Aspect Industrial Estate

Mod 3 – Estate Masterplan & Warehouse 9 ESD Report

Prepared for: Mirvac Projects Pty Limited

Attention: Daniel Brook

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Prepared by: Madhu Muthumalai

Ref: 301350800

Stantec Australia Pty Ltd
Level 6, Building B, 207 Pacific Highway, St Leonards NSW 2065
Tel: +61 2 8484 7000 Web: www.stantec.com

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Revision

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Disclaimer

This report has been developed based on the Development level of information provided to Stantec. Stantec has taken every effort to ensure the information presented in this report is an accurate reflection of the development but cannot guarantee the final performance of the building. The content of the development, including systems, materiality and finishes is subject to final architectural and client approval and subject to change.

Contents

1. Executive Summary

This Ecological Sustainable Development Report has been prepared for Mirvac Projects Pty Limited for the proposed new Aspect Industrial Estate development located at Mamre Road, Kemps Creek, NSW 2178. This report is intended to provide an overview of the ecologically sustainable design (ESD) principles and greenhouse gas and energy efficiency measures that will be implemented and is intended to form part of the Environmental Impact Statement (EIS) for the application to Development Consent SSD-10448 for the Aspect Industrial Estate at 804-882 Mamre Road, Kemps Creek.

This is a direct design response to the ESD and energy efficiency components of Planning Secretary's Environmental Assessment Requirements (SEARs) issued for the proposal SSD-10448, and also to other regulatory frameworks as listed below. Information contained within this report has been prepared in direct response to:

- The Secretary's Environmental Assessment Requirements (SEARs) for the development (SSD-10448);
    - Greenhouse gas and energy efficiency;
    - Ecologically sustainable development.
- The NSW Environmental Planning and Assessment Act 1979;
- The NSW Environmental Planning and Assessment Regulation 2000;
- State Environmental Planning Policy (Industry and Employment) 2021; and
- Mamre Road Precinct Development Control Plan (DCP) 2021

The report includes:

- An overview of the sustainability drivers for the project (both regulatory & identified project drivers);
- Detail regarding specific ecological sustainable development initiatives through all phases of the project;
- Initiatives that will minimise the consumption of energy, water and material resources, whilst maintaining a high indoor environmental quality for occupants.

In order to achieve the above main goals, drivers and SEARs requirements, the project will implement a number of greenhouse gas and energy efficiency initiatives and sustainable design principles, including:

- Buildings to be net positive for carbon emissions where determined by Mirvac to be appropriate;
- On-site Renewable Energy Production;
    1. Min. 100 kW Solar System per warehouse.
    2. Warehouse 9: 650 kW Solar System
- Environmental outcome equivalent to a minimum of 5 Star Green Star (Design & As-Built tool) v1.3 standard;
- Smart metering;
- Electric car and truck charging future provisioning;
- Rainwater harvesting and reuse;
- Natural ventilation to great portion of the warehouse floor area;
- Explore opportunities to reduce embodied energy reduction associated to construction material selection;
- Others as presented in the following Sections.

2. Introduction

2.1 Aspect Industrial Estate Concept Masterplan & Warehouse 9

Aspect Industrial Estate (the site) is legally described as Lots 1-5 in DP1285305, with an area of approximately 56.3 hectares (ha). The site is located east of Mamre Road, Kemps Creek within the Penrith Local Government Area (LGA).

The site has approximately 950m of direct frontage to Mamre Road with a proposed intersection providing vehicular access via Mamre Road to the M4 Motorway and Great Western Highway to the north and Elizabeth Drive to the south.

The site is located approximately 4km north-west of the future Western Sydney Nancy-Bird Walton Airport, 13km south-east of the Penrith CBD and 40km west of the Sydney CBD.

The Department of Planning, Industry and Environment (DPIE) rezoned Mamre Road Precinct, including the site, in June 2020 under the State Environmental Planning Policy (Western Sydney Employment Area) 2009 (WSEA SEPP). The rezoning of this precinct responds to the demand for industrial land in Western Sydney. The site primarily zoned IN1 General Industrial with a small sliver of land zoned E2 Environmental Conservation.

Consistent with the above, this report has been prepared to support a Development Application under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) for the purpose of:

- A Concept Masterplan for the site comprising 9 industrial buildings, internal road network layout, building locations, gross floor area (GFA), car parking, concept landscaping, building heights, setbacks and built form parameters.

Figure 1 – Aspect Industrial Estate – SSDA Mod 3 Estate Masterplan *(SBA Architects – Issued for SSDA Mod 3)*

2.1.1 SSD 10448 Concept Modification

The following modifications are proposed, relating to Warehouse/Lot 6,7,8,9, 10 and 11 area and Access Road 4, located at the southwestern portion of the AIE, as set out in the Concept Plan SSD-10448.

- Reconfiguration of the Estate layout south of Access Road 1 and west of Access Road 3 including:
    1. Reduction in overall lot numbers across AIE from 11 to 9.
    2. Relocation and shortening of Access Road 4.
    3. Reconfiguration of warehouse lots 6-11 into lots 6-9.
    4. New warehouse footprints and heights, hardstand locations, car parking, estate landscaping.
    5. Change in boundary condition to the south including orientation of warehouse hardstand for Warehouse 9 to the south rather than the north.
- Reduction in area of Lot 6 Warehouse GFA to 9,574 sq.m and Lot 7 Warehouse GFA to 15,333 sq.m.
- Increase in area of Lot 8 Warehouse GFA to 45,146 sq.m and Lot 9 Warehouse GFA to 66,548 sq.m.
- Reconfiguration of Office and Dock Office areas in accordance with the revised warehouse footprints.
- New hardstand areas along the frontages of the reconfigured lots:
    1. 38m wide east of Warehouse 6,
    2. 38m wide south of Warehouse 7,
    3. 38m south of Warehouse 8, and
    4. 36m wide north and 36m south of Warehouse 9.
- Reconfiguration of carpark areas in support of the modified warehouse layout, to be reconfigured as follows:
    1. Warehouse 6- 71 parking spaces across the lot's northern frontage,
    2. Warehouse 7- 84 parking spaces across the lot's eastern frontage, within the front setback to Access Road 3,
    3. Warehouse 8- 106 parking spaces across the lot's northern frontage (fronting Access Road 1) and 63 parking spaces across the lot's eastern frontage (fronting Access Road 4), and
    4. Warehouse 9- 266 parking spaces across the lot's north-eastern frontage (fronting Access Road 4).
- Revised vehicular and truck access off Access Road 4 in accordance with the reconfigured lots and shortened Access Road 4.
- Change in Estate-wide impacts associated with stormwater management, traffic generation, visual impact, noise, earthworks at the boundary and landscaping.

2.1.2 SSD 10448 Stage 1 Modification

The following modification is proposed to the approved road works under the Stage 1 consent, relating to the construction of road works for the realigned Road 4 and associated landscaping.

- Updated subdivision plan to include Road 4 within a separate road lot
- Civil works and construction of realigned Road 4 including stormwater works

- Construction of landscaping works in the public domain area of the Road 4 lot
- Reconfiguration of earthworks for lots 6 to 9
- Reconfiguration of boundary retaining walls (Stage 1) and other retaining walls (both Stage 1 and Lot 9)

2.1.3 New Warehouse 9 SSD

The detailed development application will seek consent for earthworks, infrastructure and roads, and the construction, fit out and operation of the warehouse and logistic facility with associated car parking for Lot/ Warehouse 9. Specifically, the SSDA will seek consent for:

- Civil works including cut/fill and benching to set the Lot 9 pad levels.
- Construction of new 66,548 sq.m building for use as 'warehouse and distribution' to be built to a ridge height of 14.6m. The following works are proposed in support of the warehouse building operations:
    1. 266 parking spaces across the lot's north and eastern frontages with driveway access to/from Access Road 4.
    2. Appropriate hardstand areas, 36m wide north and 36m south of Warehouse 9.
    3. Internal truck access roads with access from Access Road 3 to the east and egress to Access Road 4 to the north.
    4. Appropriate loading dock areas at the north and south elevations.
    5. 140 sq.m Dock Office at the north elevation and a 126 sq.m Dock Office at the south elevation.
    6. 1,350 sq. Main Office at the eastern elevation.
- Fit-out of the warehouse for the proposed use.
- Construction of vehicular crossovers to Access Road 4 (egress) and Access Road 3 (ingress).
- On lot landscaping.
- On lot stormwater management.
- Operation of the warehouse and distribution facility 24 hours a day, 7 days a week.

The Secretary's Environmental Assessment Requirements (SEARs) have been issued in respect of the proposal. This report addresses the relevant SEARs considerations.

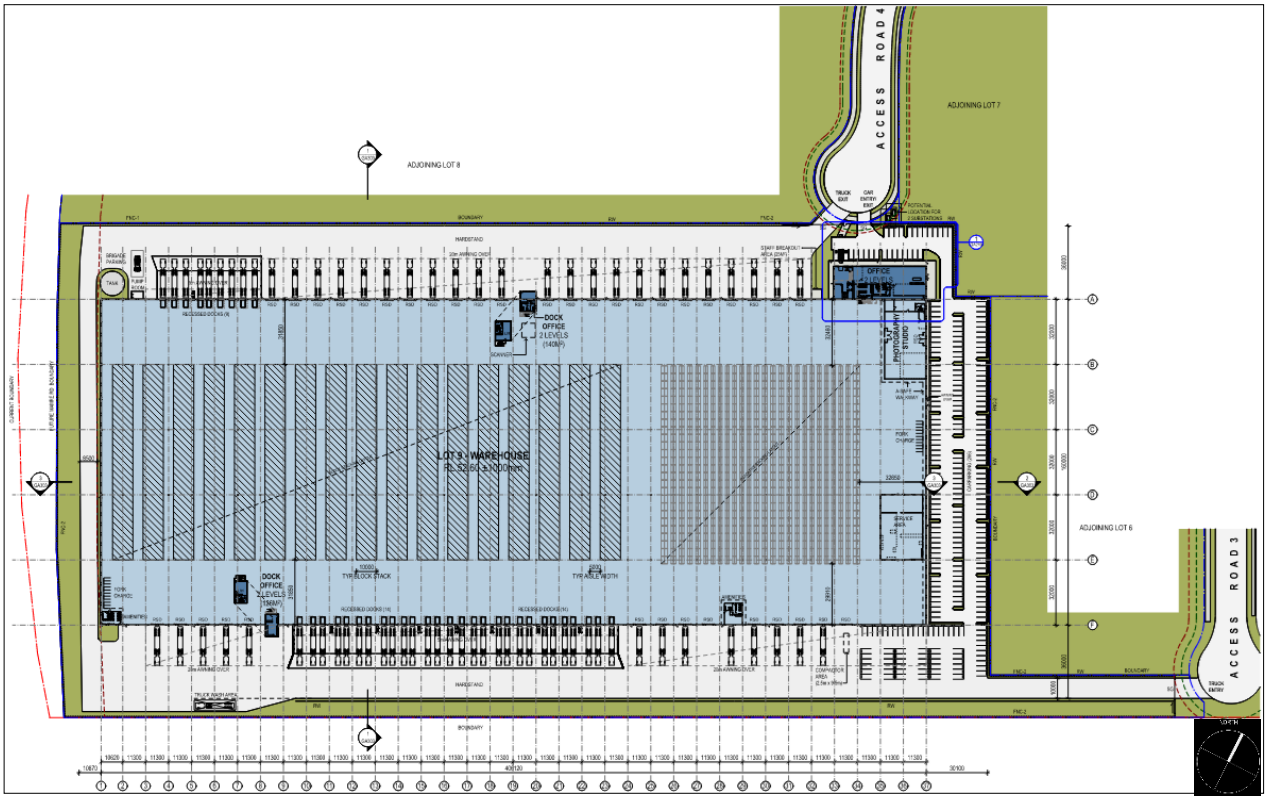


Figure 2 – Lot 9 Site and Warehouse Floor Plan *(SBA Architects – Issue for Client)*

LOT 9 AREA SCHEDULE	
SITE AREA	113,106 m²
CAR PARKING SPACES	266
DOCK OFFICE	266 m²
OFFICE	1350 m²
WAREHOUSE	64725 m²
TOTAL GFA	66341 m²

Table 1 - SSDA Mod 3 Lot 9 Site Plan – Warehouse 9 Lot Areas *(SBA Architects – Issue for Client)*

3. Sustainable Design Framework

The proposed sustainability response for the project includes various associated drivers, including the following regulatory frameworks:

- The Secretary's Environmental Assessment Requirements (SEARs) for the development (SD-10448);
    - Greenhouse gas and energy efficiency, reflecting the Government's goal of net zero emissions by 2050;
    - Ecologically sustainable development.
- The NSW Environmental Planning and Assessment Act 1979;
- The NSW Environmental Planning and Assessment Regulation 2000;
- State Environmental Planning Policy (Industry and Employment) 2021; and
- Mamre Road Precinct Development Control Plan (DCP) 2021

3.1 2021 Secretary's Environmental Assessment Requirements (SEARs) for the development (SD-10448)

The following key issues from the Secretary's Environmental Assessment Requirements SD-10448 are addressed in this report:

- **Greenhouse gas and energy efficiency** – including an assessment of the energy use of the proposal and all reasonable and feasible measures that will be implemented on site to minimise the proposal's greenhouse gas emissions, reflecting the Government's goal of net zero emissions by 2050.

  The NSW Government has committed to an aspirational objective of achieving net-zero emissions by 2050. The intent of this aspirational objective is to provide a clear statement of the government's intent, commitment, and level of ambition and to set expectations about future emissions pathways that will help the private sector and government agencies to plan and act. It is consistent with the Paris Agreement which the Commonwealth Government has committed to ratifying, and is intended to complement, rather than replicate or duplicate the Commonwealth Government's shorter term national emissions reduction targets.

- **Ecologically sustainable development** – including a description of how the development will incorporate the principles of ecologically sustainable development in the design, construction and ongoing operation of the development.

3.2 The NSW Environmental Planning and Assessment Regulation 2000

Schedule 2 7(4) of the Environmental Planning and Assessment Regulation 2000 states:

"The principles of ecologically sustainable development are as follows:

a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
    i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
    ii. an assessment of the risk-weighted consequences of various options,

b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

d) *improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:*

i. *polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
ii. *the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
iii. *environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems."*

3.3 State Environmental Planning Policy (Industry and Employment) 2021

Chapter 2 Western Sydney employment area of the State Environmental Planning Policy (Industry and Employment) 2021 states:

Part 2.4 Principal development standards

2.19 Ecologically sustainable development

The consent authority must not grant consent to development on land to which this Chapter applies unless it is satisfied that the development contains measures designed to minimise-

a) the consumption of potable water, and

b) greenhouse gas emissions.

3.4 Mamre Road Precinct Development Control Plan (DCP) 2021

The Mamre Road Precinct Development Control Plan 2021 provides detailed planning controls for industrial development in Mamre Road Precinct within the Western Sydney Employment Area.

Chapter 4 General Requirements for Industrial Development of the Mamre Road Precinct Development Control Plan 2021 states:

4.2 Built form design controls

4.2.5 Building Design

Objectives

a) To encourage innovation and a high standard of architectural design, utilising quality materials and finishes.

b) To ensure buildings achieve a high level of sustainability and environmental performance.

f) To embed circular economy design principles to maximise recycling and reuse of materials.

Controls

1) Developments with a construction cost of $1 million or more are to demonstrate a commitment to achieving no less than 4 stars under Green Star or 4.5 stars under the Australian Building Greenhouse Rating system (now part of the National Australian Built Environment Rating System (NABERS)).

Siting/Building Orientation

2) Buildings should take advantage of a north or north-easterly aspect to maximise passive solar illumination, heating and natural cross-ventilation for cooling.

Architectural Design

7) External finishes should contain a mix of materials and colours and low reflectivity to minimise glare and reflection.

*11) Energy efficient design principles shall be employed in all building designs (*Figure 3*).*

17) Roof design must provide natural illumination to the interior of the building.

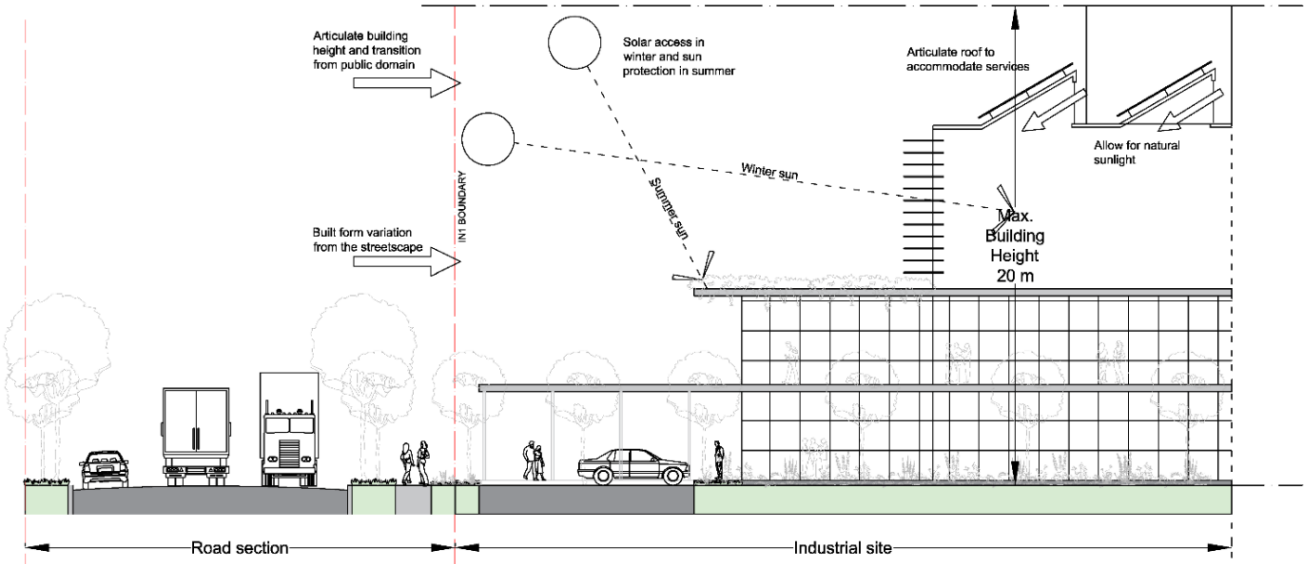


Figure 3- Energy efficient design (Source: Mamre Road Precinct DCP 2021)

Environmentally Sustainable Design

18) Development applications shall demonstrate Ecological Sustainable Design (ESD) measures have been incorporated into the design, including a consideration of:

- *Building and window orientation;*
- *Window size and glass type;*
- *Materials, colour and surface treatment (note control 19 in relation to roof colour);*
- *Insulation;*
- *Landscaping and trees to provide shade and moderate the building microclimate;*
- *Natural ventilation and light with generous, all weather openings;*
- *Utilise extensive roof areas for energy and water collection;*
- *Air flow, ventilation and building morphology to support cooling; and*
- *Circular economy in the design, construction and operation of buildings, public domain, infrastructure, and energy, water and waste systems.*

19) Light coloured materials should be used in roof construction to reduce the urban heat effect.

20) Building services, excluding manufacturing plant and operations, should promote:

- *Separate metering of water and electricity for multiple uses or tenants;*
- *Shut-off valves at stormwater outlets to trap toxic spills;*

- *Waterless urinals;*
- *Energy efficient lighting;*
- *Gas boosted solar hot water for staff amenities (kitchen, toilets, showers);*
- *Rainwater and recycled water for toilet flushing, irrigation or other non-potable uses;*
- *Waste heat recovery systems;*
- *Integrated systems for energy generation- waste and water;*
- *Air-cooled systems, ground source heat rejection or pond heat rejection; and*
- *Energy storage systems combined with the use of photo voltaic cells for roof areas.*

21) Measures to improve air quality and visual and thermal comfort to be considered include:

- *Low VOC paints and low-formaldehyde floor covering, adhesives and furniture;*
- *Glazed facades to be shaded and/or use performance glass to control radiant heat;*
- *Occupant control of comfort parameters (e.g., operable windows, control of air flow);*
- *Protection from noise (e.g. open windows or between production and office areas);*
- *Provision of high quality landscaped outdoor amenity areas for staff;*
- *Hydronic heating and ceiling fans; and*
- *Materials with low reflectance values.*

4.6 Access and Parking

4.6.1 Parking and Manoeuvring Areas

Objectives

8) Parking areas should incorporate dedicated parking bays for electric vehicle charging.

3.5 Project Design Response

The project team has assessed the energy use profile of the development and will implement a number of energy efficiency measures that will reduce significantly the greenhouse gas emissions and footprint of the project. Also, as listed below, a series of best practice sustainable initiatives will be incorporated so that potential environmental impacts are mitigated substantially.

There are no perceived threats of serious or irreversible environmental damage as a result of locating the Aspect Industrial Estate development on the desired site. The site is currently zoned RU2 Rural Landscape under the Penrith Local Environmental Plan 2010 and is not listed within the Schedule 5 Environmental Heritage – Part 1 Heritage items of the Penrith Local Environmental Plan 2010. The proposed development will have predominantly the same uses as the current industrial warehouses and developments from the surroundings.

The development will give strong consideration to potential environmental impacts by reducing it through application of best practice design and processes such as the many ESD commitments and initiatives listed in the following Section. The documented initiatives to be implemented – which are the basis for the response to the Sustainable Design Frameworks outlined above - include:

- Buildings to be net positive for carbon emissions where determined by Mirvac to be appropriate;
- On-site Renewable Energy Production;

1. Min. 100 kW Solar System per warehouse.
2. Warehouse 9: 650 kW Solar System

- Environmental outcome equivalent to a minimum of 5 Star Green Star (Design & As-Built tool) v1.3 standard;
- Smart metering;
- Electric car and truck charging provisioning;
- Rainwater harvesting and reuse;
- Energy Efficient lighting systems (internal and external) and lighting controls;
- Best Practice Façade Thermal Performance / Building Thermal Mass;
- Natural ventilation to great portion of the warehouse floor area;
- Solar Gain Reduction / Shadings;
- Efficient HVAC System Equipment (Office spaces);
- Explore opportunities to reduce embodied energy reduction associated to construction material selection;
- Increased access to natural daylight where possible;
- Water efficient fixtures and fittings (WELS rating);
- Selection of native & low water plants / trees;
- Application of Water Sensitive Urban Design (WSUD) principles;
- Increased Indoor & Outdoor Environmental Quality;
- Waste Management Plan;
- Others as presented in the following Sections.

Any further concerns will be addressed through development of a Construction Environmental Management Plan that incorporates mitigation measures to ensure that environmental impacts to the site are minimised during construction. Contractors will also be requested to provide and abide by an Environmental Management System to be in accordance with NSW Environmental Management Systems Guidelines or a similar standard. This places a value on environmentally responsible building practices to ensure they are held responsible for the environmental management of the building site as they complete their work.

Once the new development is under activity, operational guidelines, best practice procedures and appropriate monitoring and control measures will be defined by the building owner. This will be in accordance to the sustainable strategies adopted by the development, and will be distributed to the tenants to ensure environmental impacts associated with operational processes are minimised wherever possible.

4. ESD Opportunities & Initiatives

The following section addresses the Greenhouse Gas, Energy Efficiency and Ecologically Sustainable Development aspects in response to the Sustainable Design Frameworks (as per Section 3) for the project. It uses best practice sustainable design principals and borrows elements from external sustainability tools to develop a set of metrics for the site.

There are several Ecological Sustainable Development opportunities and initiatives that will be implemented in the project. The following examples are to be read in conjunction with design documentation prepared by SBA Architects. Stantec note the design is in its very early stages, and the following concepts will be considered going forward.

Fundamental to the success of improving the ESD outcome for the project is the adoption of strong design philosophy. Passive design features have the ability to:

- Lower operational energy demand via improved thermal performance;
- Promote greater indoor environmental quality;
- Reduce the requirements for artificial lighting & power;
- Reduce the buildings' reliance on HVAC systems;
- Improve building occupant comfort; and
- Improve the project's capacity to deliver a responsible development.

The warehouses design will include several passive design options and provide a robust and environmentally sensitive framework. Furthermore, several energy efficiencies measures and intelligent selection of systems are being proposed in order to improve the environmental outcome of the development while maintaining occupant level comfort and well-being.

4.1 Australian Excellence ESD Framework (Green Star)

The project's as-built environmental performance will be equivalent to a 5 Star Green Star project, based on the Green Star Design & As-Built v1.3 tool. As proposed by the Green Star framework, a holistic approach will be taken towards the environmental performance of the development, where relevant ESD principles will be applied and voluntarily accessed against the Green Star scheme so that the project can be benchmarked to achieve the equivalent of a 5 Star Green Star v1.3 standard – which represents Australian Excellence within the built environment.

Green Star is currently accepted within the building and construction industry as representative of Australian Excellence in design & construction with reference to environmental conservation and performance. Green Star is Australia's foremost holistic built environment assessment tool and outlines a series of environmental performance criteria design to improve environmental sustainability & building performance. There are nine performance categories within Green Star, as follows:

- Energy (GHG Emissions);
- Water;
- Materials;
- Indoor Environmental Quality (IEQ);
- Building Management;
- Transport;
- Land Use & Ecology;
- Emissions; and
- Innovation.

The development may not target a formal Green Star certification, but further investigation is being undertaken by Mirvac on the certification pathway.

4.2 Greenhouse Gas & Energy Efficiency

A variety of greenhouse gas and energy efficiency measures are applicable to the proposed development and form part of the initial design and operation plan for the warehouses. The final strategy will be a combination of sustainability, operational feasibility, architectural intent and site-specific appropriateness.

The energy efficiency strategy follows the hierarchy pyramid below. Best practice energy conservation dictates that in the first instance demand is reduced. This has a much greater benefit to the overall long-term sustainability of the site compared to efficiency measures or renewables/offsets. As such, the focus will be on the elements that provide the greatest impact and return on investment.

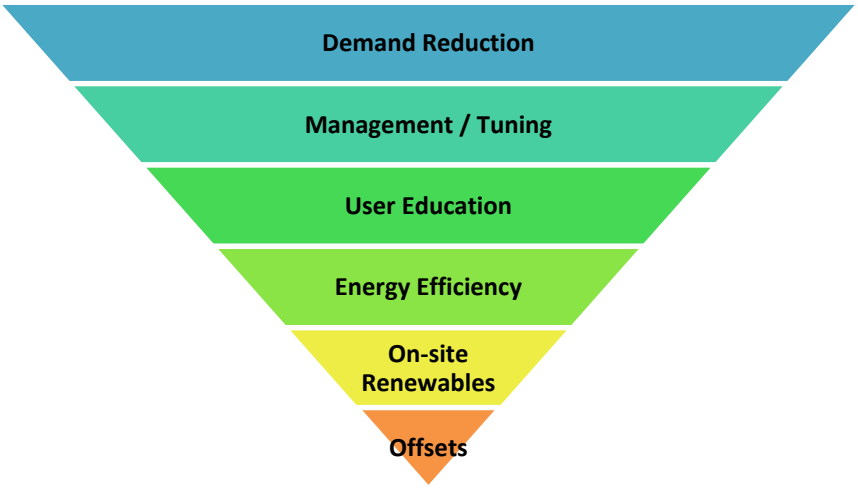


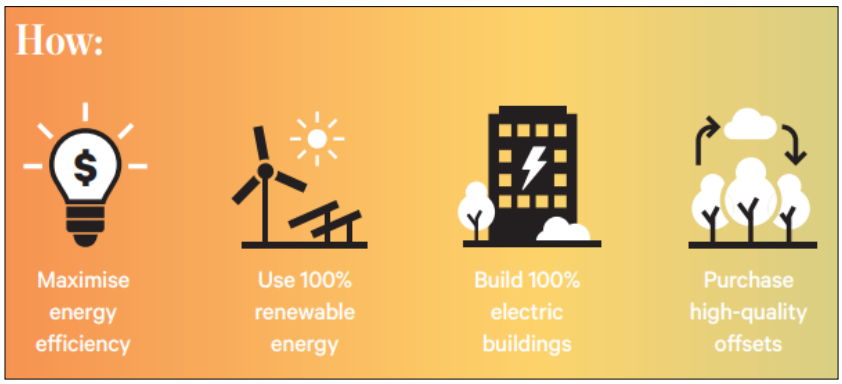
Figure 4 - Energy Efficiency Strategy Hierarchy

4.2.1 Site-wide Energy Strategies

Methods to achieve the greenhouse gas & energy efficiency goals of the projects will go above and beyond the regulatory requirements and industry benchmarks. The below is proposed to be implemented:

- **Buildings to be net positive for carbon emissions**

  The development is proposed not only be net carbon zero but to potentially go above and beyond industry benchmark and deliver a net positive development for embodied carbon emissions. This accounts for scope 1 and 2 greenhouse gas (GHG) emissions from the development. Reaching net positive carbon by 2030 is part of Mirvac's plan for the future. This is outlined in Mirvac's plan released in June 2019 *"Planet Positive – Mirvac's Plan to reach net positive carbon by 2030"*.



Source: Mirvac's Net positive carbon by 2030 infographic

"It's important to emphasise that being net positive involves going a step further than reaching net zero. For us, net positive means that our positive actions (energy efficiency, renewable energy, transitioning away from fossil fuels, and either minimising or offsetting other emissions) outweigh the carbon emissions from our buildings." Planet Positive – Mirvac's Plan to reach net positive carbon by 2030.

- **On-site Renewable Energy Production – Min. 100 kW Solar System per building:**

  On-site Renewable Energy Production will be implemented in the design to minimise utilisation of energy from the grid system. The system will be designed so that renewable energy is prioritised for use. Consideration can also be given to selling excess energy back into the grid or storage on site for peak reduction.

  Further feasibility will be completed regarding the ideal system configuration, sizing, annual energy generation, etc., but it is anticipated that there will be a minimum 100 kW Solar System provided to each building. It is noted the electricity consumption from the site is still to be estimated where the appropriate renewable energy contribution will depend on the final architectural design, industrial arrangement, building services design and tenants operational requirements.

  While there is a minimum target of 100 kW Solar System to be provided to each warehouse, Warehouse 9 is proposed to have a 650 kW capacity solar system, which represents a fantastic initiative that will have a tremendous impact in the Warehouse 9 operational carbon footprint.

Source: Google images

- **Electric car and truck charging;**

  By including conduit provisions and dedicated bays in the design for Electrical Vehicle charging, the development will provide incentive to the use of low-emissions vehicles, which reduces the harmful air pollution associated to vehicles exhaust emissions. Further consideration will be given to the implementation of some Electrical Vehicle charging units. Furthermore, if renewable energy is used to feed the stations (either through the solar systems or Green Power) then this can represent a complete transition away from fossil fuels related to transport.

- **Energy Efficient lighting systems (internal and external):**

  Energy Efficient lighting selection (LED lighting) and system can reduce the electrical load on the grid significantly for the same illuminance output in comparison to traditional incandescent lights. Further, LED globes have a longer life, reducing replacement periods which demands less maintenance, as well as reducing landfill of precious materials. Mirvac will be utilising LED lighting throughout all buildings for the Aspect development.

- **Controls of lighting systems:**

This can include zoned switching, lighting control systems with time clocks and may include lighting sensors where appropriate. This will reduce base building energy consumption by assuring artificial lighting is turned off when not required.

- **Façade Thermal Performance / Building Thermal Mass:**

  Building envelope thermal performance to comply with NCC 2019 Section J requirements (conditioned spaces). This will reduce reliance on mechanical cooling and heating and therefore bringing down HVAC operational energy consumption.

  The warehouses roof material and colour will be reflective of solar radiation, and consideration will be given to building overall thermal mass and to application of thermal insulation appropriate to the local weather profile.

- **Natural ventilation to great portion of the warehouse floor area:**

  This will reduce drastically any dependence on HVAC systems and spaces conditioning, thus reducing significantly the project energy demand (and automatically reducing greenhouse gas emissions). Passive design strategies to be applied in order to treat indoor environment to enhance thermal comfort of the occupants.

- **Solar Gain Reduction / Shadings:**

  External shading devices will be implemented in the architectural design adjacent to conditioned spaces in order to reduce solar exposure / solar gains thus reducing the reliance on mechanical systems for internal conditioning. Awnings will be provided at each access point to the warehouses. This will be provided on the warehouse edge where trucks load/unload to provide sun protection for employees.

  The building roof is designed to be light coloured (low solar absorptance), which also reduces solar gains by reflecting light and is beneficial to the local heat island effect.

- **Efficient HVAC System Equipment (Office spaces):**

  Efficient and bespoke HVAC systems with high COPs will be appropriately designed and sized for the development. This will include high efficiency centralised plant.

- **Embodied Energy reduction associated to construction material selection.**

  Construction materials are a highly carbon intensive component of any development. They often involve energy intensive production processes, large amounts of raw materials including water and energy, and long transport distances to reach the location of the development. However, there are a number of environmentally friendly practices starting to become accepted by the construction industry. Depending on the materials selected for the constructions, and the options available in the area, use of low embodied energy and water materials with preference for sourcing from local or sustainable materials suppliers will be adopted – where possible – during material selection and pre-construction process. This can also include materials with high recycled content.

4.2.2 Warehouse Areas

The warehouses floor area represents approximately 95% of the total Stage 1 Gross Floor Area and as such are responsible for the significant component of energy consumption within the site. A number of initiatives are proposed to reduce the greenhouse gas emissions and environmental impacts associated to the warehouse component on the development. These include:

- Energy Efficient lighting systems (internal and external);
- Controls of lighting systems, including zoned switching, motion sensors and time clocks / lighting sensors as appropriate;
- Natural ventilation of the warehouses, except where for functional reasons this is not practicable (i.e. potential refrigeration rooms, freezer rooms, or other spaces with conditioning required for functional reasons);
- Roof ventilators are proposed to provide effective air changes to the space. This reduces the build-up of heat in the space and encourages air circulation, thus increasing occupant thermal comfort. This also helps control humidity in the space, reducing concerns of mould in the space. Note feasibility on such systems will be reliant on the industrial processes that will take place within the warehouses.
- Encouraging natural lighting where possible (e.g. where internal thermal comfort is not compromised), through application of translucent roof materials across the warehouse roofing components. This reduces reliance on artificial lighting and supports an energy efficient design.

By providing an unconditioned space with natural ventilation, the key energy sources are lighting and plug loads. Plug loads are generally required for the function of the space and therefore reduction is proven unfeasible in most cases. Lighting loads can be reduced significantly by the introduction of zoned switching, time clocks and/or motion sensors. As such, the above provides an energy efficient solution to the warehouse component of the stage 1 development.

4.2.3 Office Areas

The office has been analysed for a number of different design elements and configurations. These include:

- Energy Efficient lighting systems (internal and external);
- Controls of lighting systems, including zoned switching, motion sensors and time clocks / lighting sensors as appropriate;
- High thermally performing glazing and general façade materials – to meet NCC 2019 Section J requirements;
- Increased mechanical equipment performance;
- Zoned mechanical systems (centre/perimeter);
- Wider temperature control band.

By combining all the above elements within the office design, there is a potential for the office energy consumption to be reduced significantly in comparison to a standard office space (considering business as usual systems in line with the BCA and standard operational procedures).

4.3 Water Efficiency

A variety of water efficiency measures can be applied to the proposed development. These best practice water efficiency measures implemented to reduce water consumption include:

- **Water efficient fixtures and fittings (WELS rating):**

  By implementing low-flow water fixtures, the consumption associated with amenities can be reduced. This includes taps, wash basins, WCs, Urinals, showers and supplementary water uses.

- **Water efficient appliances (WELS rating):**

  Where applicable, priority will be given to efficient water appliances, such as dishwashers for the office spaces.

- **Rainwater harvesting and reuse:**

  A rainwater tank will be implemented as required. Further feasibility will be completed regarding the ideal tank sizing, capture area and end-use for any non-potable water collected. Rainwater on this site is particularly advantageous given the significant collection area across the building roofs. The captured water can offset irrigation water consumption, wash down and potentially toilet flushing and industrial processes.

- **Water use metering and monitoring:**

  Which can identify leaks and amend losses before greater loss occurs.

- **Selection of native & low water plants / trees:**

  Natives plants are designed to thrive in the Australian environment and are typically more resilient than their exotic counterparts. Low water species will reduce even more irrigation demand.

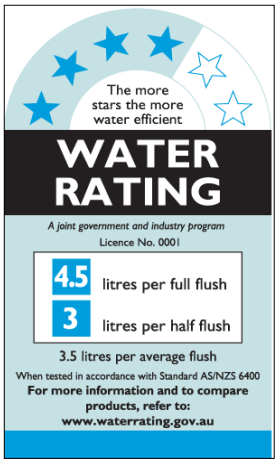


Figure 5 - Illustration of WELS rating label.

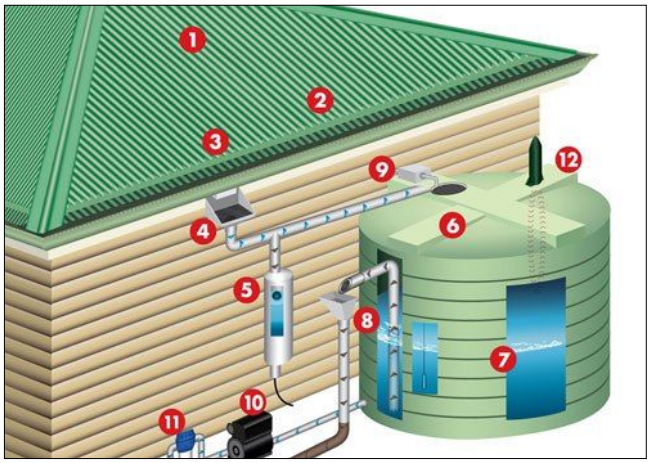


Figure 6 - Illustration of a Rainwater Harvesting System.

The above initiatives are sufficient to allow the project to meet best practice consumption benchmarks considering the HVAC mechanical design will most likely apply waterless heat rejection systems due to the size and volume of the commercial office spaces within the development.

4.3.1 Water Sensitive Urban Design (WSUD)

The WSUD principles outlined in Chapter C3 Water Management - Water Sensitive Urban Design - of the Penrith DCP will be considered for implementation by the project. These include:

- To maintain the natural water balance;
- To make more efficient use of water resources by conserving water, particularly potable (drinking) water;
- To reduce general flood risk;
- To reduce erosion of waterways, slopes and banks;
- To control stormwater and waste water pollution and improve water quality in waterways and groundwater;
- To integrate stormwater management with water supply and waste water treatment; and
- To integrate stormwater treatment into the landscape so as to maximise the visual and recreational amenity of urban development.

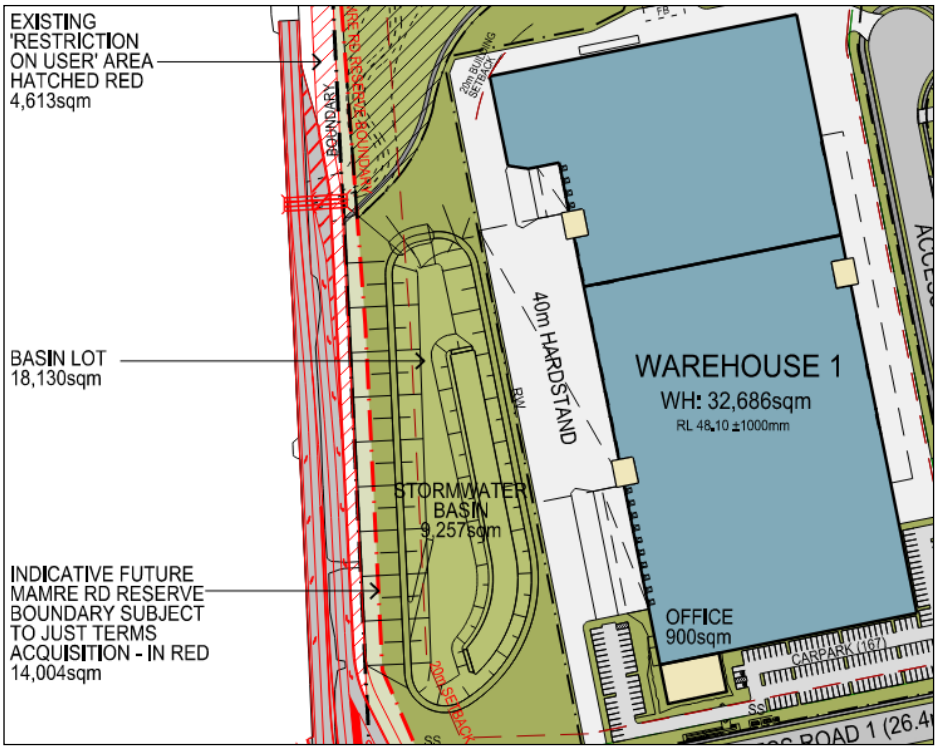


Figure 7 - Stormwater Basin within the SSDA Mod 3 Estate Masterplan drawing *(SBA Architects – Issued for SSDA Mod 3)*

4.4 Indoor & Outdoor Environmental Quality

Internal Environmental Quality and occupant comfort will be a key consideration in the warehouses design. A comfortable workplace encourages greater productivity, workplace satisfaction and tangible health benefits. These benefits range from reduction in stress, increased physical and mental health and general quality of life. Therefore, provision of more thermally comfortable spaces for employees and allowance to natural daylight are being envisaged.

Initiatives being contemplated that would improve overall occupants' comfort and internal environmental quality include:

- **Preference for reflective roof sheeting:**

Solar heat is expected to be passively absorbed by the warehouse's roof sheeting, which shall drive the internal temperatures of the building up. By using a more reflective roofing material – which has a lower solar absorptance (SA) – the internal heat gains are reduced, thus reducing the average internal temperature of the building throughout the year.

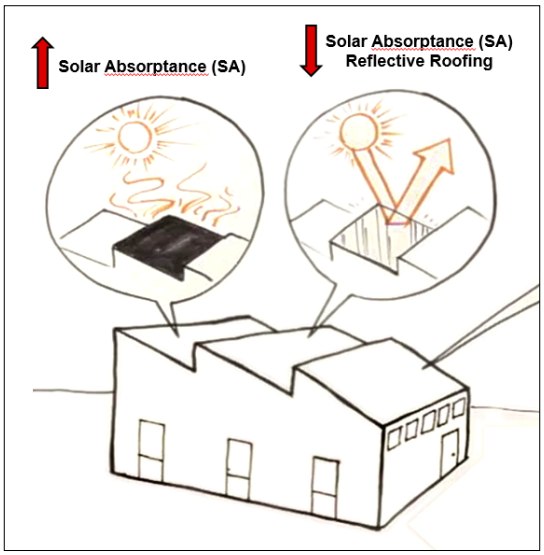


Figure 8 - Effect of roofing solar absorption (SA).

Figure 9 - Illustration of a light coloured (reflective) roof sheeting.

- **Application of translucent skylights:**

  Skylights are an excellent source of natural light. Natural light is preferred over artificial life because it falls in a more natural spectrum, is energy efficient and connects occupants to the outside.

  Considerations will be given to skylights sizing and heat transmissivity (HT), given these may allow more heat transfer to the warehouse interior, which is not desirable. Therefore, products with lower heat transmissivity will be prioritized.

  It may be preferable to reduce the skylight proportion over the staging areas, while leaving skylights in place in the storage areas. This allows a diffuse light into non-critical operation areas.

- **Increased natural ventilation:**

  Louvres or other openings in the walls/roof will allow cross-ventilation in the work zone, manageably increasing the air velocity and air change rates, what will passively reduce heat build-up in the space. The increased air movement provides a lower apparent temperature for the employees, as well as continuous introduction of fresh air.

  Even though outdoor air will eventually carry higher temperatures than the indoor air, the increased air speed allowed by louvres / openings can bring the occupants a greater thermal comfort than stagnant indoor air. This occurs because when the human body starts to overheat, it loses its capacity to remove that heat. Air movement is an important factor in thermal comfort and across the skin will remove the perspiration (sweat) heat very fast and offer a rapid drop in temperature. A lack of air movement can give a feeling of stuffiness.

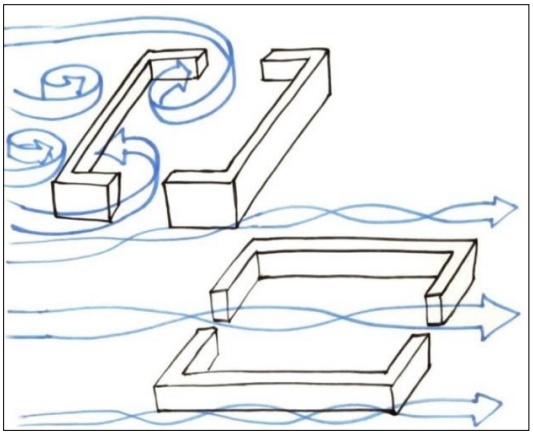


Figure 10 - Effects of opening placement in relation to wind directions.
Source: Autodesk Sustainability Workshop

Another efficient way to naturally cool a space is to locate exhausts at high levels. This can be through clerestory waterproof louvres, or preferably smoke exhaust fans can carry out the role. This is effective because rising hot air is able to escape the space through the high up fans, helping to keep the space cool. Roof exhaust fans effectively double the length of possible cross-ventilation by allowing exhaust air to exit at half the building's width.

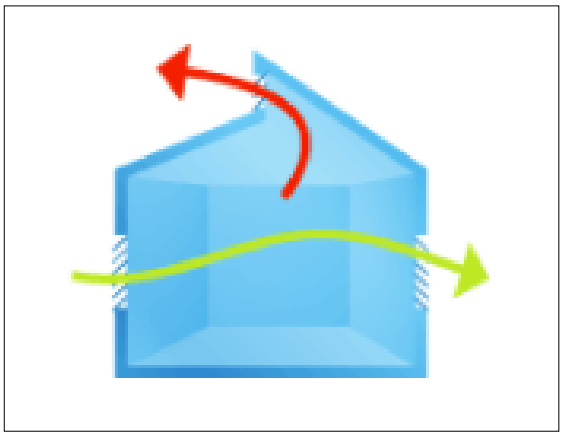


Figure 11 - Thermal Chimney Effect
(http://www.windowwarehouseqld.com.au/windows/louvres)

Figure 12 - Motorised smoke exhaust fans can enable hot air to escape through roof, facilitating air ventilation.

Note: Consideration will need to be given to the nature of the warehouse and its contents. In spaces where specific levels of air quality are required or strict humidity control, the design of louvres / openings must be more carefully considered. Additionally, there may be pollution, acoustic or dust issues with installation, which must be considered by the appropriate professional. Wind-driven rain may also provide a path for water ingress if louvres are not designed appropriately for their location.

- **Amenity Area**

  An outdoor amenity area is currently being considered within the Industrial Estate Masterplan. This could be incorporated within the site to allow for occupants' amusement and well-being. An open landscaped area and Café amenity could be included in such amenity zone. These could facilitate social interaction and would provide break-out spaces with increased levels of natural daylight, fresh air and landscaped terrain.

4.5 Building Management

Via the implementation of industry recognised best practice frameworks, the project design and built form will seek to respond to the ongoing environmental challenges of urban development and ensure the project implements a range of ESD initiatives aimed at improving ongoing building management.

Through specific contractual commitments and documented design intent the project proposes to address environmental management & building operational performance through the following initiatives.

- **Building Commissioning & Tuning Procedures:**

  Prior to practical completion / 12 months post practical completion. By implementing this via project contract documents the project ensures operational efficiency & building operation is optimised in accordance with the intended building design.

- **Smart Metering:**

  Smart metering will provide relevant data for the use & management of building staff. This will provide detailed information about the project energy use and profile on a regular basis and through an easily accessible online platform. This information will help in the understanding of the usage profile so that adjustments can be made to guarantee optimal performance. This ensures operational efficiency is maintained and also facilitates detection of systems failures, thus improving maintenance and tuning processes.

- **Waste provisions:**

  Appropriate waste provisions are going to be included within the project to ensure recycling rates & reduced waste to landfill is optimised.

4.6 Waste Management

In order to facilitate sustainable waste management within the City of Penrith in accordance with the principles of Ecologically Sustainable Development, waste minimisation and resource recovery, easy access to waste systems, pollution prevention associated with waste management practices will be taken into consideration as part of waste management strategy.

The Industrial Estate development is targeting to increase on-site recycling and resource optimisation through adoption of the Waste Management Hierarchy with the ultimate goal of reducing waste going to landfill, which is in line with the *The Waste Avoidance and Resource Recovery Act, 2001* and the *NSW Waste Avoidance and Resource Recovery Strategy 2014-21*. The waste reduction strategy follows the hierarchy pyramid below.

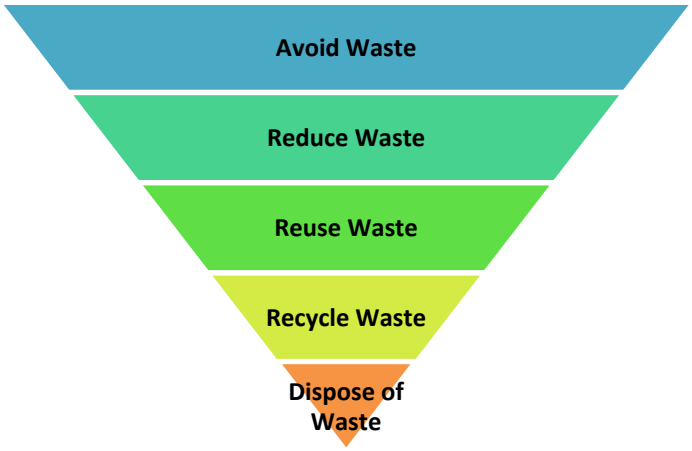


Figure 13 - The "Waste Hierarchy"

Best practice initiatives will be explored through a development of a Waste Management Plan, which is going to address Demolition, Early Works, Construction and Operation Waste Management Strategies, where appropriate.

The key objectives for the management of waste generated by the demolition, early works and construction will include:

- Minimise waste generation on site;
- Segregate waste on site to maximise recycling;
- Store wastes on site appropriately to prevent cross-contamination and/or mixing of different waste;
- Segregate hazardous waste for appropriate treatment and disposal, where applicable;
- Where appropriate, set targets for demolition and construction waste diversion from landfill;
- Where appropriate, analyse potential operational waste generation profile from the warehouses and propose best practice Waste Management Strategies.

5. Summary of Design Response

Ecologically Sustainable Design continues to be a driving consideration in the ongoing development of the Aspect Industrial Estate, Kemps Creek development. The Aspect Industrial Estate will incorporate a number of ESD initiatives - which are aligned with the applicable - to complement the initiatives undertaken to reduce the greenhouse gas emissions, potable water consumption and material resources of the site. These constitute the sustainability response from the project to the site applicable sustainable design frameworks, as listed within Section 3. Sustainable Design Framework.

The ESD initiatives outlined in this report are intended to be used as a design guide for the development. The specific initiatives that will be installed across the precinct will be determined throughout the development application stage for each individual building and will be subject to feasibility analysis, including that of the final use and layout. The initiatives are being designed to comply with the guidelines set out by the relevant authorities.

The development's commitment to reducing the overall environmental impact is evident of the holistic approach taken to long-term sustainability. Documented initiatives cover a range of categories including:

- Energy & Greenhouse gas emissions reduction
- Potable Water reduction
- Minimising Waste to landfill
- The Indoor Environment
- Occupant Amenity and Comfort
- Building Management

We trust this report provides sufficient overview of the project commitment to environmentally sustainable design and greenhouse gas and energy efficiency vision for the Aspect Industrial Estate development.

Design with
community in mind

Level 6, Building B
207 Pacific Highway
St Leonards NSW 2065
Tel +61 2 8484 7000

For more information please visit
www.stantec.com

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