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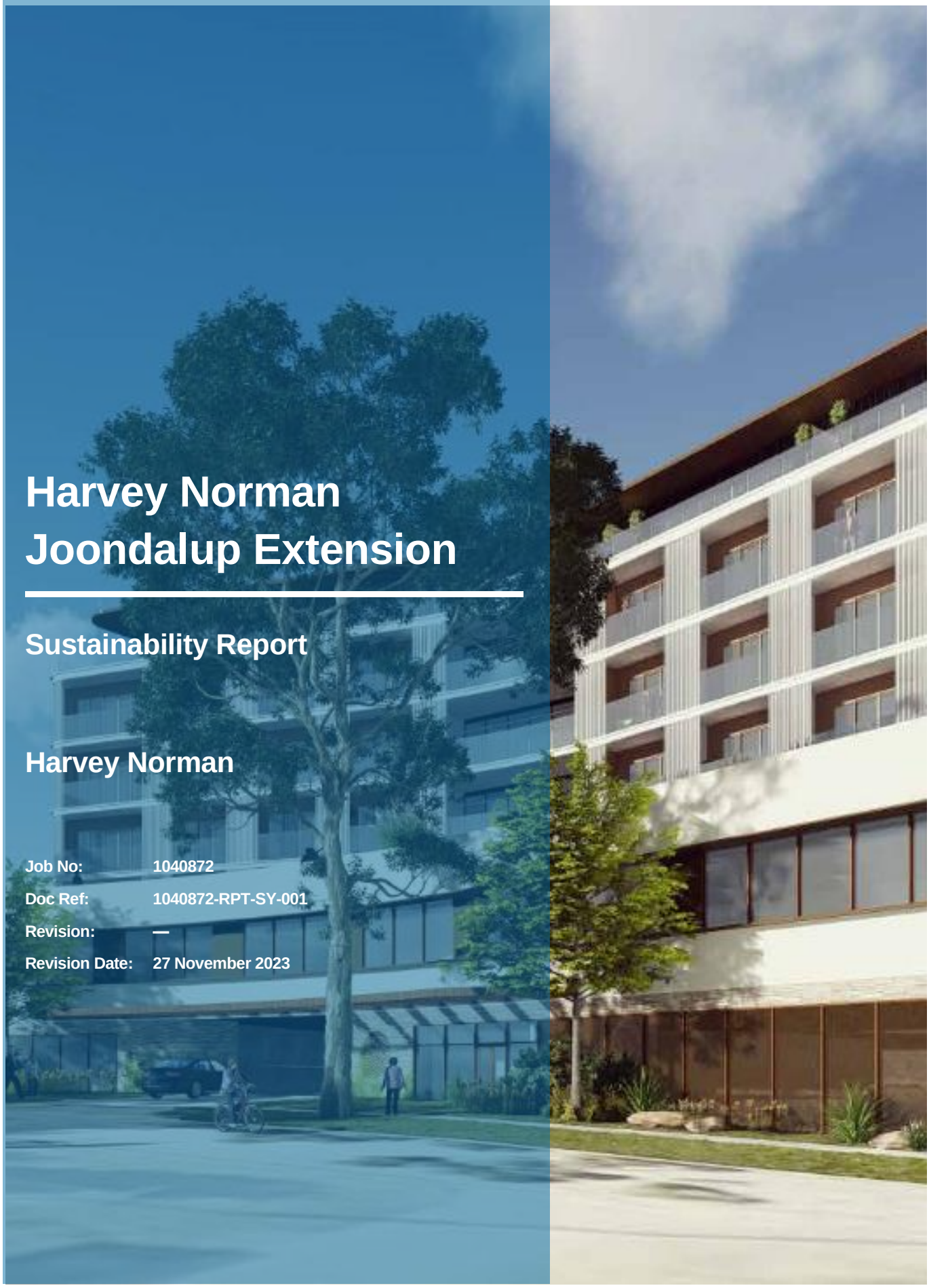

Harvey Norman Joondalup Extension

Sustainability Report

Harvey Norman

Job No:	1040872
Doc Ref:	1040872-RPT-SY-001
Revision:	—
Revision Date:	27 November 2023

	Harvey Norman Joondalup Extension	Job Number
Report title	Sustainability Report	1040872

Revision Ref	Issue Date	Purpose of issue / description of revision
-	27/11/2023	ESD report

Document Validation (latest issue)

27/11/2023	27/11/2023	27/11/2023
X	X C Gubb	X
Principal author	Checked by	Verified by
Signed by: Jordan Kirrane	Signed by: Curtis Gubb	Signed by: Jordan Kirrane

Executive summary

This report outlines the Sustainability Strategy for the proposed extension to the existing Harvey Norman retail unit on the corner of Clarke Crescent and Joondalup Drive within the City of Joondalup, Western Australia approximately 24 km from Perth CBD.

Figure 1-1 Site Location

The proposed extension is located on the existing 238 space carpark. The proposed 3,005m^2 (GFA) retail extension includes multideck parking for 197 cars, 15 motorbikes and 24 cycle spaces.

The report outlines how the proposed development aligns with the sustainability credentials of the City of Joondalup, Local Planning Scheme No. 3 and Joondalup Activity Centre Plan. **Overall, the proposed development is considered to meet all the sustainability objectives included in the City of Joondalup local planning requirements.**

Table 1-1 below confirms that the proposed development responds to each of the Local Planning Scheme requirements and outlines which sections of this report are relevant for each requirement. The site is currently zoned under:

- City of Joondalup City Centre Precinct, and
- Joondalup Activity Centre (JAC) Plan.

Table 1-1 City of Joondalup Activity Centre Plan

Development must demonstrate that:	Requirement will be met	Comments
Joondalup Activity Centre Plan, Activity. • Facilitate land assembly and redevelopment that will further intensify development and activity in the city centre. • Focus travel, employment, and user intensive activity around public transport stations and along movement corridors.	✓	The proposed extension is adding an additional 3,005m^2 of retail space to the site and retaining the majority of the existing car parking spaces with a roof top solution thereby intensifying economic activity on the site. The development also provides enhanced landscaping along Joondalup drive whilst retaining connectivity to Clark Crescent and Joondalup train station. Refer to sections 3.0, 4.0 and 8.0
Joondalup Activity Centre Plan, Movement. • Provide car parking commensurate with the road network capacity. • Provide adequate bicycle parking and end of trip facilities to promote cycling trips within JAC.	✓	The proposed development is to retain the majority of the existing car parking capacity. End of trip facilities are to be provided in line with policy requirements. Refer to section 7.0
Joondalup Activity Centre Plan, Urban Form (Character). • Create an attractive city centre that sets Joondalup apart through the use of high-quality design, materials, street furniture, public art, landscape and the retention of vegetation where appropriate. • Encourage increased development intensity, building scale and design quality along transport corridors to appropriately frame the city centre. • Encourage buildings and development that are able to adapt to changing economic, technological, environmental and social conditions. • Encourage buildings that have a well- considered relationship to the street, enabling the city to become more intense and active while retaining a human scale. • Enhance the natural environment and emphasise the existing 'bush' identity and landscape quality throughout the JAC.	✓	The proposed development aims to enrich Joondalup's character by incorporating enhanced landscaping and high-quality materials, including a perforated metal facade system displaying images of Lake Joondalup from multiple angles. These elements contribute to fostering Joondalup's distinct sense of place. The proposed development has been designed to be functionally adaptable and future proofed with provision for future solar battery storage and the infrastructure for EV charging throughout the car park. Refer to sections 3.0, 4.0, 7.0 and 8.0
Joondalup Activity Centre Plan, Resource Conservation. • Adopt an environmentally sustainable approach to development within the JAC. • Create a green open space and landscaped street network to lessen the heat island effect of city development. • Encourage conservation of resources, including reduced waste and energy and water use. • Encourage solar access, natural cross ventilation and renewable energy use in buildings. • Maximise solar access and good microclimate conditions in public open spaces and city squares. • Optimise water quality management outcomes.	✓	The proposed development will keep existing trees and create enhanced landscaping for cyclists, pedestrians, staff, or customers to rest and contemplate in Joondalup. The proposed development incorporates 244 solar panels, a light-coloured roof extension with high surface reflectivity, and uses specific hard landscaping materials to minimize heat absorption and mitigate the heat island effect. The proposed development includes large windows providing natural light and good views to the external landscaping. The development will investigate the installation of oil separators in the car park storm water drainage system. Refer to sections 3.0, 4.0, 5.0, 6.0 and 8.0

Joondalup Activity Centre Plan, Precinct 1 – City Centre. • Encourage the highest intensity of mixed use development and the greatest concentration of employment intensive land uses. • Support mixed-use development along Joondalup Drive and Grand Boulevard to form intense inner-city development corridors. • Establish the Joondalup Drive/Grand Boulevard and Shenton Avenue/Grand Boulevard intersections as the primary gateways into the city centre.	✓	See comments for 'Joondalup Activity Centre Plan, Activity' above.
Joondalup Activity Centre Plan, City Centre 5 – Adaptable Buildings. All buildings should be adaptable to future uses. They should have: • Minimum floor to floor height of 4.5 metres at ground floor; and • Structure and core configurations, vertical circulation and service provision to enable future subdivision/amalgamation of tenancy spaces and enable future uses (e.g. grease traps, metering provisions).	✓	The retail extension and multideck car park are designed with adaptable floor-to-ceiling heights for versatile future purposes. All metering aligns with NABERS standards. Additionally, the development is future-proofed, equipped for potential solar battery storage and widespread EV charging infrastructure in the car park. Refer to Sections 3.0
Joondalup Activity Centre Plan, City Centre 6 – Open Space & Landscape. Where a building is set back from the street, the front setback area is to be landscaped.	✓	The proposed development is set back along Joondalup drive and includes a landscaped area. Refer to Section 3.0
Joondalup Activity Centre Plan, City Centre 7 – Car Parking & Access: • 1 car parking bay per 75m^2 NLA • 10% of required car bays shall each be replaced by 2 motorcycle/scooter bays. The car bay requirement shall be reduced accordingly.	✓	See comments for 'Joondalup Activity Centre Plan, Movement.' above.
Joondalup Activity Centre Plan, Bicycle parking and end of trip facilities: Cycle parking requirements for Shopping Centres under 30,000m^2. • Employee Bicycle Parking 1 per 1500 m2 NLA • Visitor Bicycle Parking 1 per 3000 m2 NLA **End of trip facilities** • A minimum of one female and one male shower, located in separate change rooms or a minimum of two separate unisex showers and change rooms; • Additional shower facilities to be provided at a rate of one shower for every 10 additional bicycle parking bays; • A locker for every bicycle parking bay provided; and • End-of-trip facilities are to be located as close as possible to the bicycle parking facilities	✓	See comments for 'Joondalup Activity Centre Plan, Movement.' above.

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1.0 Introduction

The proposed extension is located on the existing 238 space carpark. The proposed 3,005m^2 (GFA) retail extension includes rooftop parking for 197 cars, 15 motorbikes and 24 cycle spaces.

The report outlines how the proposed development aligns with the sustainability credentials of the City of Joondalup, Local Planning Scheme No. 3 and Joondalup Activity Centre Plan.

Overall, the proposed development is considered to meet all the sustainability objectives included in the of the City of Joondalup local planning requirements.

Table 1-1 below confirms that the proposed development responds to each of the Local Planning Scheme requirements and outlines which sections of this report are relevant for each requirement. The site is currently zoned as:

- City of Joondalup City Centre Precinct
- Joondalup Activity Centre (JAC) Plan

2.0 Policy

2.1 City of Joondalup

The Joondalup Activity Centre Plan Scheme sets out the City's aim and intentions for the development of land and includes a number of relevant sustainability requirements to the development as follows:

- **Joondalup Activity Centre Plan, Activity**. Facilitate land assembly and redevelopment that will further intensify development and activity in the city centre. The focus is to be on travel, employment, and user intensive activity around public transport stations and along movement corridors.
- **Joondalup Activity Centre Plan, Movement.** Provide car parking commensurate with the road network capacity. Provide adequate bicycle parking and end of trip facilities to promote cycling trips within JAC.
- **Joondalup Activity Centre Plan, Urban Form (Character)** Create an attractive city centre that sets Joondalup apart through the use of high-quality design, materials, street furniture, public art, landscape and the retention of vegetation where appropriate. Encourage increased development intensity, building scale and design quality along transport corridors to appropriately frame the city centre. Encourage buildings and development that are able to adapt to changing economic, technological, environmental and social conditions. Encourage buildings that have a well- considered relationship to the street, enabling the city to become more intense and active while retaining a human scale. Enhance the natural environment and emphasise the existing 'bush' identity and landscape quality throughout the JAC.
- **Joondalup Activity Centre Plan, Resource Conservation.** Adopt an environmentally sustainable approach to development within the JAC. Create a green open space and landscaped street network to lessen the heat island effect of city development. Encourage conservation of resources, including reduced waste and energy and water use. Encourage solar access, natural cross ventilation and renewable energy use in buildings. Maximise solar access and good microclimate conditions in public open spaces and city squares. Optimise water quality management outcomes.

- **Joondalup Activity Centre Plan, City Centre 5 – Adaptable Buildings**. All buildings should be adaptable to future uses. They should have; a minimum floor to floor height of 4.5 metres at ground floor; and Structure and core configurations, vertical circulation and service provision to enable future subdivision/amalgamation of tenancy spaces and enable future uses (e.g. grease traps, metering provisions).
- **Joondalup Activity Centre Plan, City Centre 6 – Open Space & Landscape.** Where a building is set back from the street, the front setback area is to be landscaped.
- **Joondalup Activity Centre Plan, City Centre 7 – Car Parking & Access:** 1 car parking bay per 75m^2 NLA is required for non-residential developments; 10% of required car bays shall each be replaced by 2 motorcycle/scooter bays. The car bay requirement shall be reduced accordingly.
- **Joondalup Activity Centre Plan, Bicycle parking and end of trip facilities: Cycle parking requirements for Shopping Centres under 30,000m^2 are as follows:**
    - Employee Bicycle Parking 1 per 1500 m^2 NLA
    - Visitor Bicycle Parking 1 per 3000 m^2 NLA

  And end of trip facilities are as follows:
    - A minimum of one female and one male shower, located in separate changing rooms or a minimum of two separate unisex showers and changing rooms;
    - Additional shower facilities are to be provided at a rate of one shower for every 10 additional bicycle parking bays;
    - A locker for every bicycle parking bay provided; and
    - End-of-trip facilities are to be located as close as possible to the bicycle parking facilities

3.0 Activity

Economic viability is a central pillar to sustainability. The following table summarises the specific initiatives included in the design which relate to economic sustainability.

Table 3-1 Economic sustainability initiatives

Item	Proposed design initiatives
Intensify development and activity in the city centre.	The proposed extension is adding an additional 3,005 m^2 of retail space to the site and retaining the majority of the existing car parking spaces with a roof top solution.
Focus travel, employment, and user intensive activity around public transport stations and along movement corridors	The proposed intensification of the site will increase movement along Joondalup Drive Clark Crescent transport corridor. In addition, the proposed landscaping plans will enhance the pedestrian amenity (including areas for rest and contemplation by passing cyclists, pedestrians, staff or customers) along Joondalup drive. The existing connectivity to Clark Crescent is to be maintained.

4.0 Character (Urban Form) & Social Sustainability

Sustainable buildings are buildings people use now and, in the future, as well as contributing local community. The following table summarises the specific initiatives included in the design which relate to character and social sustainability.

Table 4-1 Economic sustainability initiatives

Item	Proposed design initiatives
Create an attractive city centre that sets Joondalup apart through the use of high-quality design, materials, street furniture, public art, landscape and the retention of vegetation where appropriate. **Encourage buildings and development that are able to adapt to changing economic, technological, environmental and social conditions.** **Encourage buildings that have a well- considered relationship to the street, enabling the city to become more intense and active while retaining a human scale.** **Enhance the natural environment and emphasise the existing 'bush' identity and landscape quality throughout the JAC.**	The Proposed development is in keeping with the existing urban character of Joondalup. The proposed extension whilst keeping the same form as the existing structure, includes a pattern of fenestration and awning style that differentiates itself from the existing showroom. The development includes the retention of most of the existing trees along Joondalup Drive, a landscape area which enhances the existing planted verge and provides areas for rest and contemplation by passing cyclists, pedestrians, staff or customers; and a clear, legible pedestrian entry to the site/building from Joondalup Drive. The proposed development is to be built from a pallet of high-quality materials including perforated metal facade systems for the multideck car park providing shading and acoustic benefits. The façade will have actual images of Lake Joondalup, looking to the west, east and north contributing to the Joondalup sense of place. The retail extension and multideck car park floor to celling heights allow flexibility for future uses. In addition, the increased floor area and associated improved landscaping and entrance will provide an enhanced shopping experience to the local community.
All buildings should be adaptable to future uses. **They should have; Minimum floor to floor height of 4.5 metres at ground floor; and Structure and core configurations, vertical circulation and service provision to enable future subdivision/amalgamation of tenancy spaces and enable future uses (e.g. grease traps, metering provisions).**	The retail extension and multideck car park floor to ceiling heights allow flexibility for future uses. All metering is to be provided in accordance with NABERS standards. The development is to be future proofed with provision for future solar battery storage and the infrastructure provided for EV charging throughout the car park.

5.0 Resource consumption

The following sections set out design strategies to reduce the building's energy, water demand and waste.

5.1 Energy efficiency

The following table summarises the specific initiatives targeted for inclusion in the design which relate to energy efficiency:

Table 5-1 Energy efficiency initiatives

Item	Proposed design initiatives
Building fabric	The extension will be NCC 2019 Section J complaint.
Fossil fuel free	The proposed extension will be all electric and fossil fuel free.
Lighting efficiency	All lighting will be LED, low energy lighting.
Ventilation and air-conditioning	Air conditioning equipment will be a minimum of 3-star as per AS 3823.2-2011.
Appliances and equipment	All appliances installed will be energy and water efficient. Appliances to have an Energy Star rating within one star of the most efficient rating. All fixtures are to be at least within one star of the most efficient WELS rating except for the showers which will be two stars below the maximum WELS rating.
Metering	All metering to be designed in line with NABERS requirements.
Renewables	The proposed development includes approximately 224 PV panels generating approximately 107MWh per year. The development will be designed to allow for future connection to onsite battery storage.

5.1.1 Light fittings

All light fittings to be specified as LED, including lighting in the 'communal' corridors, stairwells, garage, and external lighting.

Additionally, downward facing fittings will be considered for the external landscaped areas to reduce the negative effects of light pollution. All common area lighting will incorporate light sensing such as occupancy sensing (PIRs) to reduce lighting consumption when lighting is not required.

5.1.2 Metering

All metering is to be in accordance with NABERS requirements to allow for monitoring of the end use activities.

5.1.3 Solar photovoltaic (PV) panels

Solar photovoltaic will be provided as an alternate energy source, to supply power to Harvey Norman.

Figure 5-1 Rooftop PV system

5.2 Water efficiency

The water consumption of Western Australia is the second highest in Australia with an average of 241,000 litres per household per annum, well above the Australian average of 190,000 litres (Australian Bureau of Statistics, 2017).

A reduction of water usage does not only alleviate pressure from the local water supply but also means reduced costs of living in WA.

The following table summarises the specific initiatives to be investigated for inclusion in the design in relation to water efficiency:

Table 5-2 Water efficiency initiatives

Item	Proposed design initiatives
Potable water consumption	All water fittings and fixtures to be water efficient. All fixtures are to be at least within one star of the most efficient WELS rating except for the showers which will be two stars below the maximum WELS rating.
Landscape irrigation	All landscape irrigation will be drip irrigation with moisture sensing override. Native hardy plants to be specified as part of the landscaping.

5.2.1 Water fixtures & fittings

Occupant consumption is a major contributor to potable water usage. The following water fixture WELS ratings will be considered to ensure the efficient use of potable water by building occupants.

Table 5-3 Proposed water fittings WELS rating

Fixture / Fitting Type	WELS Rating
Taps	6-star
Urinals	6-star
Toilets	5-star
Showers	3-star
Clothes Washing Machine	5-star
Dishwasher	6-star

5.2.2 Water-wise landscaping and drip irrigation

The use of water-wise landscaping will be considered for the project. This includes the use of hardy natives and other low-water vegetation. A major amount of potable water usage goes back to landscape irrigation. To reduce the amount of water used for the landscaped areas a drip system with moisture sensor control will be installed for irrigation.

Figure 5-2 Use of hardy natives and drip irrigation system for landscaping

5.3 Building materials

Buildings consume considerable natural resources in their construction, operation, and demolition. This section of the report will provide details about the potential impacts caused by the building and how these impacts have been reduced when compared to typical buildings of this nature. The building will aim to reduce the total embodied energy and carbon during construction and then aim to maximise the operational efficiency of the buildings services to provide and enhance tenant provisions for the minimum amount of energy and water. Furthermore, methods for maintaining operational efficiency over the life of the building will be investigated to ensure that the benefits are maximised over the life of the building.

The following table summarises the specific initiatives to be investigated for inclusion in the design in relation to building materials:

Table 5-4 Building materials initiatives:

Item	Proposed design initiatives
Embodied carbon in the building materials	Low embodied carbon construction techniques and materials selection will be considered throughout the design development.
Concrete	Concrete in the building is aimed to have reduced Portland cement use targeting a reduction of at least 20%.
Sustainable timber	Timber selections used in the building and construction will be procured from a sustainable source.
Permanent formwork, pipes, ducts, cables	PVC products will meet Best Practice Guidelines for PVC.
Structural and reinforcing steel	Steel used in the building will be procured from an energy-reducing processing plant and a Responsible Steel Maker.
Carpets and engineered wood products	All the paints, adhesives, sealants, and carpets will have low levels of Volatile Organic Compounds. Engineered wood will be low formaldehyde. There will be no lead, asbestos, or PCBs in the building.

The design team will actively target a reduced carbon footprint during construction and embodied energy within building materials. Concrete with 20% cement replacement will be specified in conjunction with rebar with a recycled content. Timber used for construction works is targeted to be either certified as responsibly sourced or recycled material.

5.3.1 Embodied carbon

The construction industry contributes to greenhouse gas emissions in multiple ways beyond just the operational phase of buildings. The entire lifecycle of construction materials, from extraction and manufacturing to transportation and installation, involves the release of carbon and other greenhouse gases.

For instance, the production of materials like cement, steel, and aluminium—essential components in construction—requires significant energy and emits CO_2 during manufacture. Transportation of these materials to construction sites adds to the emissions. Even the demolition and disposal of buildings at the end of their life cycle contribute to greenhouse gas emissions.

The following measures will be considered throughout the design development to reduce the amount of embodied carbon:

- Sub-structure
    - Maximise recycled content of materials in structural components.

- Super-Structure
  - Maximise recycled content in concrete and formwork;
  - Use of lightweight and reusable materials where possible.
- Envelope
  - Adopt a low-carbon, lightweight approach;
  - Consider necessity of massing elements;
  - Consider composite materials or dual function elements;
  - Considering the use of recycled materials.
- Internal Walls
  - Consider necessity of internal walls;
  - Consider recycled content or reused materials;
  - Consider low carbon steel framing;
  - Designing for flexibility and futureproofing to reduce renovation efforts.
- Internal Finishes
  - Consider setting a recycled content target for all finishes;
  - Consider long life and highly durable finishes in areas of high foot traffic;
  - Considering Carbon Neutral certified products.

5.3.2 Low VOCs

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors than outdoors. VOCs are emitted by a wide array of products numbering in the thousands (typically paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers).

The development will specify materials with low emissions content including low-VOC paints.

5.4 Waste

The main objectives for the waste management strategies for construction and operational waste are to ensure that waste is avoided and recycled during design, construction, and operation.

Waste within a building construction context can be avoided by encouraging the selection of lower-impact and long-term materials. Operational waste to landfill can be reduced by providing relevant and easily accessible facilities for recyclable waste and other waste that can be diverted from landfill such as organic waste, batteries, or e-waste.

Waste streams – will be separated into refuse waste (landfill), organics, commingled recycling. The bin store has been sized to accommodate the additional retail use.

The following table summarises the specific initiatives that will be investigated for inclusion in the design in relation to waste management:

Table 5-5 Waste initiatives

Item	Proposed design initiatives
Construction and demolition waste	A minimum of 90% of waste from construction is to be diverted from landfill through active on-site waste management and waste separation.
Operational waste	Adequate facilities will be provided to store separate waste streams. Good external and internal access to the storeroom will be provided.

5.4.1 Construction and demolition waste

The team will investigate the following:

- Specifying SSA produced reinforcing bar and mesh.
- Use of low carbon construction concretes.
- Sustainably sourced timber.

Additionally, 'Designing out Waste' principles should be applied where possible. These principles are:

- Design for reuse and recovery
- Design for off-site construction
- Design for materials optimisation
- Design for waste efficient procurement, and
- Design for deconstruction and flexibility.

5.4.2 Operational waste

A dedicated waste storage area will be provided for the separation and storage of recyclable waste during operation, allowing for the different waste streams to be separated to match the local recycling scheme. At least three streams will be covered including landfill, recycling and a third stream for organic/food waste.

Throughout project design, operation and construction, principles of resource recovery will be applied, so that materials and products are recovered and reused where possible, reducing landfill and saving money. Some strategies that will be investigated include:

- Innovative waste separation and collection strategies to allow materials to be isolated for reuse;
- A purchasing policy which aims to minimise waste from products and packaging, encourages the use of products which have minimum environmental impact; and
- Manufacturers and suppliers will be encouraged to take full responsibility for the life cycle impact of products including ownership at end of life.

6.0 Indoor environmental quality

The Indoor Environment Quality of a building aims to achieve sustainable performance improvements in a manner that also improves occupants' experience of the space. Sustainable buildings are designed for people and reductions in energy use should never be made at the expense of the occupants' health and wellbeing.

A holistic approach to sustainability will result in multiple benefits both in energy efficiency and encouraging occupant wellbeing. This can be achieved by improvements to air quality through appropriate ventilation, the provision of high levels of thermal, visual, and acoustic comfort, reduction to occupant stress and the creation of a low-toxicity environment through the reduction of pollutants.

The following table summarises the specific initiatives to be investigated for inclusion in the design in relation to Indoor Environment Quality:

Table 6-1 Indoor Environment Quality initiatives

Item	Proposed design initiatives
Thermal comfort	The extension will meet the NCC 2019 Section J thermal comfort requirements.
Fresh Air	Mechanical ventilation to provide fresh air, with enhanced fresh air rates above Section J minimum requirements to be investigated.
External Views	Good orientation with views to the on-site landscaped gardens/vegetation. Large windows with moderate Visual Light Transmittance (VLT).
Exposure to toxins	Specification of low VOCs paints, adhesives, and sealants where feasible. Specification of low formaldehyde in engineered woods where feasible.
Internal lighting levels	All lighting will be LED or low energy, flicker-free and with no glare.

6.1 Fresh Air

Increased fresh air volumes can aid concertation and minimise indoor air pollution levels.

6.2 Amenity and comfort

The human body regulates its core temperature via the hypothalamus within a narrow range of 36 to 38 degrees. An indoor environment that is too hot or too cold can affect mood, performance, and productivity. However, at which temperature a resident feels comfortable varies significantly from person to person. To control internal comfort and minimise excessive heat loss in winter and heat gains in summer, the development will investigate the use of glazing with a low SHGC, and appropriate U values.

6.3 Natural lighting

The development includes facade screen shading to limit solar gains and glare, while allowing natural light into the retail space.

7.0 Transport

Sustainable projects facilitate a reduction of the dependency of occupants on private car use as an important means of reducing overall greenhouse gas emissions. The use of motor vehicles directly contributes to climate change in two ways; through the high amounts of energy required to produce cars and build and maintain supporting road transport infrastructure and services; and the direct emissions that result from car operations.

If reliance on individual motor vehicle transportation is to be reduced, it is necessary to maximise alternative transportation options. This may include initiatives that encourage and make possible the use of mass transport options, cycling or walking, and the selection of sites that are close to a large number of amenities.

The following table summarises the specific initiatives targeted for inclusion in the design in relation to transport:

Table 7-1 Transport initiatives

Item	Proposed design initiatives
Providing bike storage	Bike storage and end of trip facilities are to be provided.
Low emission vehicle infrastructure	Car parking bays and infrastructure for Electric Vehicles (EV) will be provided.
Improving pedestrian spaces	The building being located in central Joondalup provides excellent access to amenities such as shops, cafes, and bars with. The proposed landscaping to enhance the pedestrian route along Joondalup drive.

7.1 Permeability

The proposed landscaping plans enhance the amenity of pedestrian connectivity along Joondalup drive. The existing connectivity to Clark Crescent is to be maintained.

7.2 Cyclist facilities

In the greater Perth area 48% of all car trips are less than a 5 km distance. Cars produce an average of 0.3 kg of CO_2 per km travelled, whereas a cyclist emits negligible greenhouse or other pollution. For each kilometre a person cycles instead of driving, approximately 0.3 kg of CO_2 are saved from being emitted to the environment.

The proposed development includes cycle storage in the car park area and end of trip facilities.

7.3 End of trip facilities

End of trip facilities will be provided in line with the following requirements:

- A minimum of one female and one male shower, located in separate change rooms or a minimum of two separate unisex showers and changing rooms;
- Additional shower facilities are to be provided at a rate of one shower for every 10 additional bicycle parking bays (i.e. a minimum of 4 showers);
- A locker for every bicycle parking bay provided (i.e. 24); and
- End-of-trip facilities are to be located as close as possible to the bicycle parking facilities.

7.4 Access to public transport

Joondalup train station is within 650m walk along Clark Crescent, Wise Street and Collier Pass.

7.5 Electric vehicles

The number of electric cars on the road grew to 3 million worldwide between 2016 and 2017. This is an expansion of 56%. With further expected exponential growth, the number of electric cars on the roads will reach between 125 and 220 million by 2030 according to the International Energy Agency (International Energy Agency, 2018).

The proposed development intends to support the uptake of low-emissions and electric vehicles. The development includes infrastructure for car park EV charging.

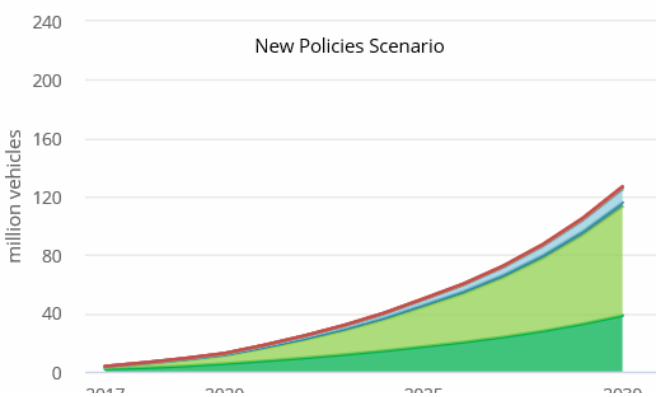

Figure 7-1 Global Electric Vehicle Deployment by 2030

8.0 Urban ecology

With continuously growing cities, urban ecology plays a large role in conserving biodiversity and improving life quality for urban residents. Well planned buildings and landscape architecture protects and enhances biodiversity, provides sustainable landscaping such as low water use, low fertiliser requirements and local native and indigenous plant species selection. If possible, remnant endemic plant communities should be managed and protected.

The following table summarises the specific initiatives included in the design in relation to urban ecology:

Table 8-1 Urban ecology initiatives

Item	Proposed design initiatives
Connection to nature	Extensive landscaping surrounding the development will enliven the frontage and pedestrian route along Joondalup Drive including areas for rest and contemplation by passing cyclists, pedestrians, staff, and customers. The majority of the existing trees along Joondalup drive are to be retained providing connection to nature and shading.
Mitigation of Light Pollution	95% of all external light fittings point downwards to mitigate the effect of urban light pollution.
Heat Island Effect Reduction	Use of vegetation, Solar PV, green spaces and roofing and hard landscaping finishes with a suitable Surface reflective index will actively reduce the heat island effect.
Water Quality	The development will investigate the installation of oil separators in the car park storm water drainage system.

8.1 Connection to nature

Connection to nature is a key design element for the project and will ensure that occupants can interact with nature either inside the building or externally through landscaped outdoor areas.

8.2 Light pollution

Light pollution is an environmental issue that is becoming more of a problem every year as cities continue to grow in size and density. Excessive amounts of light being projected upwards is not only a waste of energy and resources but has also been proven to make a negative impact on the local wildlife by affecting various species' vision, mating, nesting, and built-in migration instincts.

Similar effects have been found in humans, with some people struggling to sleep and relax with prolonged exposure to artificial daylight and glare from poorly fitted external lights. The idea of reducing light pollution through sensible light fittings can save the site owners financially by reducing wasted energy and increasing lighting efficiency whilst simultaneously contributing positively to the health and wellbeing of the surrounding natural environment.

The project will investigate the use of all external light fittings pointing downwards, mitigating the effects of light pollution.

Figure 8-1 Light and energy usage of external lighting

8.3 Minimising heat island effect

The heat island effect describes the condition where urban areas have a higher average temperature than their rural surroundings owing to the make-up of the built environment. The use of light roof materials combined with shaded and landscaped areas can reduce the heat island effect significantly and contribute to further energy savings.

The development includes enhanced landscaping along Joondalup Drive and on the car park roof mitigating the heat island effect. In addition, the proposed 244 solar panels, light coloured roof extension (to have a three-year surface reflective index more than 63) and hard landscaping (are to have a three-year surface reflective index more than 39 (i.e., Light grey / white concrete).

9.0 References

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