Lang Walker AO Medical Research Building - Macarthur 19/10/2021

Environmentally Sustainable Design Strategy

Prepared for

Western Sydney University

Melbourne
L2, 616 St Kilda Road
Melbourne, VIC 3000
P (03) 9230 5600

Sydney
L4, 73 Walker Street
North Sydney, NSW 2060
P (02) 8404 4210

Brisbane
L10/490 Upper Edward Street
Spring Hill, QLD 4000
P (07) 3831 3300

Revision Information

Project	Lang Walker AO Medical Research Building - Macarthur
Title	Environmentally Sustainable Design Strategy
Client	Western Sydney University
Prepared By	Garry Luu

Revision Schedule

Revision	Date	Issue Name	Authorised
Draft	19/07/2021	Draft for Comment	
01	07/10/2021	For SSDA	DS
02	14/10/2021	For SSDA	DS
03	19/10/2021	For SSDA	DS

Contents

1 Executive Summary

This report has been prepared by LCI for the Western Sydney University (WSU). This Report provides an overview of the Ecological Sustainable Design (ESD) initiatives considered for the new Lang Walker AO Medical Research Building - Macarthur, and to address the ESD requirements of the Secretary's Environmental Assessment Requirements (SEARs). This report will be included within the Environmental Impact Statement (EIS) that will accompany a State Significant Development Application (SSDA).

2 Introduction

The vision for the Lang Walker AO Medical Research Building - Macarthur project is to combine people-centred health research with public engagement spaces and will create a unique and exciting opportunity for community interaction and ownership. Located on the Campbelltown Hospital Campus, the research centre will be shared facility bringing together the following partner organisations:

- Western Sydney University (WSU);
- South Western Sydney Local Health District (SWSLHD);
- Ingham Institute for Applied Medical Research (IIAMR);
- University of New South Wales (UNSW); and
- Health Infrastructure (HI).

Embedding the Lang Walker AO Medical Research Building within the existing hospital campus will enable opportunities for translational research outcomes directly improving the health outcomes for the local population to be realised.

Ecological Sustainable Design (ESD) initiatives have been considered for the project to allow the project to achieve its vision in an environmentally responsible and efficient manner.

3 Site Description

3.1 The Site

The site is currently utilised as a helipad serving the Campbelltown Hospital Campus. The allotment is characterised by slopes from the south-east corner to the north-west corner, with a cross fall of approximately 30 metres towards Marsden Park (Park Central). The site itself is locally elevated to accommodate the existing helipad.

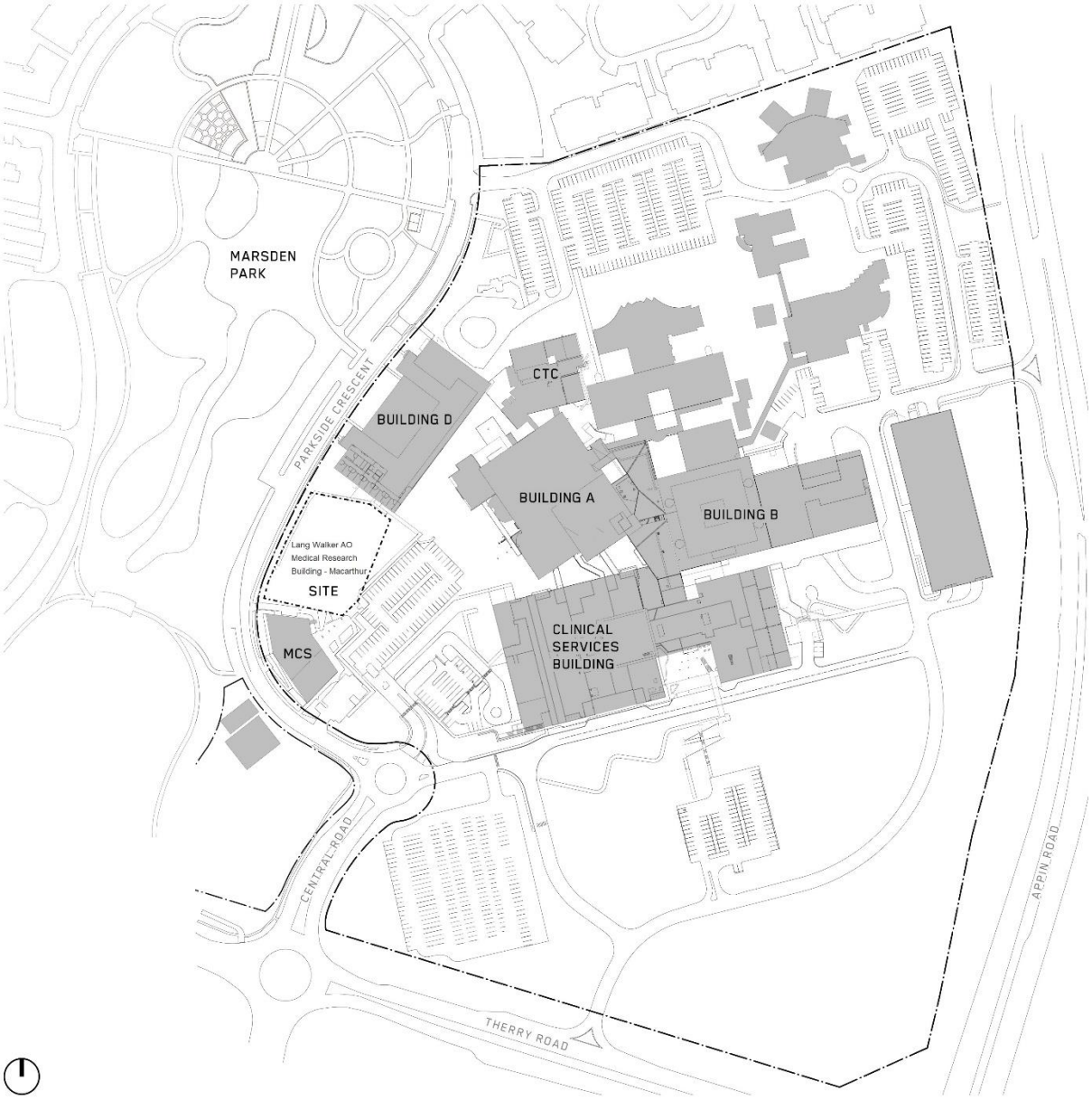

Figure 1: Precinct Plan

The Site has an area of approximately 3,384 m^2.

4 Overview of Proposed Development

4.1 Project Description

The proposed SSDA will facilitate the development of a new world-class health research facility which will support the needs of the local Campbelltown & Macarthur population. The Lang Walker AO Medical Research Building - Macarthur will be a shared facility bringing together the following partner organisations:

- Western Sydney University (WSU);
- South Western Sydney Local Health District (SWSLHD);
- Ingham Institute for Applied Medical Research (IIAMR);
- University of New South Wales (UNSW); and
- Health Infrastructure (HI).

Embedding the Lang Walker AO Medical Research Building within the existing Hospital Campus will enable opportunities for translational research outcomes directly improving the health outcomes for the local population to be realised.

Five key research themes have been identified for the site:

- Diabetes/Obesity,
- Mental Health,
- Paediatrics and Adolescents,
- Indigenous Heath, and
- Addiction to medicine.

The Lang Walker AO Medical Research Building will become an important linking piece on the Campus, with proposed bridge connections into Building D, helping to facilitate an interconnected internal pedestrian network and strengthening relationships between clinical, research and educational spaces.

The functional spaces include the following:

- Shared Public,
- Dry Research,
- Shared Support and Research Assessment Zone, and
- Logistics and support.

4.2 Site and Surrounding Context

The Site is positioned between the Clinical School and Building D along Parkside Crescent. This places the site at the western end of the Campbelltown Hospital Precinct.

The Campbelltown Hospital master plan includes future plans for a Village Green/Common area, which would front the Lang Walker AO Medical Research Building on its eastern side.

The site is serviced by and in close proximity to transport services and key road links including the M5 Southwestern Motorway off Appin Road. The site is located between Campbelltown and Macarthur railways stations, the closest being Macarthur, which is within walking distance approximately 1.2km northwest of the site.

The site can be accessed from both Parkside Crescent at the west, and from the future Village Green/Common at the east, which sits approximately 7m higher in the elevation.

Numerous carparks are located across the hospital campus including dedicated areas for public and staff.

5 Assessment Requirements

5.1 SEARs

The Department of Planning and Environment have issued Secretary's Environmental Assessment Requirements (SEARs) to the applicant for the preparation of an Environmental Impact Statement for the proposed development. This report has been prepared having regard to the SEARs as follows:

SEAR 7 | Ecologically Sustainable Development (ESD) and climate change	GS DAB v1.3 Alignment
Identify how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) would be incorporated in the design and ongoing operation phases of the development.	**See Section 6.0** regarding Clause 7(4) of the Schedule 2.
Identify proposed measures to minimise consumption of resources, water (including water sensitive urban design) and energy	**See Section 7.0** for the Sustainability strategies considered in the project.
Identify how the future development would be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on a materiality assessment and include waste reduction design measures, future proofing, use of sustainable and low-carbon materials, energy and water efficient design (including water sensitive urban design) and technology and use of renewable energy.	**See Section 6.1 and 6.2** for details regarding designing and constructing to achieve recognised building sustainability and environmental performance standards. **See Section 7.0** for the Sustainability strategies considered in the project.
Provide an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.	**See Section 6.1 and 6.2** for details regarding designing and constructing to achieve recognised building sustainability and environmental performance standards.
Provide a statement regarding how the design of the development is responsive to the NARCliM projected impacts of climate change. <u>Relevant Policies and Guidelines:</u> NSW and ACT Government Regional Climate Modelling (NARCliM) climate change projections	**See Section 8.0** for Design for Climate Change.
Provide an Integrated Water Management Plan detailing any proposed alternative water supplies, proposed end uses of potable and non-potable water, and water sensitive urban design	**Refer to the Civil design report** for details regarding the Integrated Water Management

6 SEAR 7 | Ecologically Sustainable Development (ESD) and

6.1 Clause 7(4) of Schedule 2

The ESD principles that are to be incorporated into the proposed development must be aligned with Clause 7(4) – Schedule 2 – Environmental Planning & Assessment Regulation (2000).

6.1.1 The Precautionary Principle

The proposed Lang Walker AO Medical Research Building – Macarthur development will be constructed on a previously developed site. This will not have an adverse environmental impact and therefore alleviates concern of serious or irreversible environmental damage. Proactive measures to prevent environmental degradation have been included within the design, construction and operational phases of the proposed development. During the design and construction phases the main contractor will implement an Environmental Management System that follows NSW Environmental Management System Guidelines.

6.1.2 Inter-Generational Equity

To uphold inter-generational equity, the proposed development minimises the consumption of energy and water resources while reducing waste.

The ESD principles incorporated into the proposed Lang Walker AO Medical Research Building – Macarthur facilitates the conservation of energy and water resources through energy and water efficiency measures. Energy reduction has been considered in the design of the building, through passive and active measures. The reduction in water use has been considered through high WELS equivalent water fixtures and fittings, low water demand landscaping and use of non-potable water sources where appropriate.

Waste generated during the construction and operational phases will be diverted from landfill to be recycled. An Environmental Management System (EMS) will be utilised throughout construction. Operational waste streams will be separated to maximise recycled waste in accordance with WSU's operational waste practices. Reducing energy, water and waste ensures that the health, diversity and productivity of the environment is maintained for the benefit of future generations.

6.1.3 Conservation of Biological Diversity and Ecological Integrity

The existing site comprises of lawn and an existing helipad serving the Campbelltown Hospital Campus. The project will be constructed on a previously developed site and will include excavation works and the demolition of the existing helipad. The proposed Lang Walker AO Medical Research Building – Macarthur will also seek to increase the amount of native landscaping to improve sites ecological value. As a result, the project will not reduce the surrounding biodiversity and ecological integrity.

The project's ESD principles to reduce energy, water and waste consumption have an indirect impact to conserve biodiversity and ecological integrity to the surrounding area. By minimising demand on energy and water resources, the need for land-clearing and the pollution generated from new Lang Walker AO Medical Research Building – Macarthur to support the surrounding area will be minimised.

6.1.4 Improved Valuation

The valuation of the project's assets and services consider environmental factors through the implementation of various ESD initiatives. An Environmental Management System will be adhered to during construction to ensure that contractors are responsible for costs associated with generating excessive pollution and waste. The project team will bear the extra cost of providing recycling and landfill waste streams during construction and operational phases. This creates a system where the polluter pays and creates an incentive to reduce pollution and waste.

The design and construction will be assessed against NCC, and Green Star Design and As-built v1.3 rating tool which will provide environmental goals for the project. Project requirements stipulate design teams are contractually required to deliver targeted ESD initiatives for the project.

6.2 Framework to Reflect Best Practice Sustainable Design Principles

6.2.1 WSU Sustainability Directions

In accordance with the University's strategic plan, ''Securing Success 2018-2020'', WSU is committed to Sustainability and ensuring that it is a central part of the University's organisational culture and operations.

The proposed Lang Walker AO Medical Research Building – Macarthur project aims to maximise environmental performance and achieve a commercially viable and sustainable outcome addressing:

- Management
- Energy
- Transport
- Materials
- Land use and Ecology
- Emissions
- Innovation

As a Signatory to supporting the United Nations Sustainable Development 2030, WSU is deeply committed to Sustainability, not just of the institution or WSU's Campuses and infrastructure, but to the health and well-being of WSUs communities and stewardship of the environment.

The 2030 Agenda for Sustainable Development identifies 17 Sustainable Development Goals, which are an urgent call for action by all countries in a global partnership, as well as targets to measure and report progress, The University has committed to support and promote the following Sustainable Development Goal principles:

- Undertake research that provides Solutions to Sustainable development Challenges.
- Provide the educational resources for our students to acquire the and Skills to promote Sustainable development.
- Contribute to the achievement Of the Sustainable Development Goals by ensuring our Campuses and major programs are environmentally sustainable and socially inclusive.
- Report our activities in support of the Sustainable Development Goals

The Lang Walker AO Medical Research Building – Macarthur project is aligned with the following Sustainable Development Goals:

- 4 — Quality Education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- 6 — Clean Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all
- 7 — Affordable and Clean Energy: Ensure to affordable, reliable, sustainable, and modern energy for all
- 11 — Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, and Sustainable.
- 12 – Responsible Consumption and Production: Ensure sustainable consumption and production patterns
- 15 – Life on Land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

6.2.2 Green Star Design and As-built V1.3

The Lang Walker AO Medical Research Building – Macarthur will target a minimum 5 Star certified Green Star rating using the Green Star Design and As-built v1.3 rating tool.

The Green Star Design and As-built rating system provides a framework to assess how a building reduces its impact on the environment while meeting the economic and social needs for its occupants and surrounding communities. Green Star's goal is to "lead the sustainable transformation of the built environment", by encouraging practices that:

- Reduce the impact of climate change.
- Enhance the health and quality of life of inhabitants and the sustainability of the built environment.
- Restore and protect the planet's biodiversity and ecosystems.
- Ensure the ongoing optimum operational performance of buildings.
- Contribute to market transformation and a sustainable economy.

The Green Star Design and As Built v1.3 rating system assessing buildings through the following categories:

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials & Construction Waste
- Land use and Ecology
- Emissions
- Innovation

Points are awarded for a building project's ability to secure as many credits from each category. Each credit targets the environmental impact of a specific design feature. The total number of points awarded determines the level of certification (star rating) as shown in Figure 2.

Figure 2: Available Green Star Design & As Built Certification ratings

7 Sustainable Design Principles at Lang Walker AO Medical Research Building – Macarthur

The following sustainable design principles have been considered for the Lang Walker AO Medical Research Building – Macarthur and can be addressed through the categories outlined within the Green Star (GS) Design and As Built (DAB) v1.3 rating system. The following sections are structured as follows:

- 7.1 Management Practices
- 7.2 Indoor Environmental Quality
- 7.3 Energy Conservation
- 7.4 Transport
- 7.5 Water Conservation
- 7.6 Materials & Construction Waste
- 7.7 Sustainable Sites: Land use and Ecology, and Emissions

7.1 Management Practices

The following sustainable building design and construction management practices have been considered for the Lang Walker AO Medical Research Building – Macarthur project. These strategies seek to implement process and practices to maximise sustainable design opportunities from project design through to construction and operation.

Sustainable Building Design and Construction Management Practices	GS DAB v1.3 Alignment
Undertake Ecological Sustainable Design workshops to identify valuable and appropriate sustainable design initiatives for the project. Inclusion of building services design workshops and reviews with the WSU facility management teams.	1.1 Accredited Professional 2.1 Services Maintainability Review
Establish environmental performance targets for energy and water conservation, and reporting and tracking of consumption. Inclusion of sub-metering and monitoring to facility tracking and monitoring of energy and water consumption.	2.0 Environmental Performance Targets 5.1 Environmental Building Performance 6.0 Metering and monitoring
Use durable and low maintenance materials which require very little energy to maintain over their life (such as painting, cleaning etc.)	5.2 End of Life Waste Performance
Implementation of building commissioning to ensure the building is operating efficiently as intended as per the established energy and water targets.	2.2 Building Commissioning
Building tuning practices during the first year of operation to rectify operation and efficiency issues from the building services.	2.3 Building Tuning
Inclusion of contractual requirements for the contractor to provide building information in the form of Operations and maintenance manuals, and the development of a building logbook for ongoing maintenance of the building.	4.1 Building Operations & Maintenance Information

Sustainable Building Design and Construction Management Practices	GS DAB v1.3 Alignment
Contractual requirements for the head contractor to implement an Environmental Management Plan and management system in accordance with ISO14001.	7.0 Responsible Construction Practices
Inclusion of adequate waste storage facilities to allow for waste separation, and collection to be further processed at the central waste storage facility.	8.0 Operational Waste

7.2 Indoor Environment Quality

The following Indoor Environment quality strategies have been targeted during schematic design stage to improve occupant comfort and wellbeing. The strategies seek to address visual comfort, thermal comfort, indoor air quality and acoustic comfort.

Indoor Environment Quality Strategies	GS DAB v1.3 Alignment
Design and installation of mechanical services in line with best practice design to reduce pollutants from sources and dust/particulates during installation. Provision of increased outdoor air to appropriate spaces and exhaust of indoor pollutants / procurement of low emitting printers and photocopiers.	9.1 Ventilation System Attributes 9.3 Exhaust OR Elimination of Pollutants
Spaces designed in accordance with best practice noise levels.	10.1 Internal Noise Levels 10.2 Reverberation
High Colour Rendering Index for lighting, ballasts or drivers to reduce flicker in lighting and local occupant controls.	11.1 General Illuminance & Glare Reduction 11.3 Localised Lighting Control
External shading and internal blinds to assist with glare control. Views and daylight through windows and façade openings.	12.0 Glare Reduction 12.1 Daylight 12.2 Views
Specification of low VOC paints, adhesives, sealants and carpets (where appropriate). Specification of low formaldehyde engineered wood products.	13.1 Paints, Adhesives, Sealants & Carpets 13.2 Engineered Wood Products
Design of building fabric to assist with improved thermal comfort, through appropriate window to wall ratios, insulation level, window U-values and solar control performance.	14.1 Thermal Comfort

7.3 Energy Conservation

The Lang Walker AO Medical Research Building – Macarthur has adopted the energy hierarchy approach in reducing energy use. The energy hierarchy approach seeks to systematically targeting building energy use through passive means first, then supported by efficient active systems and renewable energy. The energy conservation strategies targeted for the project are included below.

Energy Reduction Hierarchy	Energy Conservation Strategies	GS DAB v1.3 Alignment
Built Form and Massing	Passive Design - Massing and orientation of spaces and facades to limit unwanted heat loads from the west. - Consideration for mixed mode ventilation to the circulation areas. - Thermal grouping/zoning of spaces with similar internal conditions.	Not specifically addressed in GS.
Demand Reduction through high performance building envelope	Passive Design - Appropriate window to wall ratios. Locating window areas such as large windows to the end of circulation/transient areas, and smaller windows to working spaces (offices and consultation rooms). - External solar shading - Appropriate thermal performance through insulation performance and window U-values and Solar Heat Gain Coefficients (SHGC) have been considered for the thermal zones.	15A.0 Conditional Requirement 15A.1 Building Envelope 15A.2 Glazing 15 Greenhouse Gas Emissions reduction
Efficient Systems and Electrical Demand Reduction	Active Design - High efficiency Air-conditioning (4-pipe heat pump air cooled chillers) equipment such as simultaneous heating and cooling equipment have been considered. - LED lighting throughout, including programmable lighting control system (intelligent lighting) - High efficiency domestic hot water technology (Heat Pumps) has been considered. - Energy efficient lifts have been considered.	15A.3 Lighting 15A.4 HVAC 15A.5 Domestic Hot Water 15A.9 Vertical Transport 15 Greenhouse Gas Emissions reduction
Onsite Generation and Renewable Energy	- Solar Photovoltaics (Onsite Electricity Generation) have been considered for the project and will be further reviewed against the project's budget.	15 Greenhouse Gas Emissions reduction
Building Networks	- Energy metering, Sub-metering of Air-conditioning, general power, lighting, domestic hot water will be considered to allow for waste energy use and peak electricity demand. Metering and monitoring do not	6.0 Metering and Monitoring

Energy Reduction Hierarchy	Energy Conservation Strategies	GS DAB v1.3 Alignment
	reduce energy; however, they facilitate energy management practices. - Building Management System to track power and energy use for ongoing monitoring and reporting	
Offsite Renewable Energy	- Offsite renewable energy to be considered by WSU against their existing power supply contracts with Campbelltown Hospital and possibility to incorporate offsite renewable energy for the project.	15A.10 Off-Site Renewables 15 Greenhouse Gas Emissions reduction
Electrification	- No fossil fuels (gas) equipment has been incorporated in the project. This initiative excludes the diesel generators which will only be used for backup power.	15A.8 Fuel Switching 15 Greenhouse Gas Emissions reduction

7.4 Transport

No additional carparking will be included as part of this development which continues to support access by public transport.

7.5 Water Conservation

The Lang Walker AO Medical Research Building – Macarthur has adopted the water hierarchy approach in reducing potable water use. The water hierarchy is similar to the energy hierarchy, and seeks to reduce potable water demand, then supported by efficient distribution systems and recycled water / non-potable water sources. The water conservation strategies considered for the project are included below.

Water Reduction Hierarchy	Water Conservation Strategies	GS DAB v1.3 Alignment
Demand Reduction	- Low flow fixtures, fittings and appliances rated to the WELS standard. - Native landscape species selection and design. - Weather and moisture sensing technology for control of landscape irrigation. - Waterless heat rejection systems (Air cooled Chillers) have been proposed.	18B.1 Sanitary Fixture Efficiency 18B.3 Heat Rejection
Efficient distribution	- Water efficient irrigation systems (drip irrigation or subsoil drip) - Water metering of equipment.	18B.4 Landscape Irrigation
Fit for purpose water sources	- A rainwater tank has been incorporated to capture and reuse rainwater for landscape irrigation and toilet flushing.	18B.2 Rainwater Reuse
Water Recycling	- Rainwater harvesting	18B.2 Rainwater Reuse

7.6 Materials & Construction Waste

The following materials and construction waste strategies have been considered for the Lang Walker AO Medical Research Building – Macarthur to increase the uptake of environmentally preferable materials with a focus on reuse and recycle content, reduced embodied energy, greater transparency, and reduction of waste to landfill.

7.6 Materials & Construction Waste	GS DAB v1.3 Alignment
Concrete mixes with Portland cement reduction, contains at least 50% captured or reclaimed water, and aggregates Reduction through coarse or fine aggregates.	19B.1 Concrete
Reduce reinforcing steel use, sourced from a Responsible Steel Maker, and at least 60% of all reinforcing bar and mesh is produced using energy-reducing processes.	19B.2 Steel 20.1 Structural and Reinforcing Steel
Timber products used are certified by a forest certification scheme such as Forest Stewardship Council (FSC) certified. Use rapidly renewable materials (eg. bamboo flooring) where possible.	20.2 Timber Products
All permanent formwork, cables, pipes, flooring and blinds do not contain PVC and have an Environmental Product Declaration (EPD) OR meet Best Practice Guidelines for PVC.	20.3 Permanent Formwork, Pipes, Flooring, Blinds & Cables
Preference for products and materials with sustainability credentials such as Reused Products, Recycled Content Products, Environmental Product, Declarations, Third Party Certifications (such as GECA) and Stewardship Programs.	21.1 Product Transparency
Commit to at least 90% of the waste generated during construction and demolition to be diverted from landfill for recycling. This includes re-use of onsite spoil where appropriate, or back fill aggregate with clean recycled content (e.g. Construction Demolition waste aggregate).	22.1 Demolition and Construction Waste
Minimise on site cutting noise and waste, standard size materials or prefabricated materials used, or materials cut to size at supplier's premises.	Not addressed in Green Star
Materials are sourced locally where possible to reduce emissions associated with transportation.	19A life Cycle Impacts

7.7 Sustainable Sites: Land use and Ecology, and Emissions

The following sustainable site strategies have been considered to:

- Reduce the negative impacts on sites as a result of construction and development and enhancing the local ecology.
- Reduce the negative impacts associated with buildings, such as refrigerant leaks, storm water peak discharge and pollution and light pollution.

Sustainable Site Strategies	GS DAB v1.3 Alignment
Water Sensitive Urban Design principles are incorporated Porous/permeable landscaping and ground surfaces where appropriate to reduce stormwater runoff.	26.1 Peak Discharge 26.2 Stormwater Pollution Targets 18B.4 Landscape Irrigation 25.1 Heat Island effect
No critically endangered, endangered, vulnerable species or ecological communities were present on the site at the time of purchase. The site does not include old growth forest or wetland of 'High National Importance', or did not impact on 'Matters of National Significance'	23.0 Endangered, Threatened or Vulnerable Species 24.0 Conditional Requirement
Improvement of ecological value of the site.	23.1 Ecological Value
Site contamination is identified with remedial steps undertaken to decontaminate site prior to construction	24.2 Contamination and Hazardous Materials
Consideration of site surface treatments to reduce heat island effect, such as vegetation and light-coloured roofs to reflect solar radiation.	25.1 Heat Island effect
Achieve a reduction in peak sewer discharge comparing pre-development to post-development discharge. Achieve a reduction in pollution levels	26.1 Peak Discharge 26.2 Stormwater Pollution Targets
All outdoor lighting to comply with AS4282:1997 to reduce light pollution, downlighting for external light fixtures including external pathway.	27.0 Light Pollution Neighbouring Properties 27.1 Light Pollution Night Sky
Microbial control from air-conditioning heat rejection systems is eliminated through the use of air-cooled heat rejection.	28.1 Microbial control
The combined Total System Direct Environmental Impact (TSDEI) of the refrigerant is less than 15 or use refrigerants that have a zero Ozone Depletion Potential (ODP); AND a Global Warming Potential (GWP) of 10 or less	29.1 Refrigerants

8 Design for Resilience to Climate Change

The project requires design features that will future-proof itself from the impacts of climate change. NSW and ACT Government Regional Climate Modelling (NARCLiM) has identified the following climate change projections:

1. More hot days and fewer cold nights
2. Increase the number of heatwave events
3. More hot days above 35°C; particularly in Spring and Summer
4. Rainfall will increase in Summer and Autumn and decrease in Winter and Spring
5. Change in rainfall patterns will affect drought and flooding events

These projections will have an impact on operational costs and occupancy comfort and safety. Hotter days with more heatwaves will particularly affect patients and the operation of building services equipment. This will also require higher capacity and operational costs for mechanical services to maintain occupancy comfort. Increased drought events will require provisions to supplement shortages in potable water. Stronger and reinforced façade components will be required to withstand increased rainfall and wind gust events.

The design initiatives in the following table aim to mitigate the effect of future climate change while maximising efficiency in energy, water and material use. These measures should allow the project to meet the difficulties predicted by the CSIRO's climate change projections while maintaining occupancy comfort and operational efficiency.

Climate Change Projections	Climate Change Risk	Climate Change Design Mitigation Measure
Hotter days and more frequent heatwave events 	T1: Hotter conditions leading to occupant comfort concerns	T1: Minimise unwanted solar heat gain into spaces through shading and glazing performance.
	T2: Hotter conditions leading to occupant comfort concerns due to higher cooling demand during peak conditions	T2: Improve efficiency of mechanical services.
Extreme Heat 	T3: Extreme Heat leading to warmer outdoor areas	T3: Utilise landscaping and trees to reduce surface temperatures for a cooler microclimate during warmer seasons
	T4 Extreme Heat leading to occupant comfort concerns	T4: Improved thermal performance building fabric will be utilised to mitigate heat discomfort and heat stress.
	T5 Extreme Heat to increased solar absorptance and cooling loads.	T5: Reduce the urban heat island effect through consideration of light-coloured roofs, site hardscaping surface finishes and landscaping.
	T6 Extreme Heat leading to occupant comfort concerns due to higher cooling demand during peak conditions	T6: Mechanical system will be designed to provide adequate thermal comfort to occupants to ensure safe operation of equipment during extreme heat events.
Extended drought periods	D1: Extended drought periods leading to restrictions for water use	D1: Reuse of non-potable water for landscaping by capturing rainwater.

Climate Change Projections	Climate Change Risk	Climate Change Design Mitigation Measure
	D2: Extended drought periods leading to dying off of planting and vegetation	D2: Landscaping with native low-water plant species
More extreme rainfall events  **Storms and Flooding** 	R1: More extreme rainfall events leading to flooding.	R1: Increase peak stormwater discharge capability. Increase over-flow drainage from site. Permeable site finishes to allow for ground water infiltration.
Gustier wind conditions 	W1: Gustier wind conditions leading damage to the façade and windy outdoor areas.	W1: Consideration of reinforced façade and drainage of the building, respite, and shelter areas.

9 Conclusion

This report details responses to the Department of Planning, Industry and Environment's SEARs for the preparation of an Environmental Impact Statement (EIS) for the Lang Walker AO Medical Research Building – Macarthur. The report demonstrates the following:

- A broad set of ESD initiatives have been targeted within the current project design, and all the policy requirements under SEAR 7. The initiatives include ESD strategies that benefit the design and ongoing operation phases of the development.
- Measures to minimise consumption of resources, water (including water sensitive urban design) and energy.
- Consideration of low carbon materials,
- Demonstrate ESD performance through achievement of a 5 Star rating certified against the Green Star Design & As-Built v1.3 tool.
- Inclusion of strategies that address and respond to climate change impacts.