



EMERGEN

SUSTAINABLE DESIGN ASSESSMENT REPORT

PROPOSED LARGE FORMAT RETAIL EXPANSION, TREEBY

Lot 701 Armadale Road, Treeby WA

PREPARED BY

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CONTENTS

1	OVERVIEW	3
1.1	STATE PLANNING POLICY SUMMARY	3
1.2	DESIGN AND CONSTRUCT TO AUSTRALIAN BEST PRACTICE.....	4
2	PROJECT INFORMATION	6
3	ENERGY REDUCTION STRATEGY	6
3.1	BUILDING ENVELOPE	7
3.2	ENERGY USE	8
4	LIGHTING COMFORT	10
4.1	EFFICIENT LIGHTING AND CONTROL.....	11
4.2	ARTIFICIAL LIGHTING AND CONTROLS	12
4.3	DAYLIGHTING.....	12
4.4	SOLAR ANALYSIS	13
5	URBAN ECOLOGY.....	15
5.1	MINIMISING HEAT ISLAND EFFECT	15
6	WATER EFFICIENCY.....	16
6.1	SUSTAINABLE WATER INITIATIVES	16
6.2	LANDSCAPE AND IRRIGATION PLAN.....	16
7	MOVEMENT AND PLACE.....	17
7.1	BICYLCE PARKING FACILITIES & SUSTAINABLE TRANSPORT FACILITIES.....	17
8	WASTE EFFICIENCY.....	17
8.1	RECYCLING BUILDING MATERIALS	18
9	EXPOSURE TO TOXINS	18
9.1	INTERNAL FINISHES.....	18
9.2	PAINTS, ADHESIVES, AND SEALANTS.....	18
9.3	FORMALDEHYDE MINIMISATION	21
10	CONCLUSION	23
	APPENDIX 1 – THERMAL CONSTRUCTION - GENERAL.....	25





1 OVERVIEW

EMERGEN has developed a sustainable design report on the proposed commercial development at Lot 701 Armadale Road, Treeby WA in consultation with Meyer Shircore 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 CADDIS GROUP), in collaboration with the design team (Meyer Shircore Architects) has developed a sustainable design strategy aligning with State Planning Policy 7.0 and City of Cockburn, 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.





1.2 DESIGN AND CONSTRUCT TO AUSTRALIAN BEST PRACTICE

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

ITEM	ENVIRONMENTALLY SUSTAINABLE DESIGN INITIATIVES	RESPONSIBLE
ENERGY USE REDUCTION	Targeted 30% Reduction in predicted Energy use of the building over NCC minimum compliance. Through solar passive design principles, energy efficient building envelope, appropriate shading.	EMERGEN
RENEWABLE ENERGY	On-site solar photovoltaic (PV) systems offer a number of benefits, including reducing energy costs, mitigating environmental impacts and enhancing energy security.	EMERGEN/ Electrical
WATER EFFICIENT SANITARY FIXTURES & FITTINGS	All fixtures and water-using appliances installed within the project's scope will at a minimum, meet the following WELS ratings. Taps – 5 star Urinals – 5 star Toilets – 4 star Showers – 3 star Dishwasher – 5 star	Architect/ Hydraulic
ARTIFICIAL LIGHTING	Efficient LED Lighting will be provided. Lighting within the building will meet the following requirements: • Colour Rendering Index (CRI) 85 or higher. • Have a MacAdam Ellipse or a Standard Deviation Colour Matching (SDCM) of ≤ 3.	Electrical
WASTE EFFICIENCY	A waste planning expert will produce an Operational Waste Management Plan (OWMP) that addresses best practice in operational waste management, which will include clearly identified waste streams and setting diversion from landfill targets.	Client
SUSTAINABLE MATERIALS	Materials (concrete, steel, engineered wood etc) with low carbon emissions and recycled content will be considered. Materials with Environmental Product Declarations (EPD) will be prioritised.	Structural to include in design.
LOW VOC FINISHES	Finishes (paints, adhesives, sealants, carpets) with low VOC and formaldehyde content will be considered.	Architect to include in design.





ITEM	ENVIRONMENTALLY SUSTAINABLE DESIGN INITIATIVES	RESPONSIBLE
HEAT RESILIENCE	The following strategies will be utilised to mitigate heat island effect: • Increase green spaces, i.e., vegetation. • Roofing materials will have a Solar Reflective Index (SRI) ≥ 64. Furthermore, the project will explore passive design strategies, including optimal building orientation, the use of sunshades, and efficient glazing, etc to mitigate heat stress caused by solar radiation.	Architect to include SRI values for roof materials in design.
WATER EFFICIENT LANDSCAPING	Landscaping with low crop coefficients will be considered so that water use is minimised. Landscape irrigation to use efficient irrigation systems such as drip irrigation.	Landscape to include in design.
BIODIVERSITY ENHANCEMENT	A focus on native and locally endemic vegetation for new landscaped areas, including Pocket Parks and screening	Landscape to include in design
SUSTAINABLE TRANSPORT OPTIONS	Sustainable transport options to be provided for staff and visitors to the facility Provide adequate EOT facilities and bicycle parking	Architect/ Client / Electrical to confirm





2 PROJECT INFORMATION

The proposed commercial development site is located at Lot 701 Armadale Road, Treeby WA. The project focuses on large format retail which comprises of 7 buildings in the proposed stage 2.



Figure 1: Proposed Development

3 ENERGY REDUCTION STRATEGY

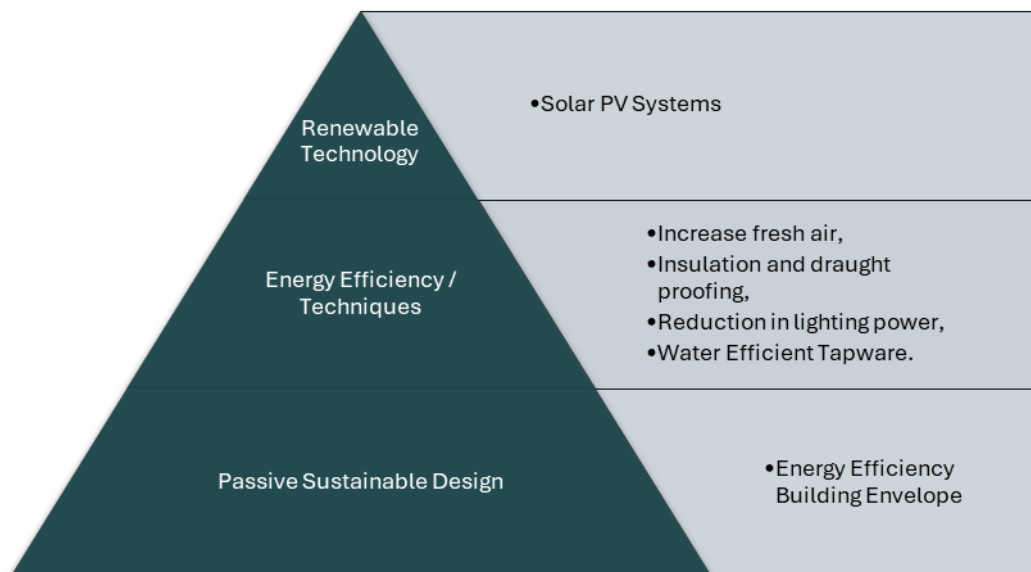


Figure 2: Energy Reduction Strategy





3.1 BUILDING ENVELOPE

Energy savings can be achieved within a building through the reduction for the need for heating and cooling by means of a well-designed and insulated façade. The construction for the proposed building envelope is as per plans provided and outlined below.

3.1.1 BUILDING FABRIC

CONSTRUCTION		DESCRIPTION	REQUIREMENT
ENVELOPE WALLS	External Concrete Wall	150mm Concrete tilt panel on 92mm steel stud frame with plasterboard lining. External finishes as per elevations	R2.5HD Insulation Batts inside steel frame.
	Party Wall	200mm Concrete tilt panel	No Insulation Required.
FLOORS	Concrete Slab	Concrete Slab on ground	No Insulation Required.
	Concrete Slab	Suspended concrete slab	No Insulation Required.
CEILINGS/ ROOFS	Roof Type 1	Metal deck roof sheeting. Roof colour not specified (SA ≤ 0.45)	130mm R3.6 Anticon to be installed under roof sheeting with 120mm Ashgrid Roof Spacer System

WINDOW SPECIFICATION		U-VALUE	SHGC
EXTERNAL GLAZING	Single Low E Neutral glazing in aluminium frame. (i.e., 6.38mm Viridian ComfortPlus Neutral , or equal)	4.42	0.48

Note: Glazing values provided are for Whole System (Frame + Glass)





3.2 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 BCA 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 2: Energy Compliance Overview

BUILDING	CLASS	VERIFICATION
1: Tenancy 11-19	6	J1V3 – Verification using a reference building
2: Tenancy 8-10	6	
3: Tenancy 4-7	6	
4: Tenancy 24-26	6	
5: Tenancy 20-23	6	
6: Tenancy 1-2	6	
7: Tenancy 3 +BOH	6	

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 3.1.1).

The design team has also included provisions for future solar PV installation on the roof of all buildings, accommodating both structural and electrical requirements. The plan is to install the solar systems within two years of the building's operational start.

3.2.1 ESTIMATED ENERGY USED

The figures shown below demonstrate the difference in performance between the Proposed Building and the Reference Building, allowing for a quantifiable comparison on the performance of each building using J1V3-Verification using reference building method. It's important to note that a **solar photovoltaic (PV) system** have been integrated into the proposed building's design to assist in offsetting the overall energy consumption by 30% over an NCC deemed to satisfy building.

Table 3: Estimated Energy Used – Building 1

MODEL	HEATING	COOLING	FANS	LIGHTS	EQUIP	PV	TOTAL
REFERENCE (kWh/m ²)	1.17	7.21	0.64	41.20	30.49		80.71
PROPOSED (kWh/m ²)	1.12	6.93	0.60	41.2	30.49	-24.42	55.91
ENERGY REDUCTION							30.5%

It's important to note that an approximate sized **170kW solar photovoltaic (PV) system** has been integrated into the proposed building's design to assist in offsetting the overall energy consumption.





Table 4: Estimated Energy Used – Building 2

MODEL	HEATING	COOLING	FANS	LIGHTS	EQUIP	PV	TOTAL
REFERENCE (kWh/m ²)	1.03	6.33	0.54	38.54	30.28	-	76.69
PROPOSED (kWh/m ²)	0.99	6.23	0.53	38.51	30.28	-22.7	53.84
ENERGY REDUCTION							30%

It's important to note that an approximate sized **170kW solar photovoltaic (PV) system** has been integrated into the proposed building's design to assist in offsetting the overall energy consumption.

Table 5: Estimated Energy Used – Building 3

MODEL	HEATING	COOLING	FANS	LIGHTS	EQUIP	PV	TOTAL
REFERENCE (kWh/m ²)	0.52	8.70	0.65	41.61	30.68	-	82.16
PROPOSED (kWh/m ²)	0.46	8.20	0.60	41.61	30.68	-25.4	56.15
ENERGY REDUCTION							31%

It's important to note that an approximate sized **55kW solar photovoltaic (PV) system** has been integrated into the proposed building's design to assist in offsetting the overall energy consumption.

Table 6: Estimated Energy Used – Building 4

MODEL	HEATING	COOLING	FANS	LIGHTS	EQUIP	PV	TOTAL
REFERENCE (kWh/m ²)	1.48	8.85	0.79	40.21	30.39	-	81.72
PROPOSED (kWh/m ²)	1.42	8.17	0.71	40.21	30.39	-23.11	58.61
ENERGY REDUCTION							29%

It's important to note that an approximate sized **20kW solar photovoltaic (PV) system** has been integrated into the proposed building's design to assist in offsetting the overall energy consumption.

Table 7: Estimated Energy Used – Building 5

MODEL	HEATING	COOLING	FANS	LIGHTS	EQUIP	PV	TOTAL
REFERENCE (kWh/m ²)	1.1	7.46	0.65	28.96	23.04	-	61.21
PROPOSED (kWh/m ²)	1.01	8.49	0.75	28.96	23.04	-18.3	43.95
ENERGY REDUCTION							30%

It's important to note that an approximate sized **45kW solar photovoltaic (PV) system** has been integrated into the proposed building's design to assist in offsetting the overall energy consumption.





Table 8: Estimated Energy Used – Building 6

MODEL	HEATING	COOLING	FANS	LIGHTS	EQUIP	PV	TOTAL
REFERENCE (kWh/m ²)	0.41	8.60	0.64	41.61	30.73	-	81.99
PROPOSED (kWh/m ²)	0.4	8.05	0.58	41.61	30.73	-24.86	57.13
ENERGY REDUCTION							30%

It's important to note that an approximate sized **35kW solar photovoltaic (PV) system** has been integrated into the proposed building's design to assist in offsetting the overall energy consumption.

Table 9: Estimated Energy Used – Building 7

MODEL	HEATING	COOLING	FANS	LIGHTS	EQUIP	PV	TOTAL
REFERENCE (kWh/m ²)	0.52	7.17	0.51	37.87	31.77		77.84
PROPOSED (kWh/m ²)	0.46	7.25	0.51	37.87	31.77	-26.28	51.58
ENERGY REDUCTION							34%

It's important to note that an approximate sized **25kW solar photovoltaic (PV) system** has been integrated into the proposed building's design to assist in offsetting the overall energy consumption.

Table 10: Annual Greenhouse Gas Emissions

MODEL	ANNUAL GREENHOUSE GAS EMISSIONS	
	REFERENCE kgCO ₂ -e	PROPOSED kgCO ₂ -e
BUILDING 1	668,495.71	466,186.86
BUILDING 2	625,147.24	440,136.52
BUILDING 3	214,073.14	147,907.04
BUILDING 4	86,710.40	62,192.89
BUILDING 5	160,839.22	112,915.42
BUILDING 6	140,974.66	98,229.99
BUILDING 7	85,131.29	56,385.13

4 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.

4.1 EFFICIENT LIGHTING AND CONTROL

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 J6.2a of the NCC 2019. Motion Detectors and daylight sensors are provided to reduce demand.

Table 11: Lighting Characteristics

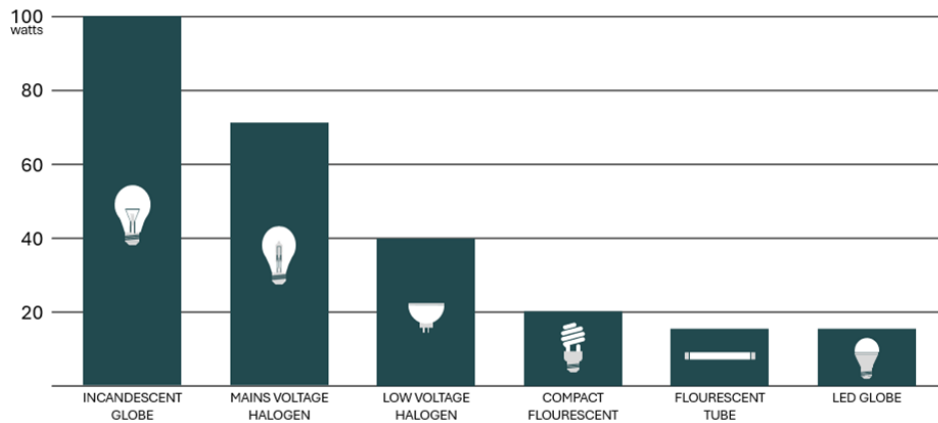
PARAMETER	PROPOSED BUILDING	REFERENCE BUILDING
LIGHTING TYPE	LED light fittings	LED light fittings
DESIGN ILLUMINANCE (LUX)	Various lux	Various lux
NOMINAL LIGHTING POWER DENSITY (W/M ²)	20% less compared to NCC max requirements.	As per NCC max requirements.
OCCUPANT SENSOR CONTROLS	Motion sensors	N/A
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





4.2 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.



4.3 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 target 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 non-residential buildings, at least 40% of the regularly occupied areas across the building must receive high levels of daylight with no less than 20% on any floor or tenancy (whichever is smaller).

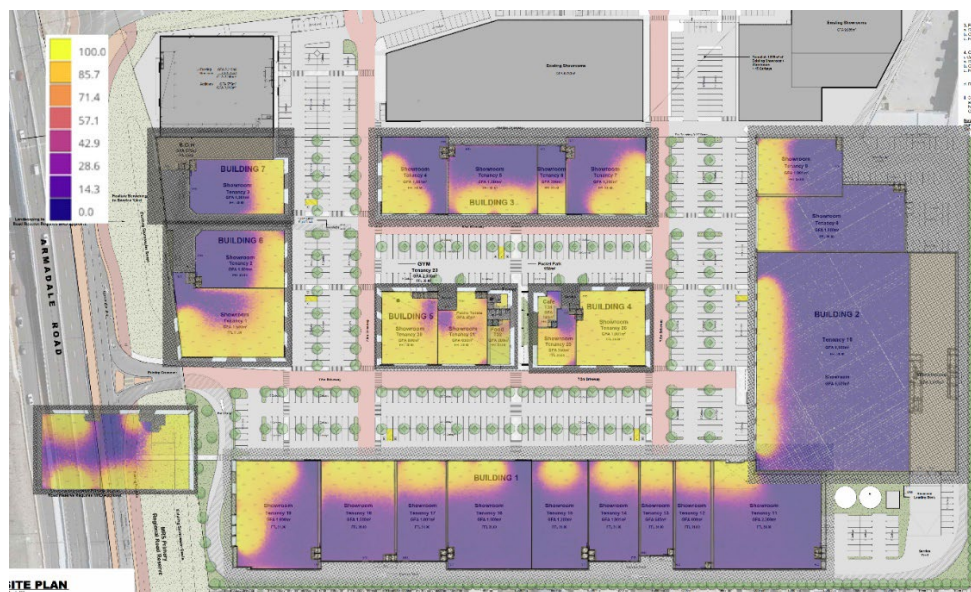


Figure 3: Daylighting Model





Table 12: Calculation Conditions - Daylight

PARAMETER	INPUT
Dynamic daylight simulation	Spatial Daylight Autonomy (sDA)
Sky model	Standard CIE overcast sky
Grid size	0.5 m
Grid height	0.0 m

Table 13: Daylighting Results for each commercial unit

BUILDING NUMBER	PROPOSED USAGE	NOMINATED AREA (M ²)	COMPLIANT AREA (m ²)	COMPLIANT AREA (%)
1	Showroom	11535.81	2344.14	20.31
2	Showroom	9236.33	1314.39	14.23
3	Showroom	3637.56	1241.76	34.13
4	Showroom, Cafe	1429.21	1258.84	88.08
5	Showroom, Fast Food, Gym	3463.31	225.17	65.21
6	Showroom	2411.18	1088.87	45.16
7	Showroom	964.59	280.82	29.11
AVERAGE TOTAL				42.32

Buildings 1, 2, 3 and 7 fall short of the targeted 40% of floor area receiving high levels of daylight (above 160 lux), however this is considered acceptable as Large Format Retail use artificial light to create the desired lighting levels. 160 lux is also based on best practice which is very high for this type of building.

4.4 SOLAR ANALYSIS

A solar analysis was undertaken using a detailed 3D model to assess how sunlight interacts with the building throughout the year. The modelling visualises transmitted solar radiation on window surfaces, allowing the design team to evaluate seasonal solar gains and optimise shading, glazing performance, and building orientation, as illustrated in Figures 4 - 6.

The results show that winter solar access is maximised to improve indoor comfort, while summer solar gains are effectively controlled through façade design measures. This ensures good daylight access while reducing unwanted heat loads and supporting the building's overall energy performance.



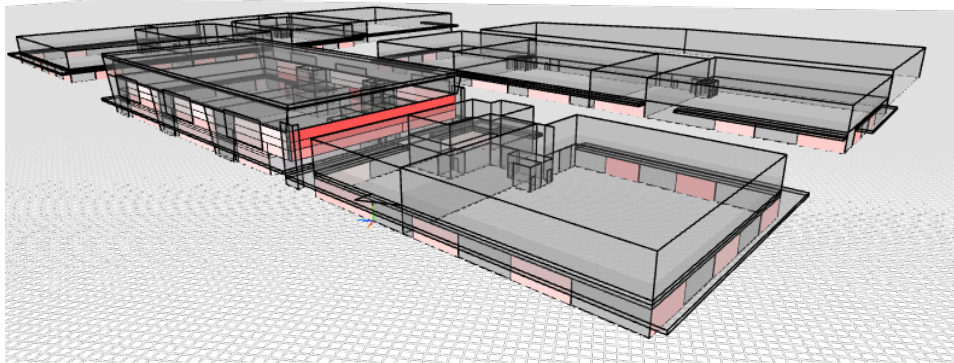


Figure 4: Building 3, 4, and 5 facades solar analysis.

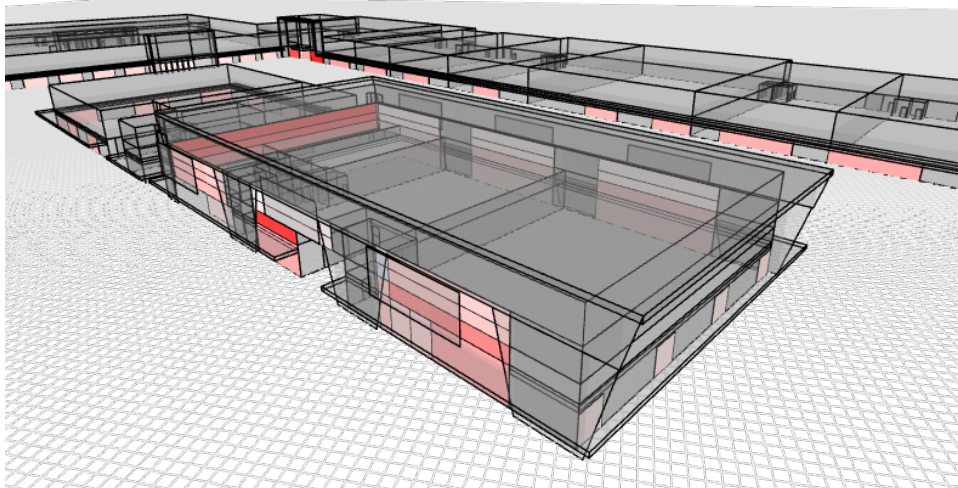


Figure 5: Building 1, 2, 3, and 4 facades solar analysis.

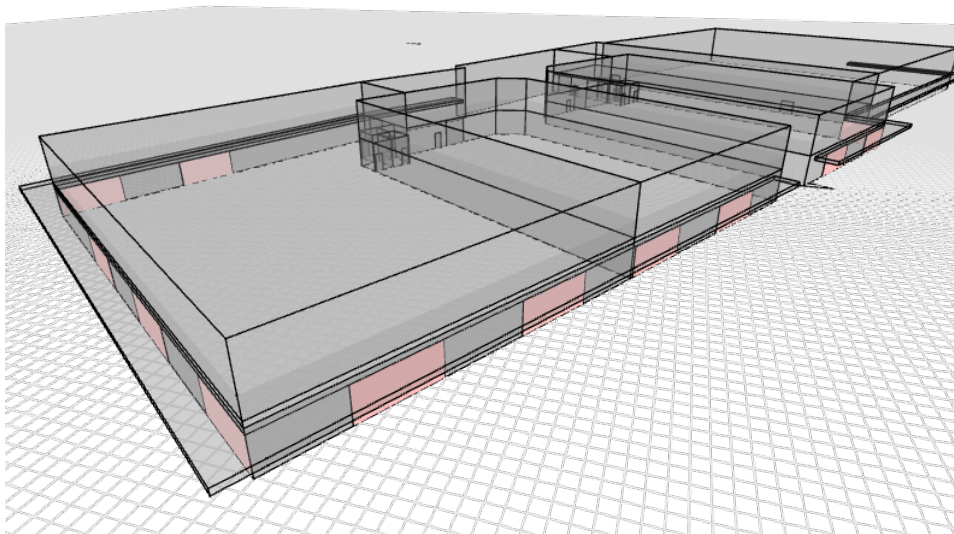


Figure 6: Building 6, and 7 facades solar analysis.





5 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. Existing mature trees in the perimeter buffers will be maintained as much as possible.

5.1 MINIMISING HEAT ISLAND EFFECT

The heat island effect occurs when urban areas are warmer than their rural surroundings due to the built environment. The design has mitigated this effect by using light-coloured roof materials and shaded landscaped areas, which significantly mitigates this effect and enhances energy savings.



Figure 7: Potential Design Provisions for Heat Island Effect





6 WATER EFFICIENCY

6.1 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 14: WELS Ratings

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

6.2 LANDSCAPE AND IRRIGATION PLAN

The development's location in Western Australia is considered a drying climate and as such, water conservation is critically important. The following sections set out design strategies utilised for this development to reduce its overall water consumption

6.2.1.1 Drip-Irrigation System

- Efficient drip irrigation system with bubblers ensuring optimal water delivery to trees and uniform hydration throughout the landscape.

6.2.1.2 Plant Selection:

- Drought-tolerant and water-wise plants will be selected wherever possible to ensure sustainable water use.

6.2.1.3 Vegetation and Landscaping:

- Native vegetation that is water-wise will be prioritized.

6.2.1.4 Car Park Design:

- The car park will feature shade trees for cooling and permeable paving to enhance water management. Traditional kerbs will be included for clear boundaries. Additionally, a swale will be integrated within the parking aisles to aid in natural water drainage and stormwater management.

6.2.1.5 Stormwater Management:

- Stormwater will be directed to an integrated system comprising a wetland, swales, and bioretention gardens, rather than being discharged into the main sewer system.





7 MOVEMENT AND PLACE

7.1 BICYCLE PARKING FACILITIES & SUSTAINABLE TRANSPORT FACILITIES

It is the intention of this category to reduce occupant's dependency on carbon intensive vehicles. Although the location of the development is not a highly walkable location, the development will install infrastructure to allow for future installation of metered EV charging stations and a high number of secured bike racks for customers and staffs.

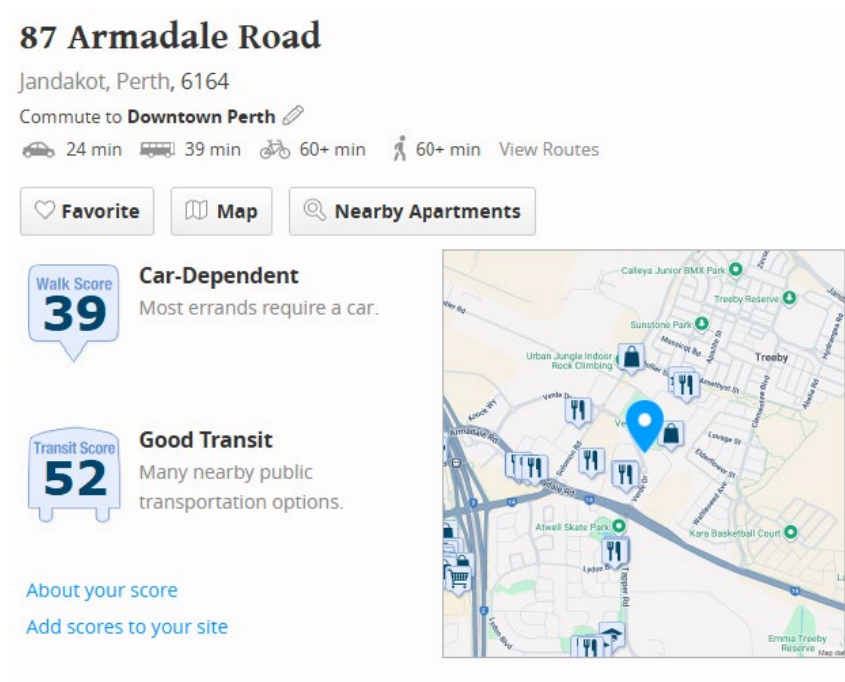


Figure 8: Walkability Score of the Proposed Development

8 WASTE EFFICIENCY

A waste planning expert will produce a Waste Management Plan (OWMP) that addresses best practice in waste management, including:

- Identifying the objectives of the plan, by setting diversion from landfill targets and / or target for reducing total materials generation (general waste materials + recyclable / reusable materials);
- Clearly identify waste streams including general waste, paper and cardboard, glass and plastic;
- Clearly identify applicable bins for various waste streams, that allow for separation of recyclable streams – or use of comingled systems where appropriate.
- Clearly identify at least one other waste stream that can be recycled, and for which recycling facilities are provided.
- Clearly identify storage areas for all waste streams identified in the OWMP.
 - Area to be sized sufficiently for all streams nominated above, based on waste generated by the project and the collection frequency for each stream; and
 - Calculations shall be based on third-party best practice guidelines.
- Outline best practice access requirements for the collection of all waste streams identified in the OWMP.





- Outline individual roles responsible for delivering and reviewing the OWMP

8.1 RECYCLING BUILDING MATERIALS

Buildings use significant natural resources throughout their lifecycle. This section will outline the impacts of material procurement and construction, and how these have been minimized compared to typical developments. The goal is to reduce the total embodied energy and carbon of the building.

Design Focus	Intended Design Initiative
Sustainable timber	• Timber used in the building and construction will primarily come from sustainable sources or be reused.
Recycled Asphalt	• Using recycled asphalt pavement
Structural and reinforcing steel	• The aim is for the majority of the steel used in the building to come from an energy-efficient processing plant and a Responsible Steel Maker

9 EXPOSURE TO TOXINS

9.1 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.

9.2 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 15: 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 16: 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 17: 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-Phenolcyclohexene) 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/m²/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/m²/h and 0.5mg/m²/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 18: 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-Phenolcyclohexene) 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

9.3 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 19: 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.	





10 CONCLUSION

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

Table 20: Sustainability Commitments

ITEM	ENVIRONMENTALLY SUSTAINABLE DESIGN INITIATIVES	RESPONSIBLE
ENERGY USE REDUCTION	Targeted 30% Reduction in predicted Energy use of the building over NCC minimum compliance. Through solar passive design principles, energy efficient building envelope, appropriate shading.	EMERGEN
RENEWABLE ENERGY	On-site solar photovoltaic (PV) systems offer a number of benefits, including reducing energy costs, mitigating environmental impacts and enhancing energy security.	EMERGEN/ Electrical
WATER EFFICIENT SANITARY FIXTURES & FITTINGS	All fixtures and water-using appliances installed within the project's scope will at a minimum, meet the following WELS ratings. Taps – 5 star Urinals – 5 star Toilets – 4 star Showers – 3 star Dishwasher – 5 star	Architect/ Hydraulic
ARTIFICIAL LIGHTING	Efficient LED Lighting will be provided. Lighting within the building will meet the following requirements: • Colour Rendering Index (CRI) 85 or higher. • Have a MacAdam Ellipse or a Standard Deviation Colour Matching (SDCM) of ≤ 3.	Electrical
WASTE EFFICIENCY	A waste planning expert will produce an Operational Waste Management Plan (OWMP) that addresses best practice in operational waste management, which will include clearly identified waste streams and setting diversion from landfill targets.	Client
SUSTAINABLE MATERIALS	Materials (concrete, steel, engineered wood etc) with low carbon emissions and recycled content will be considered. Materials with Environmental Product Declarations (EPD) will be prioritised.	Structural to include in design.
LOW VOC FINISHES	Finishes (paints, adhesives, sealants, carpets) with low VOC and formaldehyde content will be considered.	Architect to include in design.





ITEM	ENVIRONMENTALLY SUSTAINABLE DESIGN INITIATIVES	RESPONSIBLE
HEAT RESILIENCE	The following strategies will be utilised to mitigate heat island effect: • Increase green spaces, i.e., vegetation. • Roofing materials will have a Solar Reflective Index (SRI) ≥ 64. Furthermore, the project will explore passive design strategies, including optimal building orientation, the use of sunshades, and efficient glazing, etc to mitigate heat stress caused by solar radiation.	Architect to include SRI values for roof materials in design.
WATER EFFICIENT LANDSCAPING	Landscaping with low crop coefficients will be considered so that water use is minimised. Landscape irrigation to use efficient irrigation systems such as drip irrigation.	Landscape to include in design.
BIODIVERSITY ENHANCEMENT	A focus on native and locally endemic vegetation for new landscaped areas, including Pocket Parks and screening	Landscape to include in design
SUSTAINABLE TRANSPORT OPTIONS	Sustainable transport options to be provided for staff and visitors to the facility Provide adequate EOT facilities and bicycle parking	Architect/ Client / Electrical to confirm





APPENDIX 1 – THERMAL CONSTRUCTION - GENERAL

Excerpt from the BCA, Volume One - Part J1.2

Thermal Construction - General

1. Where required, insulation must comply AS/NZS 4859.1 and be installed so that it –
 - a. Abuts or overlaps adjoining insulation other than at supporting members such as studs, noggings, joists, furring channels and the like where the insulation must be against the member; and
 - b. Forms a continuous barrier with ceilings, walls, bulkheads, floors or the like that inherently contribute to the thermal barrier; and
 - c. Does not affect the safe or effective operation of a domestic service or fitting.
2. Where required, reflective insulation must be installed with –
 - a. The necessary airspace, to achieve the required R-Value between a reflective side of the reflective insulation and a building lining or cladding; and
 - b. The reflective insulation closely fitted against any penetration, door or window opening; and
 - c. The reflective insulation adequately supported by framing members; and
 - d. Each adjoining sheet of roll membrane being –
 - i. Overlapped not less than 50 mm; or
 - ii. Taped together.
3. Where required, bulk insulation must be installed so that –
 - a. It maintains its position and thickness, other than where it crosses roof battens, water pipes, electrical cabling or the like; and
 - b. In a ceiling, where there is no bulk insulation or reflective insulation in the wall beneath, it overlaps the wall by not less than 50mm.
4. Roof, ceiling, wall and floor materials, and associated surfaces are deemed to have the thermal properties listed in Specification J1.2
5. The required Total R-Value and Total System U-Value, including allowance for thermal bridging, must be –
 - a. Calculated in accordance with AS/NZS 4859.2 for a roof or floor; or
 - b. Determined in accordance with Specification J1.5a for wall-glazing construction; or
 - c. Determined in accordance with Specification J1.6 or Section 3.5 of CIBSE Guide A for soil or sub-floor spaces.

