If a building becomes architecture, then it is art. Clearly, if a building is not functionally and technically in order, then it isn't architecture either – it's just a building.
Arne Jacobsen

Mechanical Engineering
Lighting Design
Sustainable Design
Electrical Engineering

Copenhagen
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SUSTAINABLE DESIGN

STEENSEN VARMING

Gunnedah Hospital Redevelopment
ESD Review of Environmental Factors (REF) Report

Gunnedah Hospital Aerial - Skyview Aerial

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Document Revision and Status

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17/04/2023	01	Revised Draft	Updated to reflect staging plan	JW	
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1.0 Executive Summary

This report has been prepared by Steensen Varming on behalf of the Applicant. It accompanies an Review of Environmental Factors (REF) for Gunnedah Hospital Redevelopment (GHR).

The purpose of this report is to summarise the Environmentally Sustainable Design (ESD) initiatives being considered for GHR, explain how the project has addressed the REF and, provide an overview of how the proposed design is responding to sustainable planning.

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2.0 Assessment Requirements

In preparing this report, the following Review of Environmental Factors (REF) General Requirements and Key Issues have been addressed. The table below sets out the reference or location of these matters within this report.

Ecologically Sustainable Development

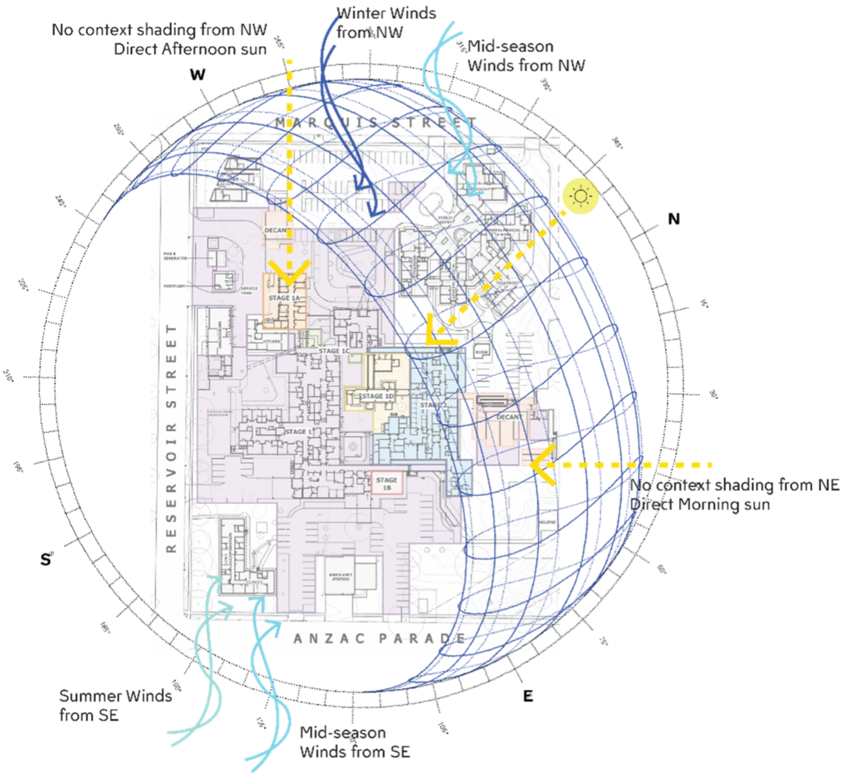
General Requirement or Key Issue	Reference / Location within this report
Address how the development will meet HI's ESD principles and achieve building sustainability/ energy/water/material performance.	The ESD initiatives proposed for the project aim to reduce the environmental impacts typically associated with buildings during the construction and ongoing operation of the building. The project utilises a resource hierarchy approach, with emphasis on avoiding, then reduction of energy, water, waste and materials. Resource conservation is a key focus of the sustainability strategy, including strategies for energy, water, and material resources. The project will meet HI's ESD principles by aspiring to meet the sustainability targets from HI's ESD Evaluation tool from DGN 058. Refer to sections 6, 7 and 8.

3.0 Introduction

This report has been prepared by Steensen Varming for Gunnedah Hospital Redevelopment (GHR).

Steensen Varming has been engaged by GHR as an independent ESD consultant. This report outlines the Ecologically Sustainability Development (ESD) requirements, principles and strategies recommended for this project required to meet HI's ESD principles.

At Steensen Varming, the approach to sustainability is to work with the client and design teams to develop best practice sustainable principles that align with the vision and respond to the unique context of the site and building requirements as well as acknowledging the unique requirements of this project as a research and development facility.



Proposed site plan with complete works. Plan by DWP architecture.

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4.0 Requirements and targets

NSW Health Infrastructure (HI) and the Local Health District (LHD) have defined high-level ESD targets for GHR as follows:

- As per DGN 058 and considering the project's location, **a minimum of 45 points + 5 buffer points (or 4-star equivalent**) to be achieved by the design in accordance with HI's ESD Evaluating tool.
- LHI has set an aspirational target for this project to go beyond the minimum requirements and aim to meet **60 points + 5 buffer points (or 5-star equivalent)** to be achieved by the design in accordance with HI's ESD Evaluating tool.
- A **minimum 10% improvement** in energy efficiency compared to a baseline of NCC Section J compliance applicable to the development.

4.1 HI ESD Evaluation Tool

HI ESD evaluation tool is a list of sustainable initiative categorised in 9 sustainability sections which cover issues such as management, indoor environment quality, energy, water, waste, transport, emissions, ecology, and innovation.

GHR is targeting a self-certified approach to achieve 'Australian Excellence' level, which is equivalent to 65 points out of 110 available.

The self-certification pathway is based on the agreed approach between Health Infrastructure and Department of Planning, Industry and Environment (DPIE) in demonstrating an equivalency against the Green Star rating system.

The evaluation tool contributes to the 2050 Net Zero goal by including several targets focused on resource conservation and minimising operational energy use. It also incentivises the transition to full electric developments, enabling 100%.

4.2 NCC Section-J

Section-J of the National Construction Code (NCC) 2019/2022 (TBC) (Previously known as the Building Code of Australia (BCA)) relates to "energy efficiency" of buildings". Section J is a minimum performance target for standard buildings and specifies minimum performance targets known as deemed-to-satisfy (DTS) requirements, for building fabric and services.

GHR target is to achieve a minimum 10% greenhouse gas improvement against the NCC 2019 Section J baseline. This will require to perform energy modelling and incorporate energy efficiency features into the proposed building. For this project, energy modelling is outside the ESD Consultant's scope of work; it will be performed by the Mechanical engineer during Schematic design through to Detailed Design. Any improvement in energy-efficiency beyond the minimum requirements of Section-J, will also contribute towards the project's HI ESD Evaluation Tool energy score.

NSW Government has committed to achieving net zero emissions by 2050. DPIE's *NSW Net Zero Plan, Stage 1:2020-2030* report outlines key priorities for achieving this target. Recently, the NSW Government has committed to an interim target of 50% emission reduction from 2005 levels by 2030. Steensen Varming recommends a high performance and low carbon outcome for the GHR project to align with the NSW Government's stated emissions reduction targets.

5.0 Health care specific considerations

The physical environment of healthcare facilities can have a significant effect on the health and wellbeing of both patients and staff and has the potential to minimise stress. Therefore, the design team should focus on optimising the environment to ensure positive outcomes.

There has been a growing awareness among healthcare administrators and medical professionals of the need to create a healthy indoor environment that would be healing and therapeutic to enhance patient wellbeing and conducive to staff wellbeing and productivity. This list below outlines some of the key healthcare specific requirements that must be addressed, including:

Indoor environmental quality

Health Care facilities are one of the most complex building types, and the greatest challenge is to reduce their energy consumption, while maintaining their specific functional needs to enhance patient comfort.

Daylight

Daylight is found to be a critical requirement for human beings, for both psychological and physiological wellbeing. In healthcare settings daylight is found to be beneficial to the patients as well as staff.

Views

Windows provide access to a view to the outside and establish connections to the surrounding natural environment, both in terms of weather conditions and time of day. Among patients, having such visual connections have been associated with reduced anxiety, pain, depression, and delirium.

Outdoor Places of Respite

There is increasing evidence that proves that patients gain healing benefit from having access to outdoor gardens and places of respite.

Biophilia

Integration of greenery improves views, air quality and connection to nature, which can reduce anxiety, pain and depression. Balconies can also support additional shading and improved energy efficiency and access to outdoor space.

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Air Quality

It is important to achieve good air quality in controlling and preventing airborne infections in healthcare facilities. Providing clean, filtered air and effectively controlling indoor air pollution through ventilation are two key aspects of maintaining good air quality. Several studies show that high-efficiency particulate air (HEPA) filters are highly effective in filtering out harmful pathogens and are strongly recommended in areas housing immunocompromised patients. Adequate ventilation rates and regular cleaning and maintenance of the ventilation system are critical for controlling the level of pathogens in the air.

Acoustics

Healthcare facilities can be extremely noisy. The high ambient noise levels, as well as peak noise levels in these types of buildings, can have serious impacts on patient and staff outcomes ranging from sleep loss and elevated blood pressure among patients to emotional exhaustion among staff. Poorly designed acoustic environments can pose a threat to patient confidentiality if private conversations between patients and staff or between staff members can be overheard by unintended listeners and, a poor acoustic environment impedes effective communication between patients and staff and between staff members by rendering speech and auditory signals less intelligible or detectable. Installing high-performance sound-absorbing acoustic finishes results in shorter reverberation times, reduced sound propagation, and improved speech intelligibility.

Smart Technology & Infrastructure

Integrate site wide data connectivity to enable open data sharing and adoption of smart technology throughout building areas.

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6.0 Sustainability Approach

Sustainability requires a holistic and integrated design approach, which builds on the awareness of climate, site, form, function, and a broad range of other initiatives.

6.1 Climate Overview

Understanding the local climatic conditions is essential for the development of appropriate, climate-responsive passive and active strategies for the building and its services. The analysis includes:

- Temperatures – daily and annual heights, lows, and averages
- Humidity and dewpoint – periods of muggy or dry conditions
- Wind – annual average wind frequency, direction and strength
- Sun – solar exposure and intensity

The following graphs show the average conditions from the Gunnedah Airport weather station. A review of likely climate change impacts is also presented to acknowledge the shifting climate conditions in the future.

Table 1 – Climate Statistics for Australian Locations:
Gunnedah Airport

Climate Variable	Period 2001-2022 Annual Average
Mean Maximum Temperature (C°)	26.2 C° (Summer: 34.6 C° Winter: 17.4C°)
Mean Number of Days ≥ 35 C°	42.1
Mean Minimum Temperature (C°)	10.2 C° (Summer: 18.6 C° - Winter: 2.0C°)
Mean Number of Days ≤ 2 C°	58.4
Mean Rainfall (mm)	568.3
Mean number of days of rain	86.3
Mean number of days of rain ≥ 10 mm	19.4

Source: [BOM]

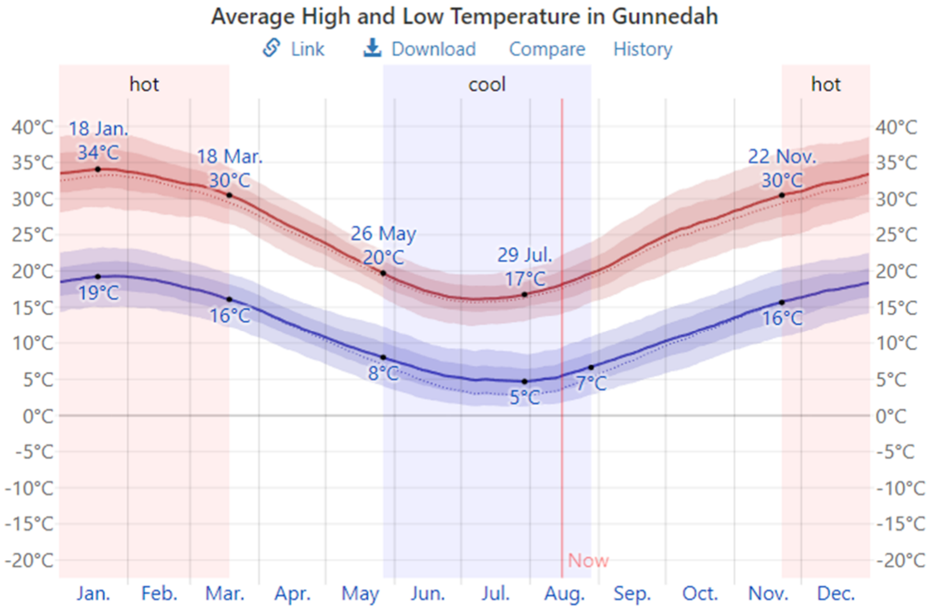
6.2 Temperature

The area will have a wide temperature range through the year. During mid-seasons the temperatures can be comfortable offering significant opportunities for natural ventilation and being outdoors in shoulder seasons. There are some hot periods during summer and some cold periods during winter.

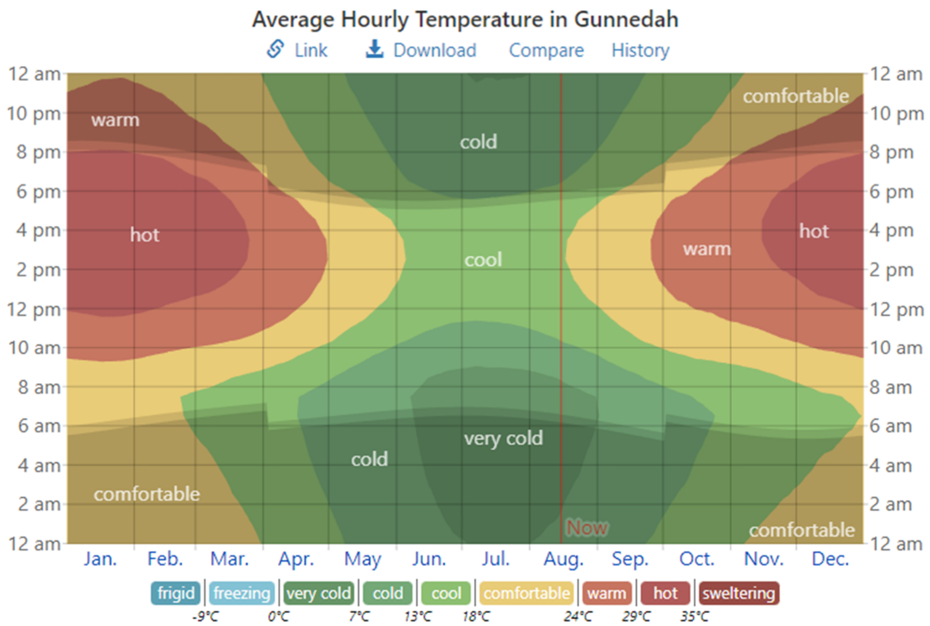
High external air temperatures in summer advocates for ground sourced heat rejection were feasible and the need for effective solar control.

Swings in diurnal temperatures offer opportunities for night-time cooling/thermal storage strategies utilising the cooler temperatures overnight in summer and midseason, in offsetting AC consumption for the following day.

The following diagrams show the annual average variation (high and low) in outdoor temperatures and the comfort ranges for the site throughout the year.



The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.



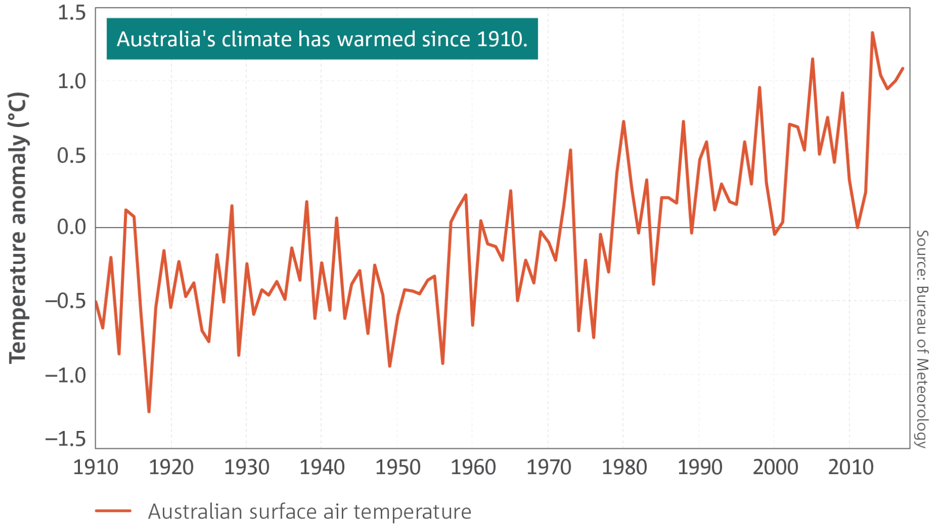
The average hourly temperature, color coded into bands. The shaded overlays indicate night and civil twilight.

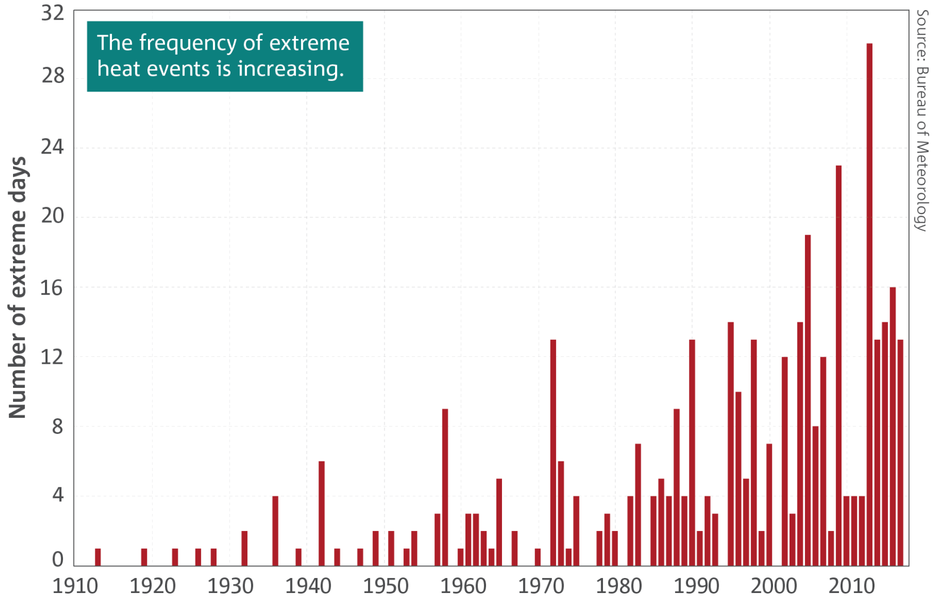
(https://weatherspark.com/y/144517/Average-Weather-in-Gunnedah-Australia-Year-Round)

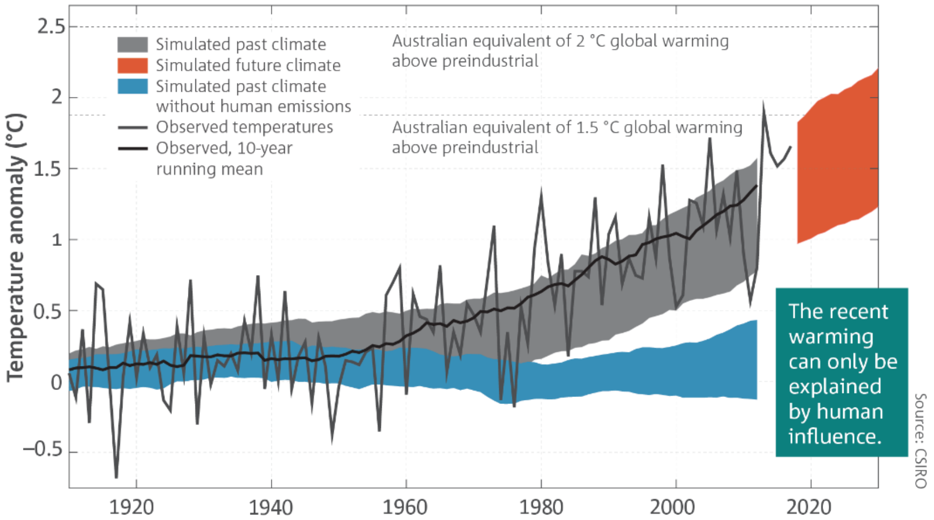
6.3 Climate change impacts on temperatures

Australia's climate has seen gradually increasing average temperatures over the past century, with an increase of just over 1°C since 1910. The majority of this increase has occurred since 1950 and 8 of Australia's top ten warmest years on record have occurred since 2005.

It has also seen an increase in the number of extreme temperature days (days where temperatures exceed the 99th percentile of each month from 1910-2017). The two graphs below show the average temperature anomalies (using 1961-1990 as the averaging point) and the frequency of extreme heat events between 1910 and 2019:







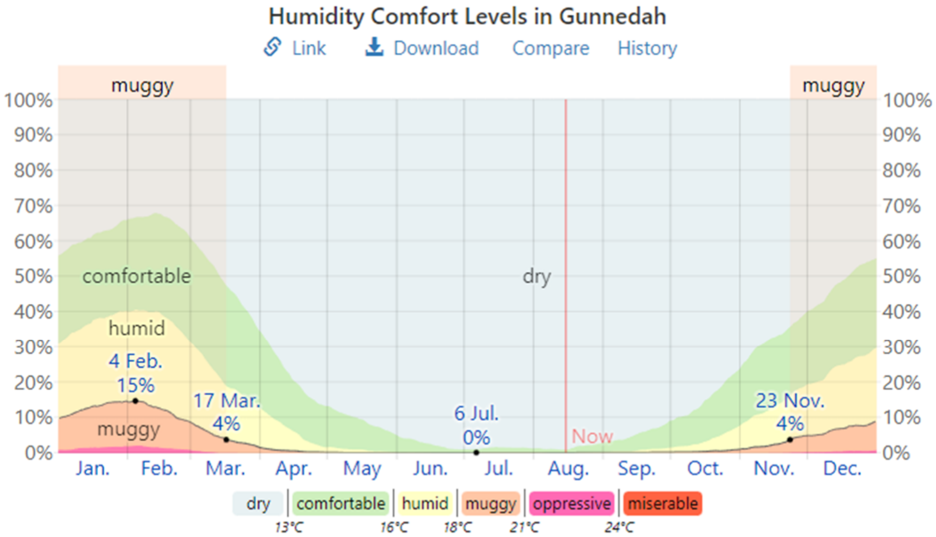
This trend is predicted to continue, and the extent of the warming will be based on global emissions scenarios. The current projections (source: Adapt NSW) are as follows:

Climate Projections for:	Near future (2020-39) Annual:	Long term (2090) Annual:
Change in mean temperature	+0.71°C	+2.17°C
Change in rainfall	+3.63%	+9.19%
High fire danger days	+0.27	+1.31
Hot days over 35°C	+7.67	+26.63

6.4 Humidity

Humidity can be high at certain points during the peak summer months, but otherwise, the air will feel fairly dry and comfortable.

The following diagram shows the humidity comfort levels throughout the year. The graph shows the percentage of time at different dew point temperatures (not Relative Humidity levels), which provides a good indication of how comfortable space feels. Lower dew points feel drier and higher dew points feel more humid.



The percentage of time spent at various humidity comfort levels, categorized by dew point.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Muggy days	3.9d	3.4d	1.3d	0.1d	0.0d	0.0d	0.0d	0.0d	0.0d	0.1d	0.8d	2.1d

6.5 Wind

The diagrams below show the annual wind distribution as averages 10m above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages.

Prevailing winds shift between easterly and westerly directions, with summer winds predominantly from the south east, and in winter, when some level of shelter may be desired when temperatures are cooler, predominant winds are more commonly from the north west.

The acceptability of wind is dependent on the activity of the people in the outdoor space. For example, people walking will tolerate higher wind speeds than those seated. In the table below acceptable wind speeds for different activities are summarised.

Classification	Activity	Mean wind speed (m/s)
Acceptable for walking	Walking (fast) from A to B	8-10
Acceptable for strolling	Slow walking, window shopping, etc.	6-8
Acceptable for short exposure	Standing or sitting for a short time	4-6
Acceptable for long exposure	Sitting for a long time	0-4

Care must be taken to consider wind flows in forecourt area, where a mix of stationary and active uses will occur.

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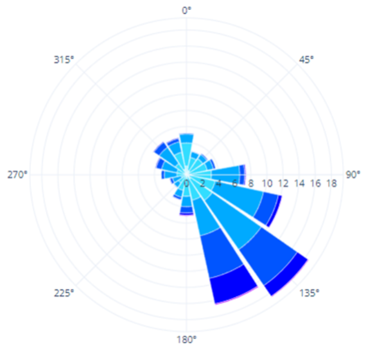
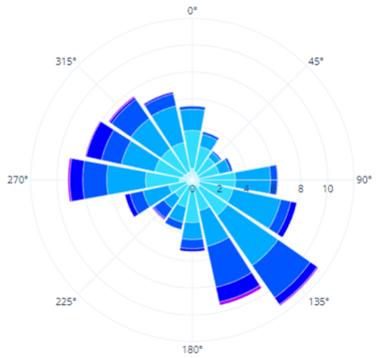
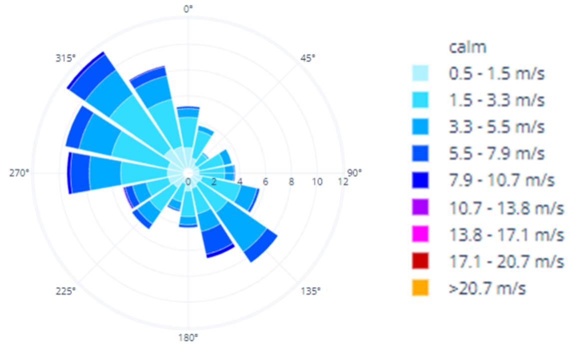
Summer Wind speed and direction.



Mid-Season Wind speed and direction.



Winter Wind speed and direction.



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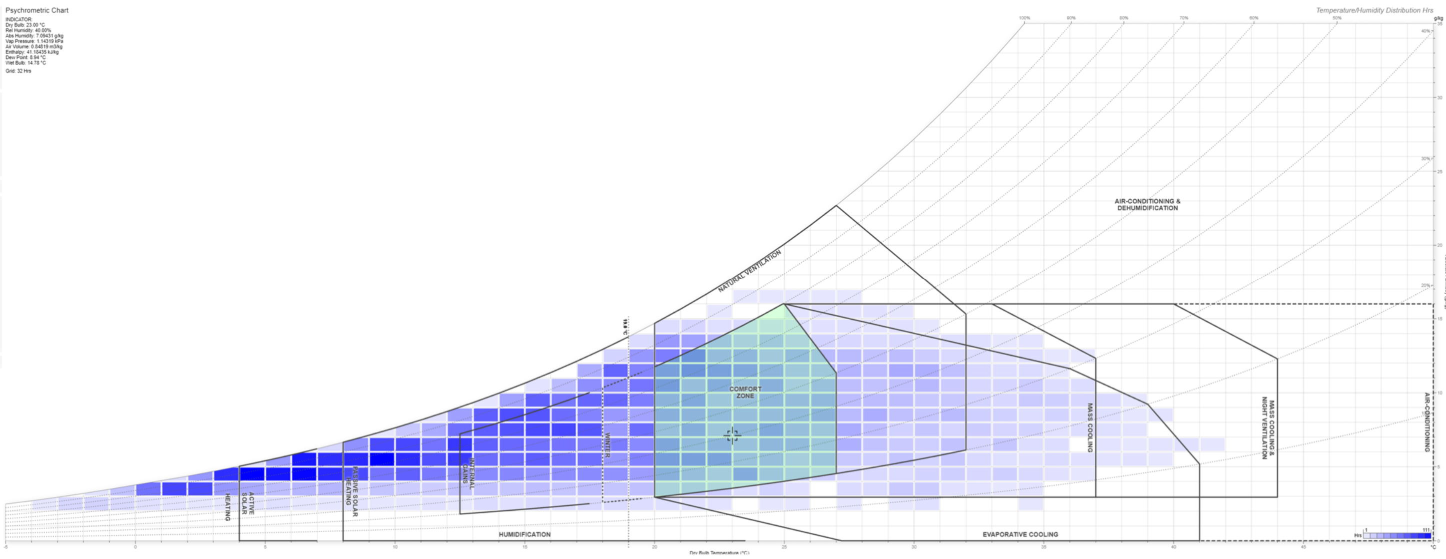
6.6 Thermal Comfort

As shown in the charts above, the climate is sub-tropical, with warm, humid summers and cool winters. Due to relatively comfortable year-round conditions, the climate should enable passive strategies to be used for most of the year.

The following psychrometric chart shows the distribution of wet and dry bulb fluctuations throughout the year, with possible passive building design strategies that could work for the new research centre:



Psychrometric chart for Gunnedah climate with passive design strategies overlaid

The chart shows the following key analysis:

1. **Summer strategies:** a combination of natural ventilation and thermal mass with night purge could help passively cool the building;
2. **Winter strategies:** thermal mass and passive solar heating could help warm the building.

It is important to note that while passive heating and cooling strategies can be adopted throughout the building, additional control of the hospital spaces will still be required throughout the year to maintain the stricter temperature and humidity set points.

6.7 External Noise Sources

Given the importance of acoustics within the work environment, potential external noise sources and levels that may impact the development will be assessed, such as surrounding roads, helicopters, possibly flights and ongoing construction to determine whether acoustic treatment is required and whether opening windows to allow natural ventilation will lead to significant noise issues.

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7.0 Site & Building Strategy Considerations

The diagram below illustrates site-specific considerations and opportunities being discussed both at site/infrastructure level and at building level. The analysis takes into consideration the current design proposal.

ESD Opportunities

Resource Conservation

Energy / Carbon

- **Electrification** – No fossil fuel usage on-site
- **Optimise façade** - balance Heat Gains / Daylight / Views / Performance / Lab Function / Privacy
- **Mixed mode** ventilation where feasible
- **Metering & Monitoring**
- **Efficient plant**, equipment, lighting, controls
- **On-Site Renewables** - Maximised Rooftop PV where possible

Water

- **On-site water storage** – Rainwater Harvesting
- **Stormwater** management - WSUD
- **Efficient Systems** and appliances
- **Non-potable water** for cooling towers

Material & Waste

- Project Specific waste management space and stream separation.
- Incorporate **modular** construction
- **Waste management** spaces
- Aim for reduce **C&D Waste** to landfill by 80%
- **Low embodied carbon**, low VOC and formaldehyde, durability considerations for material selection.

Sustainability Requirements / Targets

Australian Building Codes Board

- Minimum NCC Section J 2019/22 + 10%
- No fossil fuels on site. (Full Electric)
- Aspirational Green Star 5 Star Equivalency. (Min 4 Star)

Health, Wellbeing & Community

Health & Wellbeing

- **Indoor Environmental Quality** (Thermal comfort / Air Quality / Lighting / Views / Glare / Acoustics)
- Connection to **outdoor space**, nature and biophilia.
- **Mixed-mode** / Natural Ventilation where possible
- **Maximise daylight** access to all occupied areas where practical
- **Encourage activity** / walking
- **Community Consultation**

Site, Environment, Resilience, Transport

Transport

- Wayfinding and pedestrian access around the new build and to the existing site
- Improve cyclist access & infrastructure
- Electric Vehicle charging stations where possible.
- Direct, attractive pedestrian routes around the site

Resilience

- Climate Adaptation Plan (TBC)
- Resilience to future climate & hazards
- Reduction of Heat Island Effect
- Flexibility of building to adapt to future uses
- Maximising the building lifespan

Site & Environment

- Landscaping - Endemic native species with low water demands + drip irrigation system.
- Stormwater management - use of WSUD features
- Building responding to context
- Massing optimisation
- Creating an efficient building footprint

Operational Sustainability Management

Sustainability Management & Optimization

- Set Environmental Performance Targets
- Advanced metering and monitoring strategy
- Integrated smart technology to optimise all strategies
- Undertake building commissioning and tuning
- Prepare O&M Plan for all building systems

7.1 Resource Conservation – Route to Zero Carbon

Many strategies have been included to address resource conservation and reducing Greenhouse Gas Emissions, with an overview provided in the following sections. A key strategy is the removal of fossil fuel consumption and full electrification of the

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site. Through the design of a full electric building, the hospital could purchase 100% Green Power which would enable net zero GHG emissions in operation.

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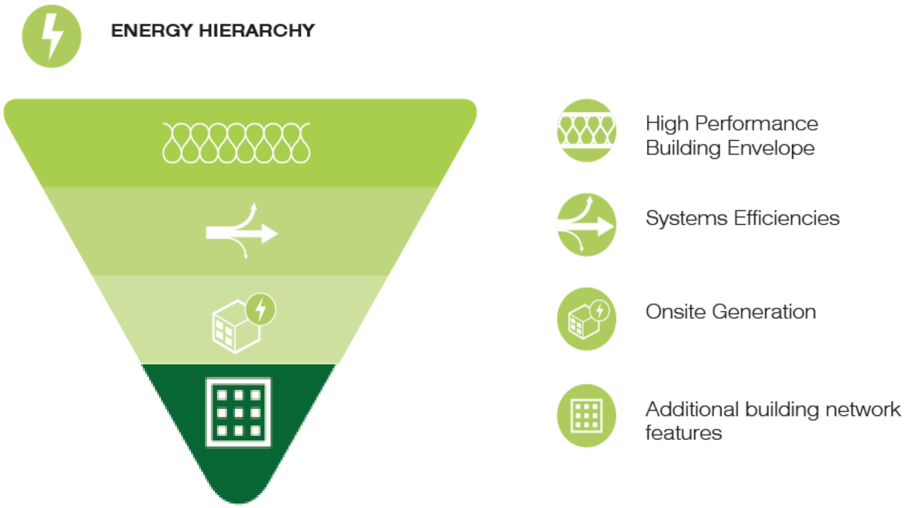
7.2 Resource Conservation – Energy

The proposed approach to sustainability and energy related systems is based on applying an "energy hierarchy" methodology.

This methodology has the reduction of energy use as its priority, and then seeks to meet the remaining energy demand by the most efficient means available, before the inclusion of on-site generation and importation of green power.



The following energy conservation initiatives are being considered for the proposed design:

7.3 Passive Design Strategies:

High-performance building envelope
An orientation-specific façade design approach has been taken to ensure orientation climatic issues are effectively managed for GHR.

Heat gain through the glazing during the summer will be managed through a combination of efficient shading and high-performance glazing where needed. External shading is proposed by way of perforated screens to the northern and western inpatient bedrooms. Internal sheer and blackout roller blinds will be provided throughout.

The external glazing should satisfy the provisions of NCC Section-J 2019/2022 of the Building Code of Australia. Consideration should also be given to future climate conditions and the respective impact on the building energy demands.

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7.4 Active Measures / Building Systems Design

Mixed-mode ventilation - Mixed-mode ventilation can be considered for non-critical spaces. When outdoor and indoor conditions are favourable for natural ventilation, the air-conditioning could be switched off, therefore reducing energy consumption.

- **Zoning of HVAC and lighting services** – Zoning of HVAC and lighting services should be incorporated to avoid energy wastage.
- **High-efficiency plant and associated controls**
- **Free Cooling** –
  - Run mechanical cooling plant in economy cycle when conditions are appropriate
  - Use evaporative cooling options
  - Night purge and other strategies
- **Pre-temper outside air** – Use of heat recovery systems to lower outside air temperatures
- **Relax internal set points** (where appropriate) – Allowing a greater range of thermal conditions can reduce heating and cooling plant loads
- **Seasonal temperature and humidity set points** – Vary set-points throughout the year based on operational use and user demographics
- **Enhanced commissioning** – Commissioning of building services, along with quarterly fine-tuning to ensure that the systems perform at their optimum capacity.

Renewable Energy

While roof space is limited, renewable energy opportunities can be considered, including:

- **Solar Photovoltaics (PV) – Rooftop, shading structures, Building Integrated PV**
- **Solar Thermal**

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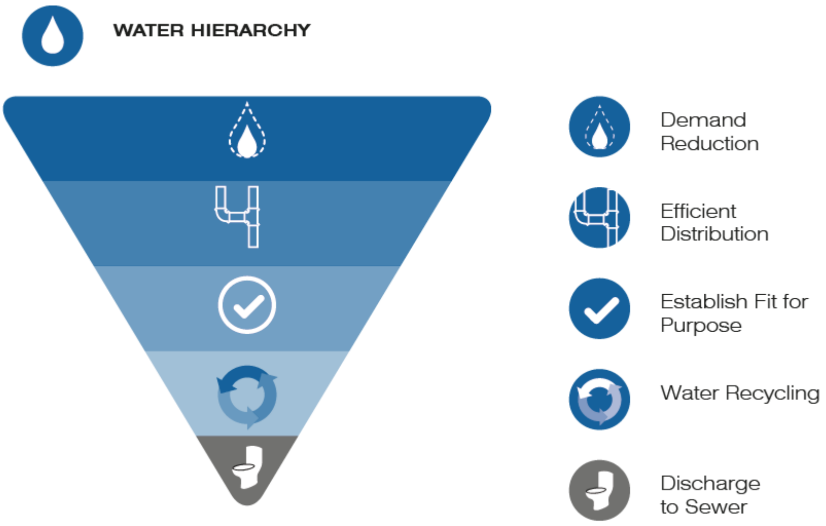
7.5 Resource Conservation – Water

The following hierarchy and strategies will be applied:



The following water initiatives have been proposed and their individual merits will be assessed further during future design stages:

- **Water efficient fixtures / fittings will be specified.** These include fittings such as taps, showerheads, toilets, zip taps, dishwashers etc certified under the WELS rating scheme.
- **Rainwater Reuse** - Rainwater collection and reuse are included in the design. Collected water will be used for toilet flushing.
- **Fire Systems test water** capture and storage for re-use using the rainwater tank will be accessed
- **Drip and demand-controlled irrigation** to optimise irrigation supply

7.6 Resource Conservation – Materials and Waste

Selection of environmentally preferable materials is a key priority for the project because building materials consume energy and natural resources during its manufacture and for their transportation to the construction site. Choices of materials and construction methods can significantly change the amount of energy embodied in the structure of a building.

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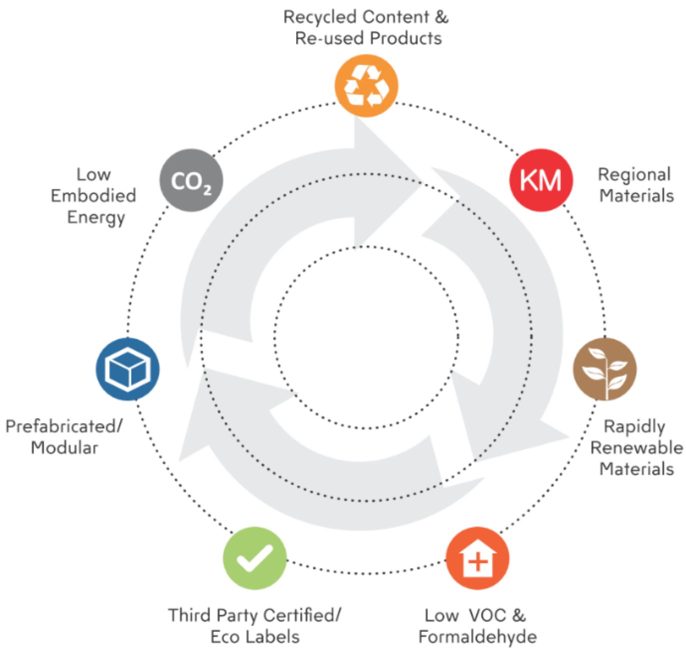

Low-impact construction methods such as offsite prefabrication/preassembly shall be considered where applicable. Prefabricated structures built in purpose-built factories are less labour intensive, more time efficient, and produce less waste compared to traditional onsite construction methods. Raw materials and construction elements are not exposed to the elements, which ensures high quality in the final building, and the construction process is less weather dependant.

Preference will be given to materials that contain high-recycled content and/or are highly recyclable. The following water initiatives have been proposed and their individual merits will be assessed further during future design stages:

- **Use sustainable timber** – Timber products used for concrete formwork, structure, wall linings, flooring and joinery will be sourced where possible from reused, post-consumer recycled or FSC-certified, or PEFC certified timber.
- **Steel** – will be specified to meet specific strength grades, energy-reducing manufacturing technologies, and off-site fabrication. Steel will also be sourced with a proportion of the fabricated structural steelwork via a steel contractor accredited by the Environmental Sustainability Charter of the Australian Steel Institute if available within rural areas.
- **Recycled concrete** – The project aims to reduce the use of Portland cement through substitutions. Fine and coarse aggregate inputs are to be sourced from manufactured sand or other alternative materials, and the amount of Portland cement will be reduced within the concrete mix when possible. It will depend on supply opportunities.
- **High recycled content or recyclability** – Furniture items with high recycled or recyclability content to be considered.
- **Materials with low VOC content -** VOC off-gassing from internal materials and finishes is very harmful to occupant health and productivity. The design team should ensure that flooring, paints, adhesives and sealants are specified to meet low VOC requirements (as per Green Star VOC targets).
- **Formaldehyde Minimisation** - All engineered wood products should be specified to either have low formaldehyde emissions or contain no formaldehyde.

- **Insulation ODP** – All thermal insulation products (used within both HVAC ductwork and building envelope) should be specified to be of zero ODP type. (i.e. avoid the use of ozone-depleting substances in both its manufacture and composition).
- **Locally manufactured materials -** Preference should be given to locally manufactured products wherever feasible, in order to reduce their embodied energy and associated GHG emissions.

The following initiatives are being considered to minimise waste during construction and operation phases:

- **Construction waste management** - This is to ensure that recycling of waste from demolition and construction is maximised and that the volume of demolition and construction waste ending up in landfill is minimised.
- Sub-contractors should be instructed to send the recyclable resources recovered from demolition and construction back to their manufacturers and suppliers for recycling/reuse where possible.
- **Operational waste management** - To ensure recycling of operational waste, dedicated storage space should be provided for locating recycling bins. Hazardous and biological waste should be considered.

7.7 Health and Wellbeing

Indoor Environmental Quality

The following occupant comfort strategies are being considered for the proposed design for the project.

- **Indoor Air Quality**–Increased levels of fresh outdoor air above AS1668 should be provided.
- **Daylight** - The façade glazing should provide high levels of natural light (where applicable. Where appropriate, the design should seek to maximise daylighting and reduce the reliance on artificial lighting, while controlling for unwanted solar heat gains. External shading and Internal blinds could be provided to manage instances of glare.
- **External views** – should be provided to give views of nature, which help to improve patient and staff wellbeing.
- **Glare** - should be reduced using fixed shading devices, window tinting or operable devices such as shades or blinds to all external or perimeter windows and glazing.
- **Thermal comfort** – should be a key focus of naturally (mixed mode spaces) and mechanically ventilated spaces.
- **Building noise** – Both internal and external noise sources and levels should be considered and controlled in accordance with AS/NZS 2107.

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7.8 Site & Environment

Proposed design aims to protect the project site and ensure the reduction of potential emissions, including air pollutants, watercourse pollutants, light pollution, refrigerant leakage, etc.

The following initiatives are being considered to preserve site quality and reduce pollution:

- **Stormwater Reduction** – Manage the impacts of stormwater run-off from the development. This would include measures to prevent stormwater contamination, control sedimentation and erosion during construction and operation of the building, such as rainwater reuse etc.
- **Pollution of the night sky** should be minimised by ensuring that the electric lighting within the site should not cause any direct beam of light into the night sky. Light pollution can disturb the habitat of migratory birds and impacts the behaviour of nocturnal animals in the site vicinity.
- **Emissions from HVAC refrigerants** and insulation products have the capacity to damage the ozone layer. For the proposed design, refrigerants with zero ODP and Low GWP should be specified and installed within all the proposed HVAC systems.

Water Sensitive Urban Design example

8.0 ESD Evaluation Tool Assessment

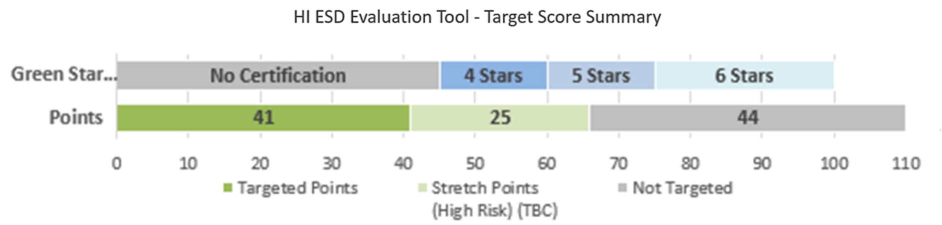
The HI ESD Evaluation tool has been used during the schematic development process to assess and coordinate the targeted credits and define the overall score. The selection of the credits targeted has been based on the following:

- ESD target requirements
- Review of site, context, and proposed design
- Opportunities & constraints identified within the current design
- Key ESD healthcare specific considerations (As described in Section 5)
- Project team experience in other similar health care projects.

The status of the assessment includes 41 low risk points and 25 higher risk points (totalling 66 points). There is a 6-point buffer above minimum threshold at this stage to confirm that the minimum requirement of 60 points is feasible.

The risk categories are determined on the following basis:-
- Low – already addressed in the design (Standard HI practise)
- Medium – can be achieved but will have some potential cost implications

High – potential cost and spatial implications, require further investigation during detailed design
The targeted credits require some further investigation to ensure they are adequately incorporated into the design and achieve the necessary performance. This work to confirm these credits will continue during the detailed design and construction stages.



HI ESD Evaluation Tool Score Summary

Category	Available Points	Low / Med Risk	High Risk	Total Targeted
Management	14	12	2	14
Indoor environmental quality	17	9	4	13
Energy	22	4	4	8
Transport	10	1	2	3
Water	12	2	2	4
Materials	14	6	1	7
Land use & ecology	6	1	2	3
Emissions	5	0	4	4
Innovation	10	6	1	10
Total	**110**	**41**	**25**	**66**
4 star Target	**45**	**Fail**		**Pass**
5 star Target	**60**	**Fail**		**Pass**

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As the project progresses, if some credits are deemed unachievable, alternative credits and strategies will be explored.

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9.0 Next Steps

This report provides a list of recommended sustainability strategies for the GHR project in line with the project brief and the schematic design proposed.
The following steps are recommended during the detailed design and construction stages consolidate a set of sustainability strategies and targets, embed these into the project and collate evidence to demonstrate achievement of performance for each targeted credit:

- Review of the targeted items to determine achievability and further coordination with design teams for strategy development as design develops at the DD stage
- Teams to carry out or finalise calculations, modelling or analysis required to support strategies and achieve targeted points (e.g. JV3, daylight, views, and energy modelling, water calculations, climate risk assessment)
- Coordination with QS to ensure any cost impact from required strategies is included within the cost plan and within the procurement requirements
- Finalise set of strategies to be agreed by the design team, stakeholders and the LHD, and to be confirmed by HI to include in the design moving forward.