounding air temperatures.
SUSTAINABLE TRANSPORT/ ACCESSABILITY	Low carbon options	• Provision for future EV charging bays. • Provision for secure bicycle storage area. • Access to public transport
INDOOR ENVIRONMENT QUALITY	Enhance indoor air quality	• Natural ventilation to all apartment units. • Low VOC and Low Formaldehyde products to be used. • Minimum 95% of internally applied paints, adhesives, sealants (by volume), and carpets (by area) must meet TVOC limits.

3 PROJECT INFORMATION

The proposed residential development site is located at Shenton Road, Claremont WA 6010 within the Town of Claremont. This project aims to revitalize a vacant site through the construction of a five-storey multi residential building comprising of 61 apartment units and common Amenities, including a rooftop space. The development aims to contribute positively to the local streetscape by delivering contemporary, high-quality, and sustainable housing that respects and complements the suburb's medium-density residential zoning.

Figure 1: Existing Site Image/Proposed Development

4 STRUCTURE DESIGN EFFICIENCY

4.1 SOLAR PASSIVE DESIGN

Solar Passive design principles have been carefully integrated into the proposed development to enhance energy efficiency and occupant comfort. While the east- and west-facing glazing is less ideal for solar gain control, the design incorporates effective shading strategies to mitigate heat during the summer months, while still preserving views and maintaining a strong connection to the surrounding natural environment. Emergen has conducted a Solar Analysis to review efficiency of proposed shading design.

4.1.1 SOLAR ANALYSIS

The architectural design incorporates several strategies to reduce unwanted heat gain from the north and west - critical for Climate Zone 5 conditions where afternoon solar exposure is significant.
Key measures include:

- Horizontal shading to north-facing glazing, blocking high-angle summer sun while allowing beneficial winter light.
- Limited use of dark cladding, with the façade predominantly finished in light, reflective materials, helping lower absorbed solar radiation.
- Setbacks and overhangs that naturally shade the ground floor glazing and entry areas.
- High-SRI roof covering, minimising heat absorption at the roof - the most solar-exposed surface.

Together, these elements reduce mechanical cooling demand, improve occupant comfort, and align with NCC 2022 thermal performance expectations.

Direct Solar (mean) W/m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12 AM	0	0	0	0	0	0	0	0	0	0	0	0
11 PM	0	0	0	0	0	0	0	0	0	0	0	0
10 PM	0	0	0	0	0	0	0	0	0	0	0	0
9 PM	0	0	0	0	0	0	0	0	0	0	0	0
8 PM	0	0	0	0	0	0	0	0	0	0	0	0
7 PM	225	122	0	0	0	0	0	0	0	0	23	504
6 PM	550	462	587	140	0	0	0	0	282	498	382	666
5 PM	708	626	721	544	443	363	313	394	450	627	592	757
4 PM	798	722	788	634	529	457	393	441	497	689	694	809
3 PM	839	783	825	674	601	525	454	475	551	726	754	853
2 PM	863	824	849	685	667	558	487	497	598	739	796	885
1 PM	870	846	840	695	683	545	503	506	619	724	806	884
12 PM	851	838	811	690	655	530	501	530	620	692	805	865
11 AM	828	810	770	646	587	495	462	519	616	652	781	836
10 AM	799	763	695	571	477	420	374	455	574	595	739	789
9 AM	744	702	570	457	342	191	179	356	464	512	687	711
8 AM	659	609	294	173	0	0	0	51	262	411	621	586
7 AM	525	450	0	0	0	0	0	0	0	145	528	383
6 AM	129	0	0	0	0	0	0	0	0	0	334	0
5 AM	0	0	0	0	0	0	0	0	0	0	0	0
4 AM	0	0	0	0	0	0	0	0	0	0	0	0
3 AM	0	0	0	0	0	0	0	0	0	0	0	0
2 AM	0	0	0	0	0	0	0	0	0	0	0	0
1 AM	0	0	0	0	0	0	0	0	0	0	0	0

Location
Swanbourne, WA, AUS

Coordinates
31.96° S / 115.76° E

Weather File
AUS_WA_Swanbourne.946140_TMYx.2007-2021

Figure 2: Average Direct Solar (W/m2)

Figure 5 displays average direct solar radiation by hour and month. It highlights peak solar loads from 9 AM–4 PM, especially in summer and early autumn, with the strongest heat on west-facing surfaces in the afternoon. There is room for improved by adding additional shading to protect the building more in summer months.

5 ENERGY EFFICIENCY

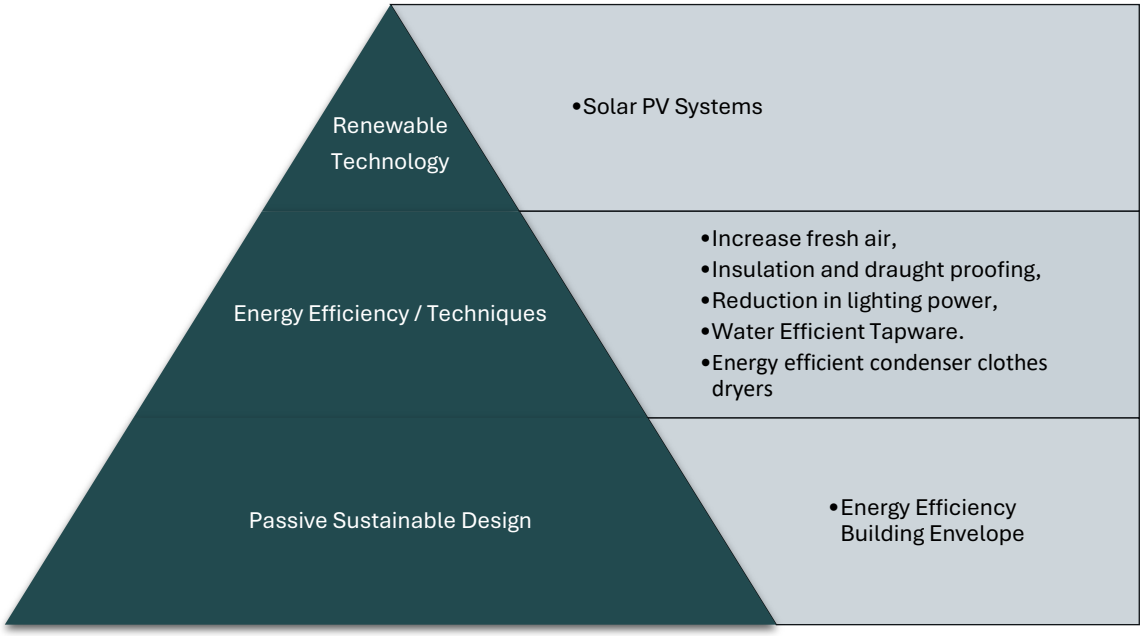

Figure 3: Energy Reduction Strategy

5.1 LIGHTING COMFORT

Lighting within the building must meet the following criteria:

- All lighting must be flicker-free.
- Light sources must have a minimum Colour Rendering Index (CRI) average R1 to R8 of 85 or higher and have a CRI R9 of 50 or higher.
- Light sources must meet best practice illuminance levels for each task within each space type with a maintained illuminance that meets the levels recommended in AS/NZS 1680.1:2006 series applicable to the project type and including maintenance.
- The maintained Illuminance values must achieve a uniformity of no less than that specified in Table 3.2 of AS/NZS 1680.1:2006, with a maintenance factor method as defined in AS/NZS 1680.4.; and
- All light sources must have a minimum of 3 MacAdam Ellipses.
- The walls within the field of view of occupants in regularly occupied spaces must have an average surface reflectance value of 0.70 and an average surface illuminance of at least 50% of the horizontal illuminance levels required for task.
- Vertical illuminance in workspaces: ensure that 50% of the horizontal task illuminance reaches the average eye height for 90% of primary spaces using vertical illuminance calculation grid.
- The illuminance values must be calculated in accordance with AS/NZS 1680 series for the relevant task.

5.2 EFFICIENT LIGHTING AND CONTROLS

The installed aggregate illumination power has been designed to be **20%** below the maximum illumination power based on maximum allowable lighting power densities defined in Table J7D3a of the NCC 2022. Motion Detectors and daylight sensors are provided to reduce demand.

Table 2: Lighting Characteristics

PARAMETER	PROPOSED BUILDING	REFERENCE BUILDING
LIGHTING TYPE	LED light fittings	LED light fittings
DESIGN ILLUMINANCE (LUX)	Various lux	Various lux
NOMINAL LIGHTING POWER DENSITY (W/M^2)	**20%** less compared to NCC max requirements.	As per NCC max requirements.
OCCUPANT SENSOR CONTROLS	Motion sensors	N/A
DAYLIGHT CONTROLS	Yes	N/A
OTHER LIGHTING CONTROLS	Timer switches	N/A
ADJUSTMENT FACTOR APPLIED	0.9 – Motion sensor 1 0.7 – Motion sensor 2 0.55 – Motion sensor 3	Room Aspect Ratio

5.3 ARTIFICIAL LIGHTING AND CONTROLS

All lighting will be equipped with light-emitting diodes (LEDs), covering all primary areas. Common area lighting will include controls like occupancy sensors (PIRs) and time switches to minimize energy usage when lighting is not needed.

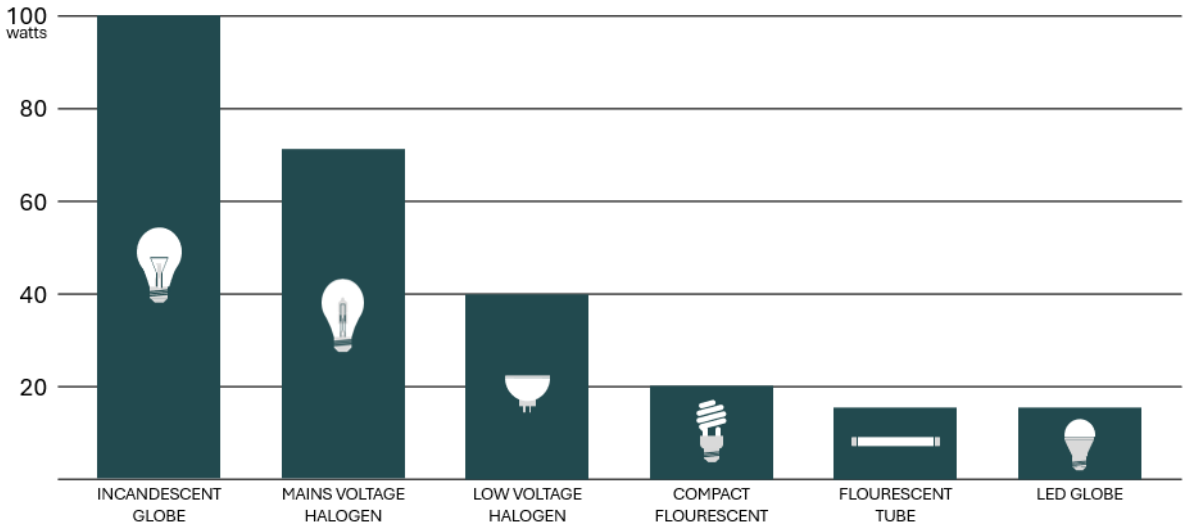

Figure 4: Comparison of LED Lighting with other Conventional Lighting

5.4 DAYLIGHTING

Preliminary daylight modelling has been conducted for all regularly occupied areas, at finished floor level under standard overcast sky conditions (CIE). The purpose of this analysis is to demonstrate that the building provides daylight access exceeding typical federal, state, or local regulations by showcasing how the design and glazing specifications optimize natural lighting in these regularly occupied spaces.

For Class 2 buildings, 60% of the combined living and bedroom area of each unit must comply with the daylight requirements. Kitchens are not included in the calculations. The daylight levels must also be present in at least 20% of the area of each bedroom and living area.

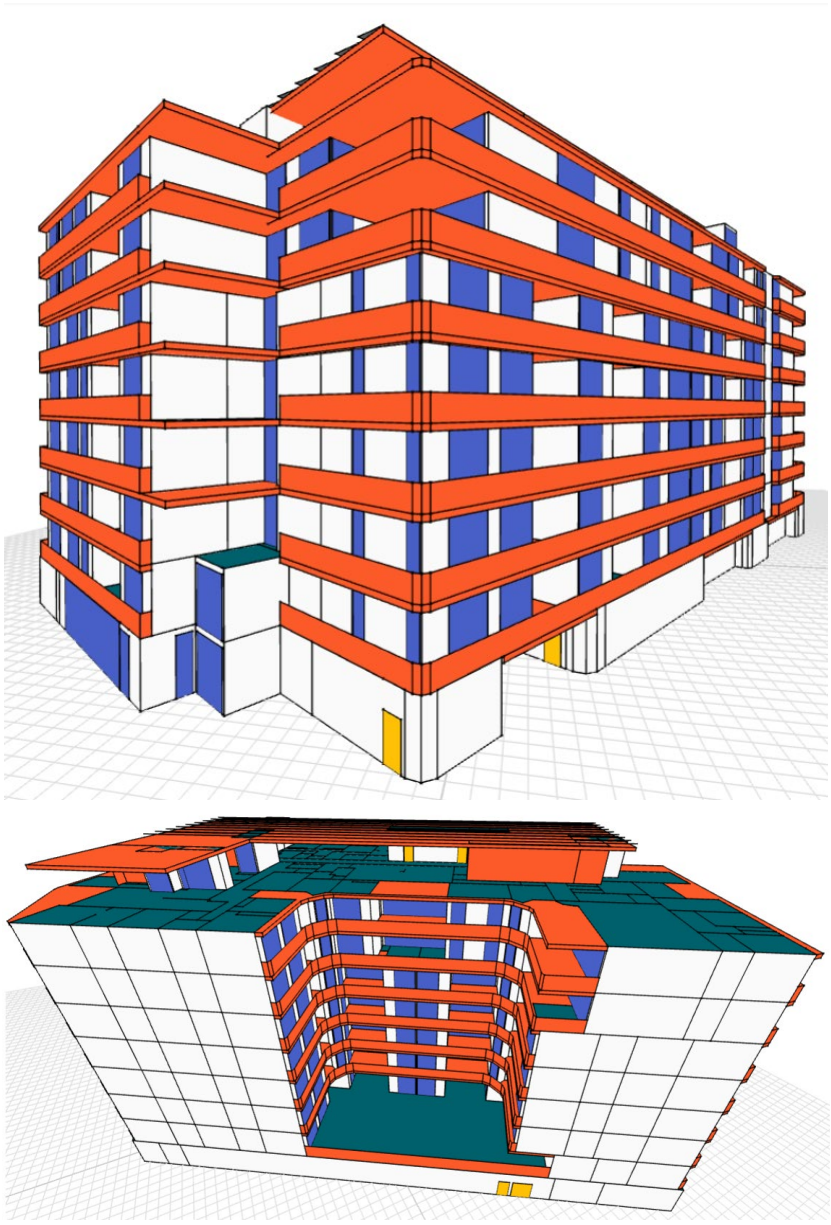

Figure 5: Daylighting Model in BetterBuilding (Speckle)

Table 3: Calculation Conditions - Daylight

CALCULATION CONDITIONS	
TEST FACTOR	Daylight Factor
SKY FACTOR	CIE Overcast Sky
DATE	September 21st 12:00pm

Table 4: Daylighting Results for Sole Occupancy Units

LEVEL	APT NO.	PROPOSE USAGE	NOMINATED AREA (m^2)	COMPLIANT AREA (m^2)	COMPLIANT AREA (%)
G	Common Areas	Lobby and Amenities	80.98	80.98	**100.00**
1	C4	Living and Bedrooms	58.00	33.56	**57.86**
1 - 5	C1b (R)		53.56	53.56	**100.00**
1 - 5	C3		66.76	66.56	**99.70**
1 - 5	C1b (L)		53.50	53.50	**100.00**
1 - 5	E2		86.80	86.80	**100.00**
1 - 5	D1		93.46	71.77	**76.79**
1 - 5	E1		81.20	70.17	**86.42**
1 - 5	C2 (L)		62.64	32.06	**50.38**
1 - 5	C2 (R)		62.64	33.16	**52.94**
1 - 5	A1		45.25	45.18	**99.85**
2 - 5	C2 (L)		63.46	42.67	**67.24**
2 - 5	C2 (R)		63.46	38.88	**61.27**
2 - 5	D2		73.82	46.05	**62.38**
6 - 7	PH1		101.50	101.50	**100.00**
6 – 7	PH2		86.80	86.80	**100.00**
6 – 7	PH3		93.3	81.31	**87.15**
6 – 7	PH4		81.20	81.20	**100.00**
6 – 7	PH5		94.36	73.56	**77.96**
6 - 7	PH6		104.44	99.59	**95.36**

Based on the results above, the proposed development meets the required daylight percentage, enhancing occupant comfort, well-being, and productivity. Additionally, by reducing reliance on artificial lighting, it contributes to lower energy consumption and a reduced environmental impact.

Showing the area above the threshold value of 160 lux:

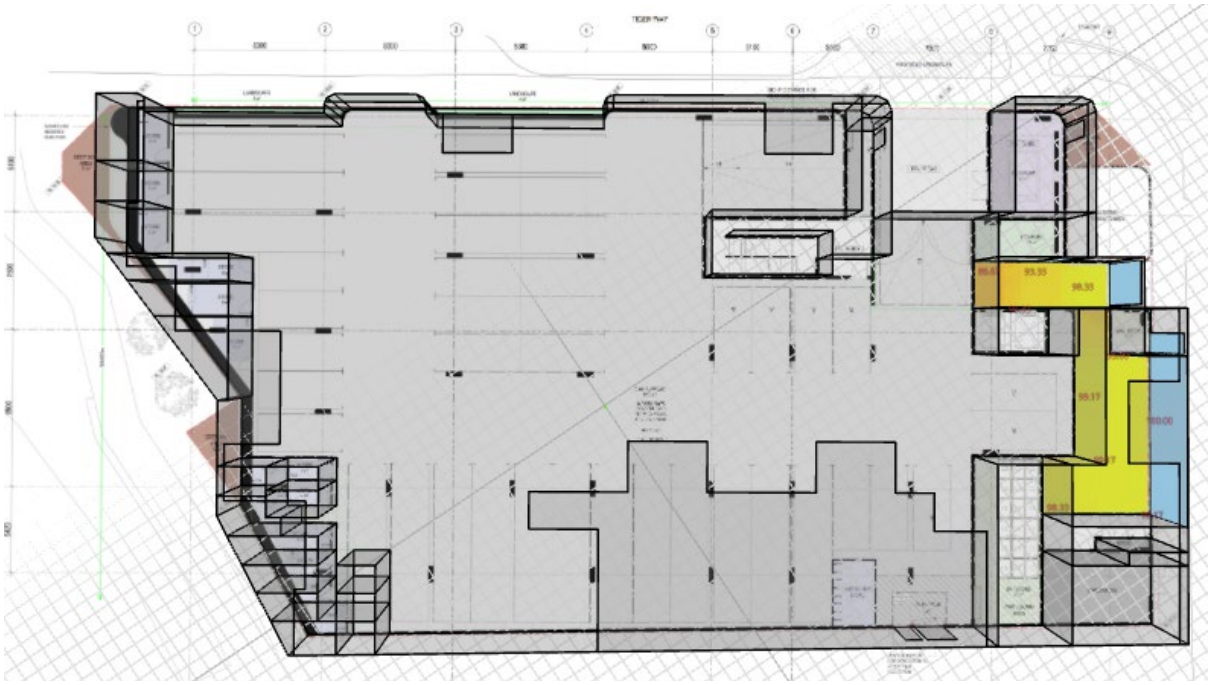

Figure 6: Daylighting for Ground Floor

Figure 7: Daylighting for First Floor

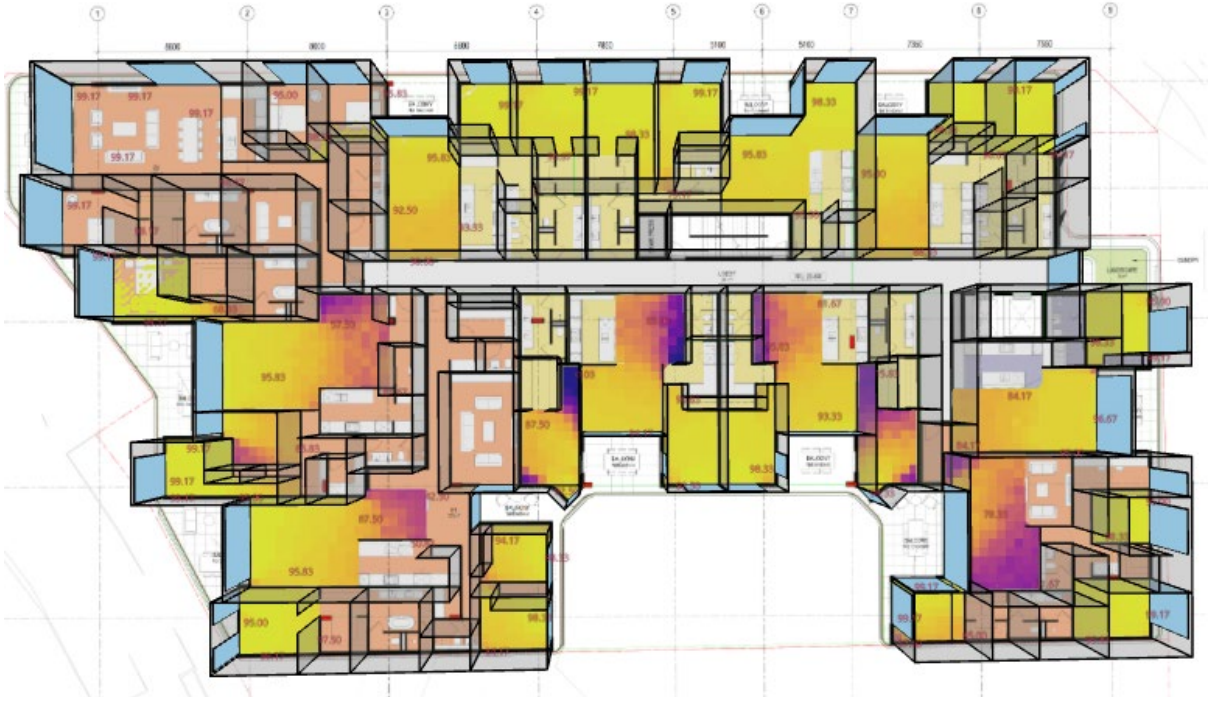

Figure 8: Daylighting for Second Floor to Fifth Floor

Figure 9: Daylighting for Sixth Floor to Seventh Floor

5.5 RENEWABLE TECHNOLOGY

Based on available roof space, EMERGEN recommends committing to allocating at least 80% of usable roof area for a commercial solar PV system.

The total roof area is approximately 1,370 m^2 and using a conservative 50% utilisation factor for panel placement (allowing for plant, access, fire setbacks and shading allowances), around 685 m^2 can be dedicated to solar PV.

This corresponds to an estimated system capacity of **~129.1 kW**, which would provide a significant operational energy offset for the common areas and reduce long-term electricity demand.

Final sizing will be confirmed during detailed design; however, the recommended commitment ensures the project secures meaningful renewable energy generation aligned with best-practice commercial developments.

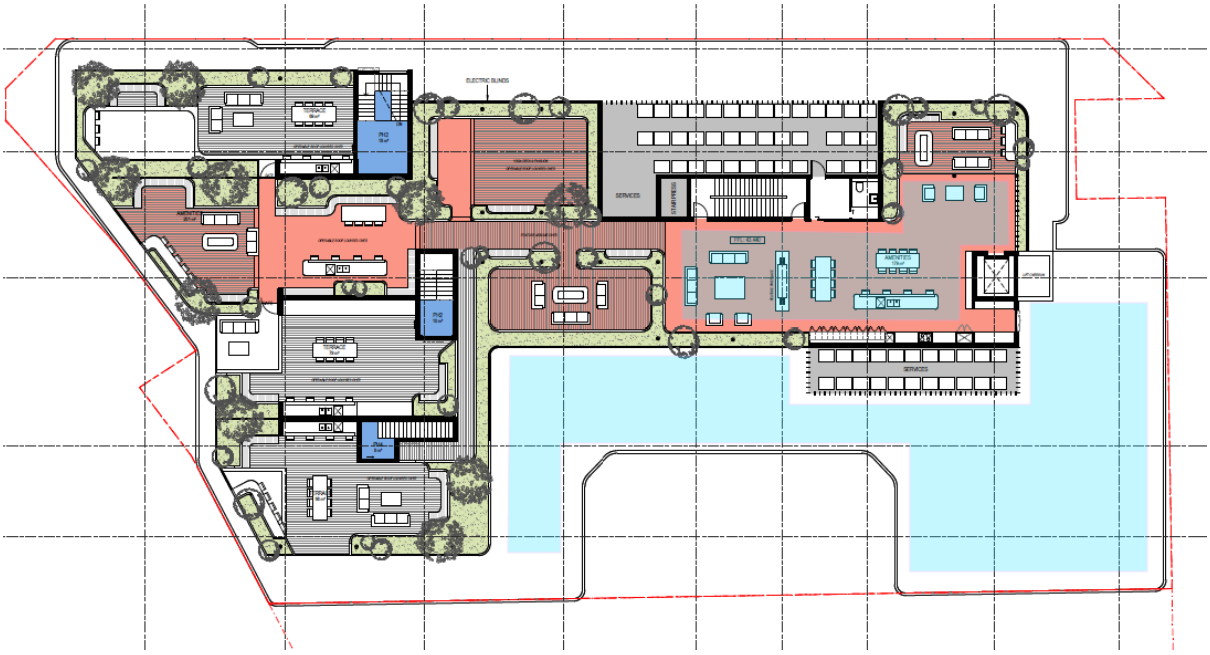

Figure 10: Provision for Solar PV System

5.6 ENERGY USE

Energy savings in a building can be realised by minimising the need for heating and cooling through a well-designed and insulated façade. The design team will focus on enhancing energy efficiency by exceeding the minimum requirements of NCC Section J. This will involve optimising the building envelope, air conditioning and ventilation systems, and lighting to ensure lower energy consumption.

The review has been undertaken in accordance with the Energy Efficiency provisions of the NCC 2022 – Amendment 1 for each class of building referred in the table below:

Table 5: Energy Compliance Overview

BUILDING	CLASS	VERIFICATION
61 x Sole Occupancy	2	NatHERS
Amenities	2 Common Areas	Solar and Daylighting

These results are produced from models based on the documentation provided by the Architects. Any updates to these plans may affect the results and may require a change to specification (Section 5.1.1 – 5.1.2).

5.6.1 BUILDING SPECIFICATIONS FOR SOLE OCCUPANCY UNITS – CLASS 2

The construction for the proposed building envelope is as per plans provided during the DA stage are outlined below. *These specifications may require upgrades once all units are modelled.*

Table 6: Proposed Building Specifications for Apartment Units

CONSTRUCTION		DESCRIPTION	REQUIREMENT
EXTERNAL WALLS	External Steel Framed Wall	9mm FC Cladding on 92mm steel stud with 13mm plasterboard lining.	**R0.2 thermal break** between external cladding and steel frame with **R2.0 insulation batts** inside steel frame. ***Total R-Value=2.1***
INTERNAL WALLS	Steel Framed Wall	92mm steel stud with 13mm plasterboard lining.	**No Insulation Required.**
	Lift/Stair Wall	250mm Concrete wall with 13mm plasterboard lining.	**No Insulation Required.**
FLOORS	Suspended Slab	250mm suspended concrete Slab. Floor coverings as per plans.	**R1.3 K10 Soffit Insulation** *to exposed/carpark below suspended floors.*
CEILINGS/ ROOFS	Roof Type 1	250mm suspended concrete Slab.	**R5.0 Insulation Batts** to dropped plasterboard ceilings. *To exposed roofs only*

** Wall constructions have been simplified for modelling purposes using worst-case assumptions.*

Table 7: Proposed Glazing Specifications for Apartment Units

WINDOW SPECIFICATION	U-VALUE	SHGC

EXTERNAL GLAZING 1	Single Glazed Low-E Clear in aluminium frame.	**4.57**	**0.56**
EXTERNAL GLAZING 2	Double Glazed Low-E Clear in aluminium frame.	**3.10**	**0.27**

Note: The glazing values specified are for whole systems values (glass + frame).

5.6.2 ESTIMATED ENERGY USED FOR SOLE OCCUPANCY UNITS – CLASS 2

The results below are based on NatHERS rating. The minimum requirement under the NCC 2022 is 6 stars and average of 7 stars. The worst case apartments have been modelled.

Table 8: Options and Upgrades Required

APARTMENT TYPE	FLOOR INSULATION R1.3	CEILING INSULATION R5.0	SINGLE GLAZED (U=4.57, SHGC=0.56)	DOUBLE GLAZED (U=3.10, SHGC=0.27)
C1b	X		X	
C4	X		X	
E1	X		X	
C2			X	
A1			X	
D1			X	
SPH3			X	
SPH4			X	
SPH5			X	
PH2		X		X
PH3		X		X
PH6		X		X

Table 9: NatHERS Results

APARTMENT TYPE	LEVEL	HEATING (MJ/m^2)	COOLING (MJ/m^2)	TOTAL	STAR RATING	THERMAL IMPACT
C1b	1	20.3	32.7	53.0	7.5	Exposed Floor
C4	1	29.6	33	62.6	6.9	Exposed Floor
E1	1	42.7	26.7	69.4	6.5	Exposed Floor
C2	2	25.2	27.1	52.3	7.5	
A1	3	30.2	30.3	60.5	7.0	
D1	3	10.0	31.2	41.2	8.1	
SPH3	6	12.7	23.8	36.5	8.4	
SPH4	6	20.9	25.2	46.1	7.8	

SPH5	6	27.7	23.7	51.4	7.6	
PH2	7	32.0	42.4	74.4	6.3	Exposed Roof
PH3	7	35.5	33.0	68.5	6.6	Exposed Roof
PH6	7	42.1	27.4	69.5	6.5	Exposed Roof
AVERAGE					**7.23**	

The project is committed to meet the minimum requirement under the NCC 2022 is 6 stars and average of 7 stars.

6 URBAN ECOLOGY

Urban ecology is crucial for conserving biodiversity and enhancing urban life. Well-planned buildings and landscapes protect biodiversity and support sustainable practices, including low water and fertilizer use and the selection of native plants.

The current site has no existing vegetation. The proposed redevelopment restores ecological function through:

- >70% native or drought-tolerant species mix
- Deep soil zones along Shenton Road and the boundary to Claremont Oval.
- Landscaped areas to the outdoor terrace on Level one and the rooftop terrace
- Shrubs and low water planting
- Pedestrian-oriented front verge interface, improving amenity and microclimate

*For more information please see [Landscape Architect's] Landscape Design Report.

Figure 11- Landscaping to the Outdoor Terrace

6.1 HEAT RESILIENCE

The heat island effect occurs when urban areas are warmer than their rural surroundings due to the built environment. The roof and external finishes have been reviewed to ensure heat resilience and long-term comfort. A light-coloured roof with a Solar Reflectance Index (SRI) ≥70 has been proposed to minimise heat absorption and reduce urban heat island effects.

The strategies that can be used to reduce the heat island effect are:

- Vegetation
- Green roofs
- Roofing materials, including shading structures, having the following:
  – For roof pitched <15°– a three-year SRI of minimum 64
  – For roof pitched >15°– a three-year SRI of minimum 34
- Unshaded hard-scaping elements with a three-year SRI of minimum 34 or an initial SRI of minimum 39
- Hardscaping elements shaded by overhanging vegetation
- Water bodies and/or water courses
-

7 WATER EFFICIENCY

7.1 SUSTAINABLE WATER INITIATIVES

Western Australia has a limited potable water supply due to the increases in population and reductions in annual rainfall levels. By reducing demand this will help to alleviate the concerns related to potable water

usage. The development aims to achieve a minimum 20% reduction in potable water consumption compared to established benchmarks.

Table 10: WELS Ratings

FIXTURE / EQUIPMENT TYPE	WELS RATING
TAPS	5 Star
TOILETS	4 Star
SHOWERS	3 Star
DISHWASHERS	4 Star
WASHING MACHINES	4 Star

7.2 WATER EFFICIENT LANDSCAPING

Water-efficient landscaping refers to techniques and strategies aimed at conserving water while maintaining aesthetically pleasing and functional outdoor spaces. This is important in Western Australia due to its semi-arid climate conditions, which often result in water scarcity. Key strategies include:

- **Plant Selection:** Choosing native or drought-tolerant plant species that are well-suited to the local climate can significantly reduce water requirements.
- **Soil Improvement:** Improving soil quality through methods such as mulching and composting can enhance water retention and reduce evaporation, thereby optimizing water usage in landscaping.
- **Irrigation Efficiency:** Employing efficient irrigation systems such as drip irrigation or micro-sprinklers helps deliver water directly to plant roots with minimal waste. Additionally, using smart irrigation controllers that adjust watering schedules based on weather conditions and soil moisture levels can further enhance water efficiency.
- **Water Harvesting:** Capturing rainwater through techniques like rainwater tanks will allow for on-site water storage and reuse, reducing reliance on potable water for landscaping needs.
- Overall, water-efficient landscaping plays a vital role in conserving water resources, promoting sustainability, and mitigating the impacts of water scarcity in urban and rural environments.

8 SUSTAINABLE TRANSPORT/ ACCESSABILITY

8.1 BICYLCE PARKING FACILITIES & SUSTAINABLE TRANSPORT FACILITIES

The intention of this category is to reduce occupants' reliance on carbon-intensive vehicles. To support this, the development will include infrastructure that facilitates the future installation of electric vehicle (EV) charging stations. Additionally, secure bike storage will be provided to encourage cycling as a sustainable mode of transportation.

8.2 WALKABILITY TO THE SITE

The building's design and location encourage walking to and from several amenities within the vicinity. This means designing roads within the building boundary to prioritise pedestrians, and either providing within, or being located close to, several amenities.

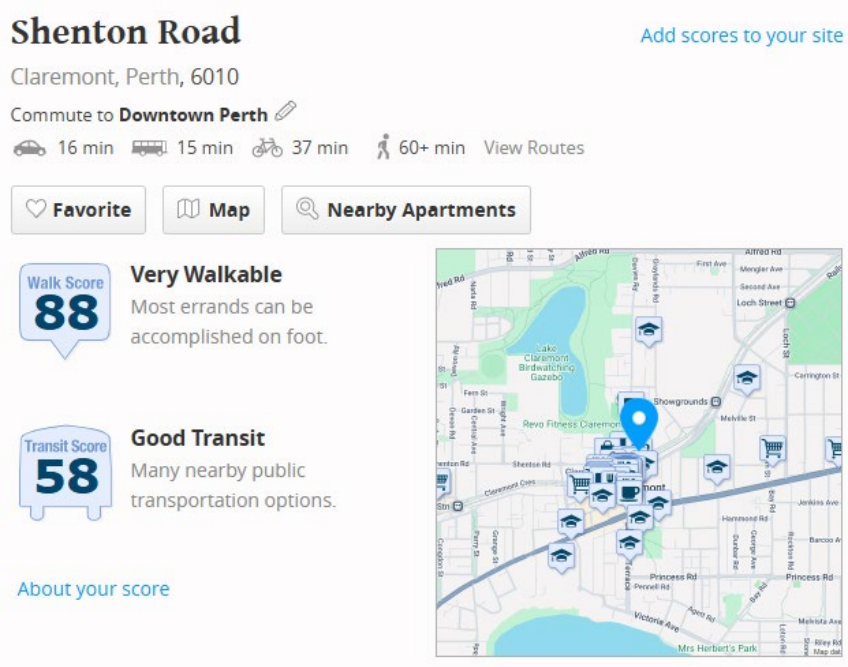

Figure 12: Walkability Score of the Proposed Development

9 INDOOR ENVIRONTMENT QUALITY

9.1 PROVISIONS FOR INCREASED OUTDOOR AIR

Pollutants entering the building are minimised, and a high level of fresh air is provided to ensure levels of indoor pollutants are maintained at acceptable levels. It is proposed that outdoor air provided to primary areas will be at a rate at least 50% greater than minimum in AS 1668.2:2012, this will need to be confirmed by the mechanical engineer.

9.2 INTERNAL FINISHES

Internal finishes (paints, adhesives, sealants, carpets) with low VOC and formaldehyde content will be prioritised.

Using low VOC (volatile organic compounds) products offers numerous benefits, primarily by enhancing indoor air quality and promoting better health. These products release fewer harmful chemicals, reducing the risk of respiratory issues, headaches, dizziness, and long-term health problems. Environmentally, low VOC products contribute less to air pollution and smog formation, supporting a healthier ecosystem.

9.3 PAINTS, ADHESIVES, AND SEALANTS

To meet the requirements, at least 95% of internally applied paints, adhesives, sealants (by volume), and carpets (by area) must meet TVOC (Total Volatile Organic Compounds) limits. Compliance with these limits can be achieved through one of the following methods:

1. **Product Certification Scheme:** The contractor can use products that are certified under a recognized and current Product Certification Scheme at the time of purchase. These schemes assess and verify the TVOC content of the materials, ensuring they meet the specified limits.
2. **Laboratory Product Testing**: If there are no certified products available, the contractor can conduct laboratory testing on the paints, adhesives, and sealants, to determine their TVOC content. The testing should be carried out using the whole paint, including water and tinters, to obtain accurate results.
3. **Absence of Non-compliant Materials**: Alternatively, if none of the materials mentioned (paints, adhesives, sealants, and carpets) are present at the time of practical completion (PC), and thus no TVOC emissions are expected, compliance can be achieved.

All paints used for internal application on the job are to have a low TVOC content as outlined below. TVOC content must be based on whole paint (water and tinters included):

Table 11: Paint VOC limits

PRODUCT TYPE / SUBCATEGORY	MAX TVOC CONTENT (G/L OF READY TO USE PRODUCT)
Walls and ceilings – Any gloss level	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65

Maximum TVOC Content Limits for Paints, Varnishes and Protective Coatings
*EU Directive
The TVOC content of the 'ready-to-use' paint shall be theoretically calculated as the sum total of the VOCs of each of the raw material component comprising the paint.

Where the TVOC content of individual components is not known, it must be determined experimentally by one of the following testing methods as appropriate:

- ISO Method 17895 (2005), for a material with a presumed VOC content <1%;
- ISO Method 11890-2 (2006), for a material with a presumed VOC <15%;
- ISO Method 11890-1 (2007), for a material with a presumed VOC content >15%;
- ASTM D3960, which is comprised of four individual testing procedures that measures TVOC (D2369) as well as density (D1475) and water content (D4017). Exempt compounds (D4457) must not be subtracted in the calculation of VOC content.

The contractor must obtain written approval from the design team before using any sealant, adhesive, paint, flooring or fit out items. This approval will be contingent on the provision of proof that the product has a VOC content below that noted above.

At the end of construction, the contractor is required to undertake a final audit to ensure that the correct products have been used.

All sealants used in an internal application on the job are to have a low TVOC content as outlined below.

Table 12: Adhesives/Sealants VOC limits

PRODUCT	MAXIMUM TVOC CONTENT (G/LITRE)

General purpose adhesives and sealants	50
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140

Maximum TVOC limits for Adhesives & Sealants
*Sealants used to enhance the fire- and water-proofing properties are included.

The testing method applicable to adhesive and sealants is only ASTM D3960 as detailed above for paints. For more information on ASTM D3960 refer to South Coast Air Quality Management District Rule 1168.

The contractor must obtain written approval from the design team before using any sealant, adhesive, paint, flooring or fitout items. This approval will be contingent on the provision of proof that the product has a VOC content below that noted above.

At the end of construction, the contractor is required to undertake a final audit to ensure that the correct products have been used.

All carpets and/or other flooring used on the project are to have low TVOC emission rates as outlined below.

Table 13: Carpet VOC limits

ALL CARPET/FLOORING PRODUCTS MUST COMPLY WITH TVOC EMISSION LEVELS	
Total VOC limit	0.5 mg/m^2 per hour
4-pc (4-Phenolcycohexene) limit	0.05 mg/m^2 per hour

Compliance Testing: Refer to Carpet and Rug Institute Green Label (US) OR American Society for Testing and Materials (ASTM) D5116 Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Material/Products OR

For carpets and laminate floor coverings, an option for demonstrating compliance with TVOC levels is as follows: ISO 10580 (also known as ISO/TC 219) – Document N238 – Resilient,

Textile and Laminate Floor Coverings Evaluation of Volatile Organic Compounds Emissions, with a limit of 500µg/m^2/hr at 24 hours. OR

For floor coverings (other than carpet), an option for demonstrating compliance with TVOC levels is as follows:

ISO16000 parts 9, 10 and 11 (also known as the EN 13419), with a TVOC limit at three days of 5mg/m^2/h and 0.5mg/m^2/h at 28 days.

Carpet or other flooring installed as part of the base building works prior to fit out works, can be deemed re-used for the purpose of this credit.

The contractor must obtain written approval from the design team before using any sealant, adhesive, paint, flooring or fit out items. This approval will be contingent on the provision of proof that the product has a VOC content below that noted above.

At the end of construction, the contractor is required to undertake a final audit to ensure that the correct products have been used.

There are two options for demonstrating compliance for carpets, as follows:

Option A - Product Certification:

Carpets certified under a relevant Product Certification Scheme standard recognised by the GBCA under the GBCA assessment Framework for Product Certification Schemes are deemed to satisfy the requirements of this criterion. Relevant GBCA recognized standards are listed on the GBCA web site. The certificate must be current at the time of project registration or submission and list the relevant product name and model.

A UL GREENGUARD Children & Schools® certification current at the time of project registration or submission is another acceptable evidence for demonstrating compliant TVOC levels for carpets.

Option B - Experimental Testing

All carpets comply with the Total VOC (TVOC) limits within Table below. The emission levels detailed in this table must be established by a NATA or another ISO/IEC17025 accreditation laboratory.

Table 14: Flooring VOC limits

ALL CARPET/FLOORING PRODUCTS MUST COMPLY WITH TVOC EMISSION LEVELS – TO ASTM D5116 TEST PROTOCOL	
Carpets using ASTM D5116 Test Protocol:	
Total VOC limit	0.5 mg/m^2 per hour
4-pc (4-Phenolcycohexene) limit	0.05 mg/m^2 per hour
Carpet using ISO 16000 test protocol (also known as EN 13419)	
TVOC at three days-	0.5 mg/sqm per hour
Flooring using ISO 10580 (also known as ISO/TC 219) – Document	
TVOC at 24 hours - 0	0.5mg/sqm per hour

9.4 FORMALDEHYDE MINIMISATION

All engineered wood products used internally, including exposed and concealed applications, must have low formaldehyde emissions as defined in the table below, or contain no formaldehyde. Engineered wood products are defined as particleboard, plywood, veneer, MDF, Laminated Veneer Lumber (LVL), High-Pressure Laminate (HPL), Compact Laminate and decorative overlaid wood panels and include both finished and unfinished products.

These requirements are not applicable to exterior applications, formwork, internal car park applications, reused engineered wood products or raw timber.

The contractor must obtain approval from the design team before substituting any product.

The limits listed here are defined according to the test method. The levels listed are equivalent results for different test procedures.

Table 15: Formaldehyde emission limits

TEST PROTOCOL	EMISSION LIMIT/ UNIT OF MEASUREMENTS
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	< 1.0 mg/L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.0 mg/L
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A1901 (not applicable to Plywood)	< 1.0 mg/L
ASTM D5116	<0.1 (+/- 0.0005) mg/m^{2}hr (may also be represented as mg/m^2/hr)
ISO 16000 part 9, 10 and 11 (also known as EN 13419)	<0.1 (+/- 0.0005) mg/m^{2}hr (may also be represented as mg/m^2/hr)
ASTM D6007	0.12mg/m^3*
ASTM E1333	0.12mg/m^3**
EN 717-1 (also known as DIN EN 717-1)	0.12 mg/m^3
EN 717-2 (also known as DIN EN 717-2)	3.5 mg/m^{2}hr (may also be represented as mg/m^2/hr).
*The test report must confirm that the conditions of Table 1 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.	

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10 CONCLUSION

In conclusion, the report outlines sustainability commitments that align with core principles, focusing on energy and water efficiency. It highlights efforts to promote environmental responsibility and resource efficiency, underscoring a commitment to a greener, more sustainable future.

Table 16: Sustainability Commitments

DESCRIPTION	GOAL	SUSTAINABILITY COMMITMENTS
STRUCTURE DESIGN EFFICIENCY	Integrate passive solar design principles into optimising solar access in winter and shading in summer.	• Enhance solar passive performance by incorporating shading devices on north, east, and west-facing windows to reduce summer heat gain and improve visual interest.
ENERGY EFFICIENCY	Enhance energy performance by reducing consumption through efficient design and the use of renewable and low-energy systems.	• Efficient LED Lighting and controls. • **20%** reduction in lighting power when compared to NCC DTS • For Class 2 units, above **60%** of the combined living and bedroom area of each unit have high level of daylight (above 160 Lux). • Provision for solar photovoltaic (PV) system to supply renewable energy. • NCC 2022 compliant building fabric. • All units meet the minimum NatHERS energy efficiency requirement of 6 stars for sole occupancy and average of 7 stars, based on the NCC 2022. • Energy efficient condenser clothes dryers
WATER EFFICIENCY	Water efficient fixtures and Landscaping.	• High WELS Ratings • Water sensitive urban design, drip irrigation.
HEAT RESILIENCE	Reduce impacts of heat island effect	• Light roof colour (SRI ≥ 0.64). • Incorporate vegetation and green spaces around the building to provide shading and reduce surrounding air temperatures.
SUSTAINABLE TRANSPORT/ ACCESSABILITY	Low carbon options	• Provision for future EV charging bays. • Provision for secure bicycle storage area. • Access to public transport
INDOOR ENVIRONMENT QUALITY	Enhance indoor air quality	• Natural ventilation to all apartment units. • Low VOC and Low Formaldehyde products to be used. • Minimum 95% of internally applied paints, adhesives, sealants (by volume), and carpets (by area) must meet TVOC limits.