Aviation Hangar Project

ESD Report

Prepared for: **RP Infrastructure c/o Aeria Management Group**

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Date: **25th June 2024**

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Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
01	30.11.2023	Draft Issue	TY	RD
02	25.06.2024	Final Issue	TY	RD

Rebecca Dracup

For and on behalf of

Stantec Australia Pty Ltd

Acknowledgment of Country

In the spirit of reconciliation, Stantec acknowledges the Traditional Custodians of country throughout Australia and their connections to land, sea and community. We pay our respect to their Elders past and present, and extend that respect to all Aboriginal and Torres Strait Islander peoples.

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 Aeria Management Group (AMG) for proposed new 9 aircraft hangars development located at Arvo Street, Bankstown Airport, NSW 2200. 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 explored and is intended to form part of the Major Development Plan application for proposed new 9 aircraft hangars located at Arvo Street, Bankstown Airport, NSW 2200.

Information contained within this report has been prepared in direct response to:

- Bankstown Airport Master Plan 2019
- The NSW Environmental Planning and Assessment Act 1979;
- The NSW Environmental Planning and Assessment Regulation 2021;
- State Environmental Planning Policy (Industry and Employment) 2021; and
- State Environmental Planning Policy (Sustainable Buildings) 2022

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 alignment with the above, the project will implement a number of greenhouse gas emissions, energy efficiency initiatives and sustainable design principles, including consideration of the below:

- Buildings to be net positive for carbon emissions where determined by AMG to be appropriate;
- Explore the possibility of on-site renewable energy production, for example, a 200kW photovoltaic (PV) solar system. For aviation safety, any PV system may be conditional on glint and glare studies Structural loading implications may also be examined for any PV system;
- 100% electric design;
- Environmental outcome benchmarked to a minimum of 5 Star Green Star Buildings;
- Smart metering;
- Explore the possibility of electric car and truck charging future provisioning;
- Explore the possibility rainwater harvesting and reuse for irrigation;
- 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;
- Waste Management Plan.

2. Introduction

2.1 Aviation Hangar Project Concept Masterplan

The project site is located on at Arvo Street, Bankstown Airport, NSW 2200, for the purposes of aircraft hangars. Bankstown Airport is located in the southwest Sydney industrial and commercial precinct, 25 km south west of Sydney CBD and 17km west of Kingsford Smith Airport. The airport is 1 km north of the M5 Motorway with access from both The River Road and Henry Lawson Drive. The Hume Highway is 2 km north.

Consistent with the above, this report has been prepared to support Section 12.5 Sustainability of the Major Development Plan for the purpose of:

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

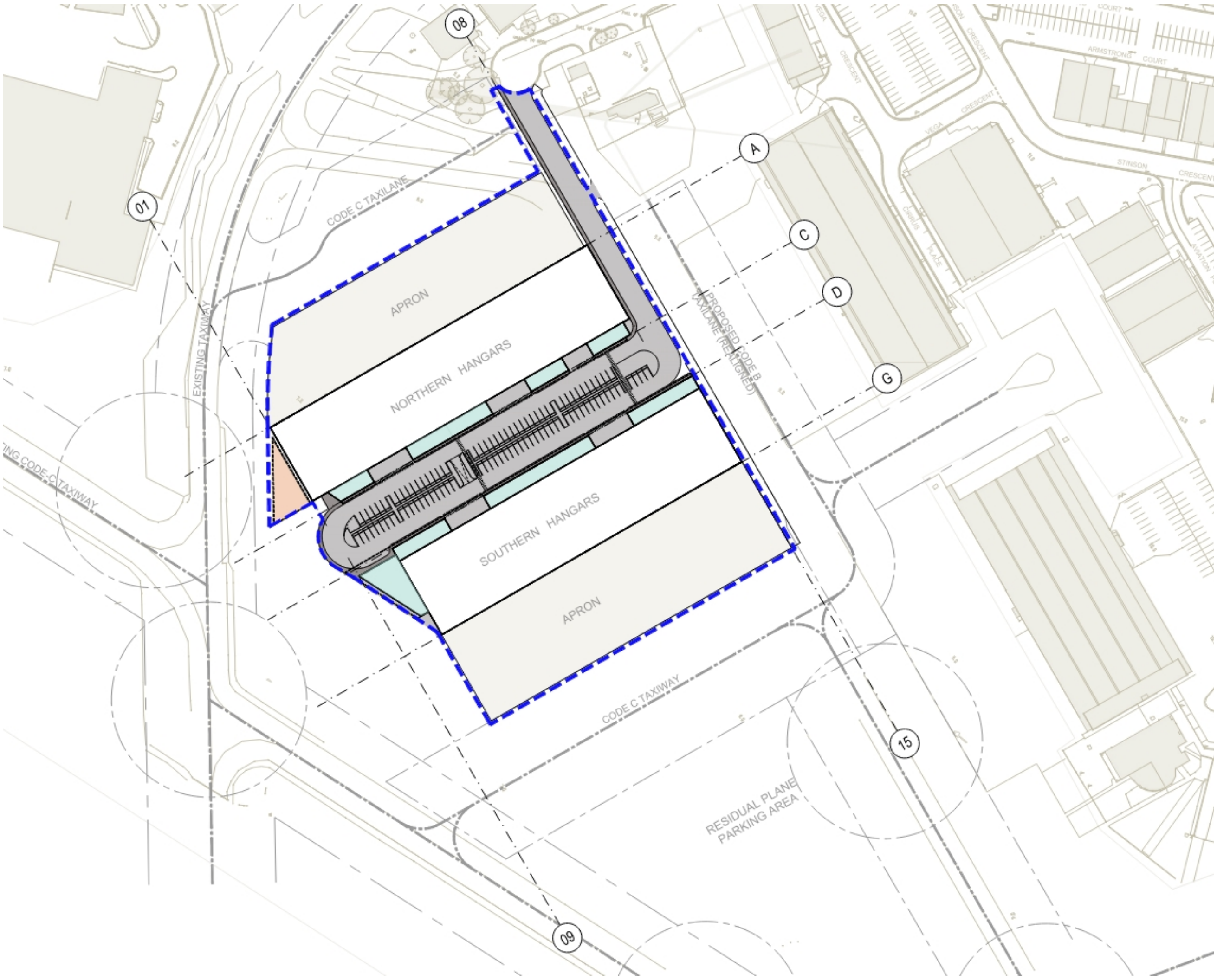

Figure 1 – Aviation Hangar Project – Site plan *(Crawford Architects)*

The project site area is 44,043 sqm. The proposed total hangar area is 9,978 sqm and the proposed office area is 3,506 sqm. Aviation Hangar Project Development is proposed to be used for aircraft storage and maintenance 24 hours a day 7 days a week.

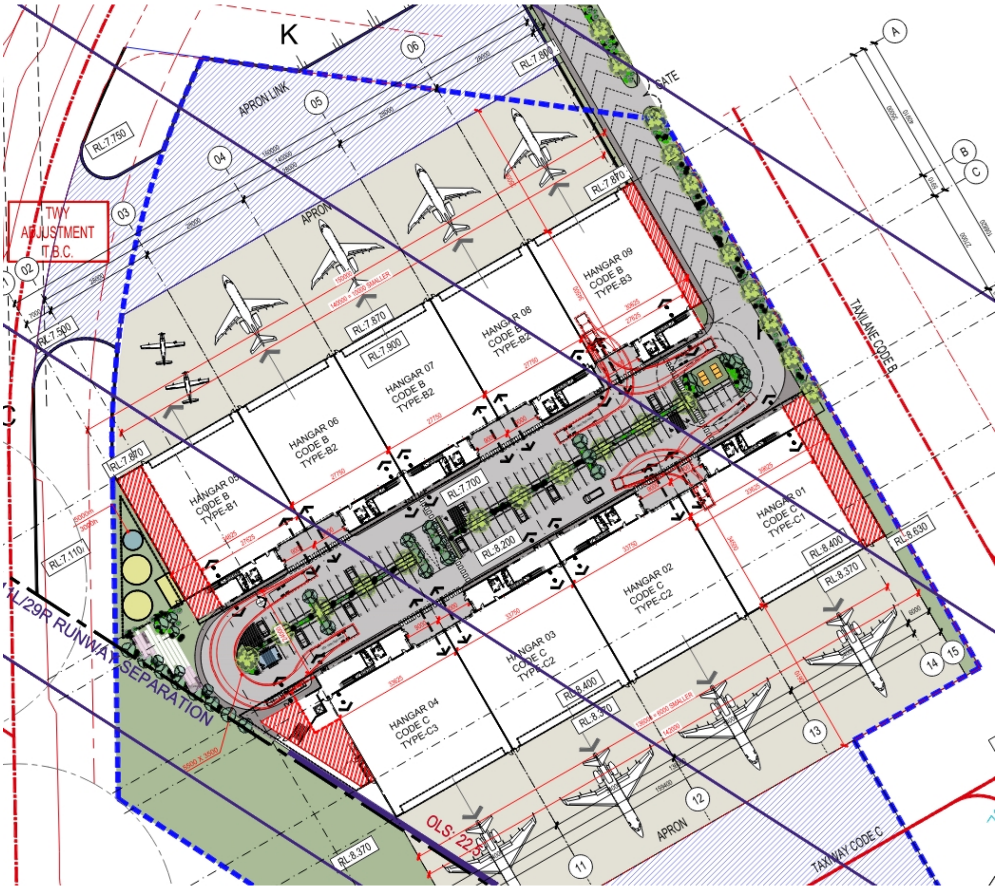

Figure 2 – Aviation Hangar Project Building Plan *(Crawford Architects)*

GROSS FLOOR AREA SCHEDULE - OPTION 01

	Hangar	Ground Floor Office	First Floor Office	2 Levels Office	
Hangar 01	1367	172	251	423	sqm
Hangar 02	1165	140	212	352	sqm
Hangar 03	1165	140	212	352	sqm
Hangar 04	1160	313	154	467	sqm
Lounge / Hangar 04		94	362	456	sqm
Hangar 05	1194	144	218	362	sqm
Hangar 06	957	105	172	277	sqm
Hangar 07	957	105	172	277	sqm
Hangar 08	957	98	172	270	sqm
Hangar 09	1056	98	172	270	sqm
CODE B	5121	550	906	1456	sqm
CODE C	4857	859	1191	2050	sqm
TOTAL	9978			3506	sqm

CODE-B HANGAR DETAILS

	Type B1		Type B2		Type B3	
Width	34.6	m	27.7	m	30.6	m
Door Opening	23.5	m	23.5	m	23.5	m
Depth	34.5	m	34.5	m	34.5	m
Height - Ridge	13.1	m	13.1	m	13.1	m
Height - Airside	12.2	m	12.2	m	12.2	m
Height - Laneside	10.9	m	10.9	m	10.9	m
Height - Door Opening	8.4	m	8.4	m	8.4	m
Area	1,194	sqm	957	sqm	1,056	sqm
Volume	14,337	m³	11,490	m³	12,680	m³

CODE-C HANGAR DETAILS

	Type C1		Type C2		Type C3	
Width	39.6	m	33.7	m	33.6	m
Door Opening	29.5	m	29.5	m	29.5	m
Depth	34.5	m	34.5	m	34.5	m
Height - Ridge	13.1	m	13.1	m	13.1	m
Height - Airside	12.2	m	12.2	m	12.2	m
Height - Laneside	10.9	m	10.9	m	10.9	m
Height - Door Opening	8.4	m	8.4	m	8.4	m
Area	1,367	sqm	1,165	sqm	1,160	sqm
Volume	16,407	m³	13,974	m³	13,922	m³

Table 1 - Aviation Hangar Project Details *(Crawford Architects)*

3. Sustainable Design Framework

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

- Bankstown Airport Master Plan 2019
- The NSW Environmental Planning and Assessment Act 1979;
- The NSW Environmental Planning and Assessment Regulation 2021;
- State Environmental Planning Policy (Industry and Employment) 2021; and;
- State Environmental Planning Policy (Sustainable Buildings) 2022

3.1 Bankstown Airport Master Plan 2019

12.5.1 ENERGY AND CLIMATE CHANGE

The Airport is considering ways to minimise the use of energy and maximising its efficiency along with alternative energy supply options for maintenance and development works. The focus is on reducing energy consumption and greenhouse gas emissions from Airport operations.

12.5.2 WATER USE

The Airport is taking steps to reduce the use of water in operational activities such as manufacturing, aircraft washing, and general maintenance and construction activities.

12.5.3 WASTE

The Airport prioritises waste management according to the resource management hierarchy embodied in the Waste Avoidance and Resource Recovery Act 2001. The Airport has confirmed through tenancy audits that recycling is generally being implemented, and is working with tenants to identify new ways to reduce waste and increase recycling.

3.2 The NSW Environmental Planning and Assessment Regulation 2021

Schedule 193 of Division 5 of Part 8 of the Environmental Planning and Assessment Regulation 2021 states:

193 Principles of ecologically sustainable development

1) *The principles of ecologically sustainable development are the following—*
    a) *the precautionary principle,*
    b) *inter-generational equity,*
    c) *conservation of biological diversity and ecological integrity,*
    d) *improved valuation, pricing and incentive mechanisms.*
2) *The precautionary principle is 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.*
3) *In applying the precautionary principle, public and private decisions should be guided by—*
    a) *careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
    b) *an assessment of the risk-weighted consequences of various options.*
4) *The principle of inter-generational equity is that the present generation should ensure the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*
5) *The principle of the conservation of biological diversity and ecological integrity is that the conservation of biological diversity and ecological integrity should be a fundamental consideration.*

6) *The principle of improved valuation, pricing and incentive mechanisms is that environmental factors should be included in the valuation of assets and services, such as—*
   a) *polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, and*
   b) *the users of goods and services should pay prices based on the full life cycle of the costs of providing the goods and services, including the use of natural resources and assets and the ultimate disposal of waste, and*
   c) *established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market 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 Sustainable Buildings SEPP 2022

Sustainable Buildings SEPP 2022 recommends consideration be given to the General Provisions listed below. Project's proposed sustainability response has been provided next to each of the provisions.

Section 3.2 (1) and (2) of the State Environmental Planning Policy (Sustainable Buildings) 2022 states:

3.2 Development consent for non-residential development

(1) In deciding whether to grant development consent to non-residential development, the consent authority must consider whether the development is designed to enable the following—

(a) the minimisation of waste from associated demolition and construction, including by the choice and reuse of building materials, - refer to Section 4.6 Waste Management

(b) a reduction in peak demand for electricity, including through the use of energy efficient technology, - refer to 4.2 Greenhouse Gas & Energy Efficiency

(c) a reduction in the reliance on artificial lighting and mechanical heating and cooling through passive design, - refer to 4.2 Greenhouse Gas & Energy Efficiency

(d) the generation and storage of renewable energy, - refer to 4.2 Greenhouse Gas & Energy Efficiency

(e) the metering and monitoring of energy consumption, - refer to 4.2 Greenhouse Gas & Energy Efficiency

(f) the minimisation of the consumption of potable water. - refer to 4.3 Water Efficiency

(2) Development consent must not be granted to non-residential development unless the consent authority is satisfied the embodied emissions attributable to the development have been quantified. - refer to Appendix for embodied emissions form

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 good practice sustainable initiatives will be incorporated so that potential environmental impacts are mitigated substantially.

The development will give strong consideration to potential environmental impacts by reducing it through application of good practice design and processes such as the many ESD commitments and initiatives listed in the following Section. The documented initiatives to be explored – 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 AMG to be appropriate;
- Explore the possibility of on-site renewable energy production, for example, a 200kW photovoltaic (PV) solar system. For aviation safety, any PV system may be conditional on glint and glare studies Structural loading implications may also be examined for any PV system;
- Environmental outcome benchmarked to a minimum 5 Star Green Star Buildings;
- Smart metering;
- Explore the possibility of Electric car and truck charging future provisioning;
- Explore the possibility Rainwater harvesting and reuse for irrigation;
- Energy efficient lighting systems (internal and external) and lighting controls;
- Design optimisation of façade thermal performance / building thermal mass;
- 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;
- Explore the opportunities of water sensitive urban design (WSUD) principles;
- Design to increase indoor & outdoor environmental quality;
- Waste Management Plan;
- Explore the provision of bike storages and end-of-trip facilities, determined by tenant needs;
- Others as presented in the following Sections.

Once the new development is under activity, operational guidelines, good practice procedures and appropriate monitoring and control measures will be defined by the building owner. This will be in accordance with 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 explores the good 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 explored in the project. The following examples are to be read in conjunction with design documentation prepared by Crawford 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 buildings' reliance on HVAC systems;
- Improve building occupant comfort; and
- Improve the project's capacity to deliver a responsible development.

The aircraft hangar 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 should be equivalent to a 5 Star Green Star project, based on the Green Star Buildings 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 Building 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 eight performance categories within Green Star, as follows:

- Responsible;
- Healthy;
- Resilient;
- Positive;
- Places;
- People;
- Nature;
- Leadership

The development may not target a formal Green Star certification, but further investigation is being undertaken by AMG 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 project. 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.

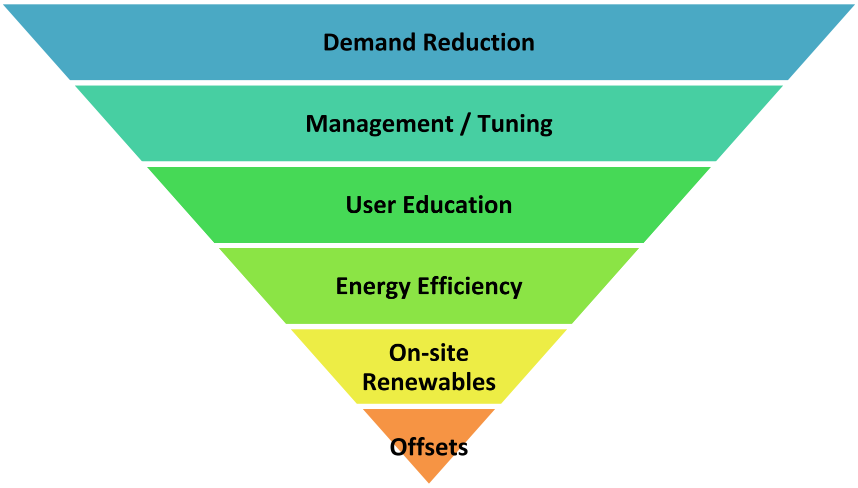

Figure 3 - Energy Efficiency Strategy Hierarchy

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:

- **Explore the possibility of On-site Renewable Energy Production – Min. 200 kW Solar System:**

  On-site Renewable Energy Production will be studied in the design to minimise utilisation of energy from the grid system and operational carbon footprint. For aviation safety, preliminary glint and glare study could be taken place to confirm ability to achieve 200kW PV system subject to CASA/Airservices reviews. Structural loading may also be examined for any potential PV system.

  The system should be designed so that renewable energy is prioritised for use. Consideration could also be given to selling excess energy back into the grid or storage on site for peak reduction.

  Further feasibility could be completed regarding the ideal system configuration, sizing, annual energy generation. 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.

Source: Google images

- **Explore the possibility of electric car and truck charging future provisioning:**

  By including conduit provisions and dedicated bays in the design for Electrical Vehicle charging, the development could provide incentive to the use of low-emissions vehicles, which reduces the harmful air pollution associated to vehicles exhaust emissions. Further consideration could 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.

- **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.

- **Design optimisation of façade thermal performance / building thermal mass:**

  Building envelope thermal performance to comply with NCC 2022 Section J for required spaces (e.g. Offices). This will reduce reliance on mechanical cooling and heating and therefore bringing down HVAC operational energy consumption.

  The aircraft hangar roof material and colour could be reflective of solar radiation subject to reflectivity assessment via CASA / ASA, and consideration will be given to building overall thermal mass and to application of thermal insulation appropriate to the local weather profile.

- **Design exploration of solar gain reduction / shadings:**

  External shading devices such as fixed aluminium sunshade louvres will be explored 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. Horizontal shading design will also be explored on North-West façade.

  The building roof could be 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. However, the final selection of roof colour will also be dependent on reflectivity and angle given proximity to runways for aviation safety reasons.

- **Efficient Hot Water Service:**

Efficient air source heat pump systems with high COPs will be appropriately explored and sized for the hot water services of the development. The efficiency of the system will be determined through design development. Individual direct electric hot water units will be minimised in the design.

- **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.

- **Selection of minimum 30% reduction in Portland cement for concrete.**

4.2.2 Aircraft Hangar Areas

The hangar floor area represents a large portion of the site area and as such is 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 hangar 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;
- Cross-flow natural ventilation strategy will be thoroughly explored for the hangar areas to minimise mechanical ventilation energy use;
- The large format efficient low-wattage big-ass fan will be designed to dry the aircraft and cool down the hangar area in the event of extreme heat wave.
- Large solar PV array to offset the energy consumption of the hangar machinery and building services.

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 2022 Section J requirements;
- Office heating/cooling will be provided by efficient air-condition system compliant with tenant office requirement;
- Exploration of zoned mechanical systems (centre/perimeter) depending on tenant fitout;
- Wider temperature control band (19-26 degrees instead of 21-25 degrees).

By combining all the above elements within the office area, 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 good 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 aircraft cleaning water uses.

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

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

- **Explore the possibility Rainwater harvesting and reuse:**

  A rainwater tank could be implemented as required. Further feasibility could 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, aircraft washing and toilet flushing.

- **Water use metering and monitoring:**

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

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

  Native 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.

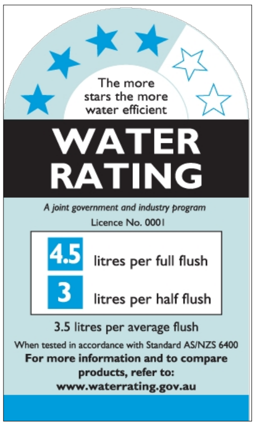

Figure 4 - Illustration of WELS rating label.

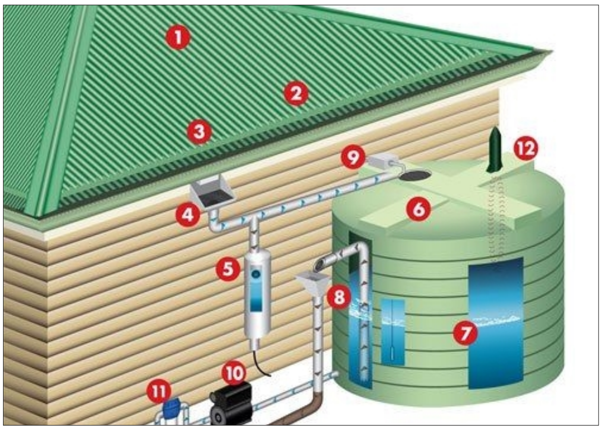

Figure 5 - Illustration of a Rainwater Harvesting System.

The above initiatives are sufficient to allow the project to meet good 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 Explore the opportunities of Water Sensitive Urban Design (WSUD)

The WSUD principles will be explored 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.
- To collect the rainwater and use the collected water for refrigerating condensers.

Examples of WSUD include rainwater tanks, porous pavements, rain gardens, green roofs, bioretention systems, swales, constructed wetlands and stormwater harvesting systems.

4.4 Indoor & Outdoor Environmental Quality

Internal Environmental Quality and occupant comfort will be a key consideration in the aircraft hangar 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 hangar'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. However, the final selection of roof will also be dependent on reflectivity and angle given proximity to runways for aviation safety reasons.

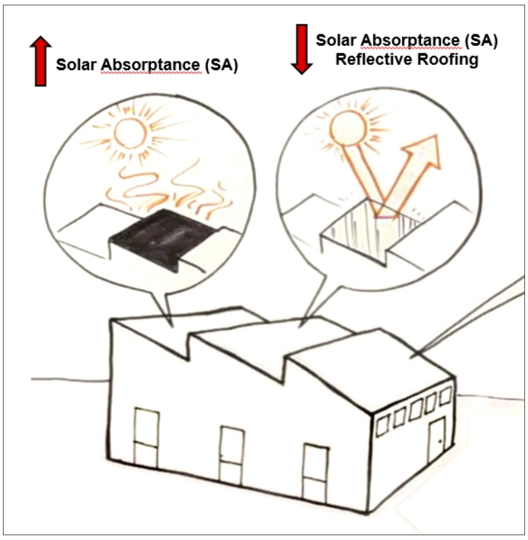

Figure 6 - Effect of roofing solar absorption (SA).

Figure 7 - Illustration of a light coloured (reflective) roof sheeting.

- **Application of translucent high level windows:**

High level windows are an excellent source of diffuse 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.

- **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.

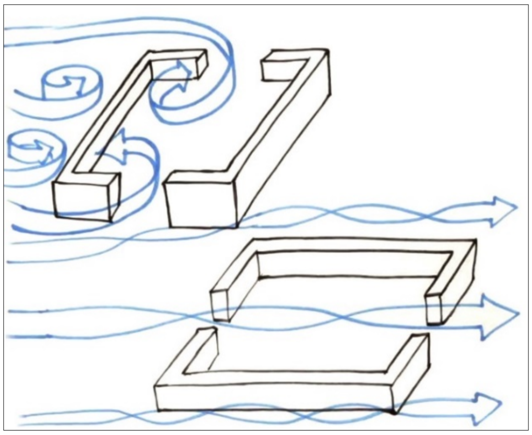

Figure 8 - Effects of opening placement in relation to wind directions.
Source: Autodesk Sustainability Workshop

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.

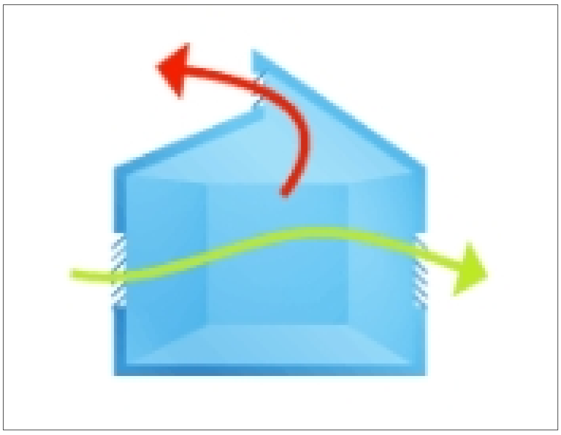

Figure 9 - Thermal Chimney Effect
(http://www.windowwarehouseqld.com.au/windows/louvres)

Figure 10 - 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 hangar 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 amenity area is currently being considered within the office area. This will be developed for occupants' amusement and well-being. A high-quality breakout area with access to daylight and spaces for staff to relax and socialise could be included in such an amenity zone.

- **End-of-trip facilities**

  Showers and changing areas could be explored for the use of regular occupants to encourage active transport to-and-from the site, and active break activities.

4.5 Building Management

Via the implementation of industry recognised good 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 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 Aviation Hangar Project 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 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.

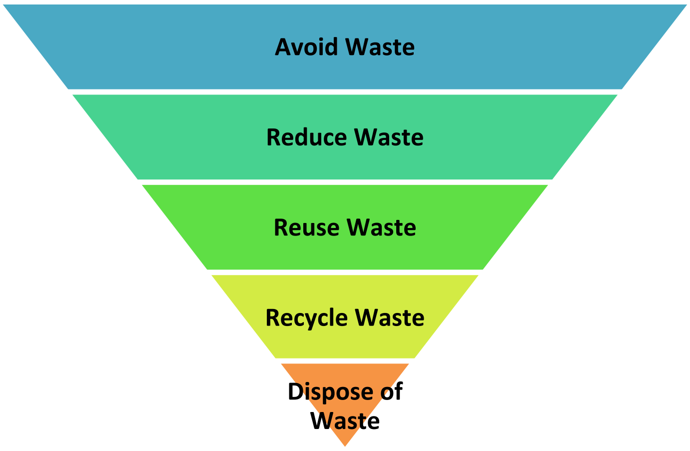

Figure 11 - The "Waste Hierarchy"

Good 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 project and propose good practice Waste Management Strategies.

4.7 Climate Resilience

Climate Change in Australia can deter the future amenity and wellbeing currently provided within the built environment. Natural disasters such as bushfires, floods, drought, dust and strong wind constitute real threats to buildings in operation, and the long-term effects of climate change are likely to increase the frequency of such events. It's paramount to future-proof building design and ensure its adaptability and resilience to long-term climate change effects. In response to the Climate Change, the following design solutions are recommended to be implemented in the development to improve the project's resilience against climate hazards:

Climate Variable	Proposed Design Solutions
Extreme Temperatures	• Provide a mixture of high-performance glazed façade systems and external shading. • Passive design elements incorporated into the design such as shading, orientation and insulation. • HVAC systems efficiently designed to maintain indoor comfort during peak conditions. • Light-coloured roof and surfaces to reduce urban heat island effect • Maximise tree canopy cover where possible, while meeting any aviation safety requirements

Water	**Water Conservation:** • Use of drought tolerant and native plants (40%) • Provide subsoil irrigation system to improve watering effectiveness • Recycled water from rainwater tank for irrigation and toilet flushing • Install water-efficient fittings to reduce risk on potable water which may be impacted during drought **Flood Mitigation:** • Provide safer access routes that are above the peak flood levels. • Provide early warning system for a risk of a flood. • Increased drainage considered for the development to reduce roof and surfaces flooding. • Increased building entrance height. • Design assessment to mitigate post development probable maximum flood (PMF) level. • Incorporate best practice maintenance strategies for stormwater system. • Install additional power sources such as back-up generators or battery storage located above the flooding heights.
Energy	• Designing for energy efficiency and grid resilience • Install additional power sources such as back-up generators or battery storage located above the flooding heights.
Fire	• Provide additional filtration for carbon filters and smoke removal. • Provisions of compliant fire and life safety design of the building to protect fire and life safety strategy (e.g., provisions of exits and egress, fire sprinkler and hydrant systems, smoke hazard management, etc.).

A Climate Change Adaptation Plan is recommended to be developed to further assess the projected climate risks for the site. This will allow for early mitigation for any elements found to be at high-risk to be designed for long-term safety, security, and operation.

4.8 First Nations Engagement

The Aviation Hangar Project development could explore the opportunities to work closely with local aboriginal community to celebrate the culture and heritage in alignment with targets from a Reconciliation Action Plan (RAP), for example:

- Local indigenous plantings, public art or placemaking will be integrated in the implementation of design.
- Aboriginal knowledge will represent in the creation of design.
- Creation of opportunities for indigenous employment and skills training.
- Respecting the diversity of Aboriginal culture by following community specific cultural protocols.
- At least 1% of project spend with First Nations business.

4.9 Diversity, Equity, and Inclusion

The Aviation Hangar Project development may explore diversity, gender equity and inclusion through the following measures:

- Implementing a social procurement plan.
- At least 10% construction workforce will come from diversity group, including Aboriginal and Torres Strait Islander peoples, women in leadership roles, women in non-traditional roles and people with disabilities.
- At least 20% of workforce will be Bankstown local residents in construction
- At least 2% of the building's total contract value will be directed to generate employment opportunities for disadvantaged and under-represented groups.
- The building's design and construction will be able to be navigated and enjoyed by stakeholders of diverse ages, genders, and physical and mental abilities. This applies to common spaces, bathroom facilities, and amenities provided within the building.
- Equal access to the building and diverse wayfinding will be provided by the building design.

4.10 Community Development

The Aviation Hangar Project development may consider its important role in social sustainability through measures that include:

- The project will design with community in mind by ensuring staff and wider community are involved in an early stage to support and contribute to decision-making. The support and engagement from stakeholders contribute to delivering objectives due to community taken ownership of these goals.
- Education of sustainable practices and ancient history of the site and buildings. Connection to place and country will increase awareness of all those participating on site to contribute to more sustainable practices. Achieving this included educational program to ensure the history and sustainable designs are delivered.
- Procurement of local products, partnerships and suppliers to support local communities and economies, minimise transportation emissions, build stronger support networks and increase connection to community
- Inclusion of wellness facilities, including end-of-trip facilities to support active, healthy lifestyles
- Provision of healthy food offerings during construction and operations

5. Summary of Design Response

Ecologically Sustainable Design continues to be a key consideration in the ongoing Aviation Hangar Project Development. The development will incorporate a number of ESD initiatives as applicable, 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
- The Indoor Environment Uplifting
- Building Management
- Minimising Waste
- Climate Change Resilience
- First Nations Engagement
- Diversity, Equity and Inclusion
- Community Development

We trust this report provides sufficient overview of the project commitment to environmentally sustainable design and greenhouse gas and energy efficiency vision for the Aviation Hangar Project Development.

Design with
community in mind

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