ESD Report

NORTHERN RIVERS FLOOD RECOVERY – RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Client:
NSW DoE

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REPORT INFORMATION

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1 Introduction

This ESD Report has been prepared to support a Review of Environmental Factors (REF) for the rebuild of Richmond River High Campus (the activity) (RRHC). The REF has been prepared to support an approval for the RRHC development under Section 68 of the NSW Reconstruction Authority Act 2022 (RA Act).

The purpose of this report is to demonstrate how the design initiatives for the project respond to the sustainability requirements for the project. The Sustainability drivers for the project are elaborated upon in Section 4 of this report.

2 Site Description

The site is located at Dunoon Road, North Lismore, also known as 163 and 170 Alexandra Parade, North Lismore. The site comprises of three separate lots, located to the north of Alexandra Parade, with Dunoon Road running parallel to the eastern boundary of the site.

The site is legally described as:

- Lot 1 DP 539012
- Lot 2 DP 539012
- Lot 1 DP 376007

The site area is approximately 33.53 hectares. The proposed activity will be undertaken mainly within the southeastern portion of the site. The site is outlined in Figure 1.

Figure 1: Aerial image of site (Source: Nearmap)

3 Proposed Activity Description

The proposed activity comprises the relocation and rebuild of the Richmond River High Campus from its existing temporary location alongside The Rivers Secondary College Lismore High Campus at East Lismore to the site at 163 and 170 Alexandra Parade, North Lismore.

The school will be delivered in one stage. A detailed description of the proposal is as follows:

1. Demolition of existing features including existing buildings, cattle drinking well, cattle sheds, and wire fencing, and removal of trees to accommodate school development.
2. Construction of new 3 storey buildings on the southeastern portion of the site for the proposed public secondary school including:
    a. General and Specialist Learning Spaces, and Workshops.
    b. Administration, and Staff facilities.
    c. Library, Hall, and Movement Studio.
    d. Construction, Hospitality, and Agricultural Learning Facilities.
    e. Amenity, Plant, Circulation, and Storage areas.
    f. Outdoor Learning Spaces and play spaces.
3. Landscaping including tree planting.
4. Public domain works comprising:
    - Access road off Dunoon Road, comprising a separate shared bicycle/pedestrian pathway, and internal access roundabout.
    - Kiss and ride drop-off and pick up zones.
    - Bus transport arrangements with a separate bus zone.
5. Outdoor spaces including assembly zones, agricultural spaces, sports fields, games courts, dancing circles, yarning and dancing circles, seating and shade structures.
6. On-site carparking, including accessible spaces and provision for EV charging spaces.

Figures 2 below show the scope of works.

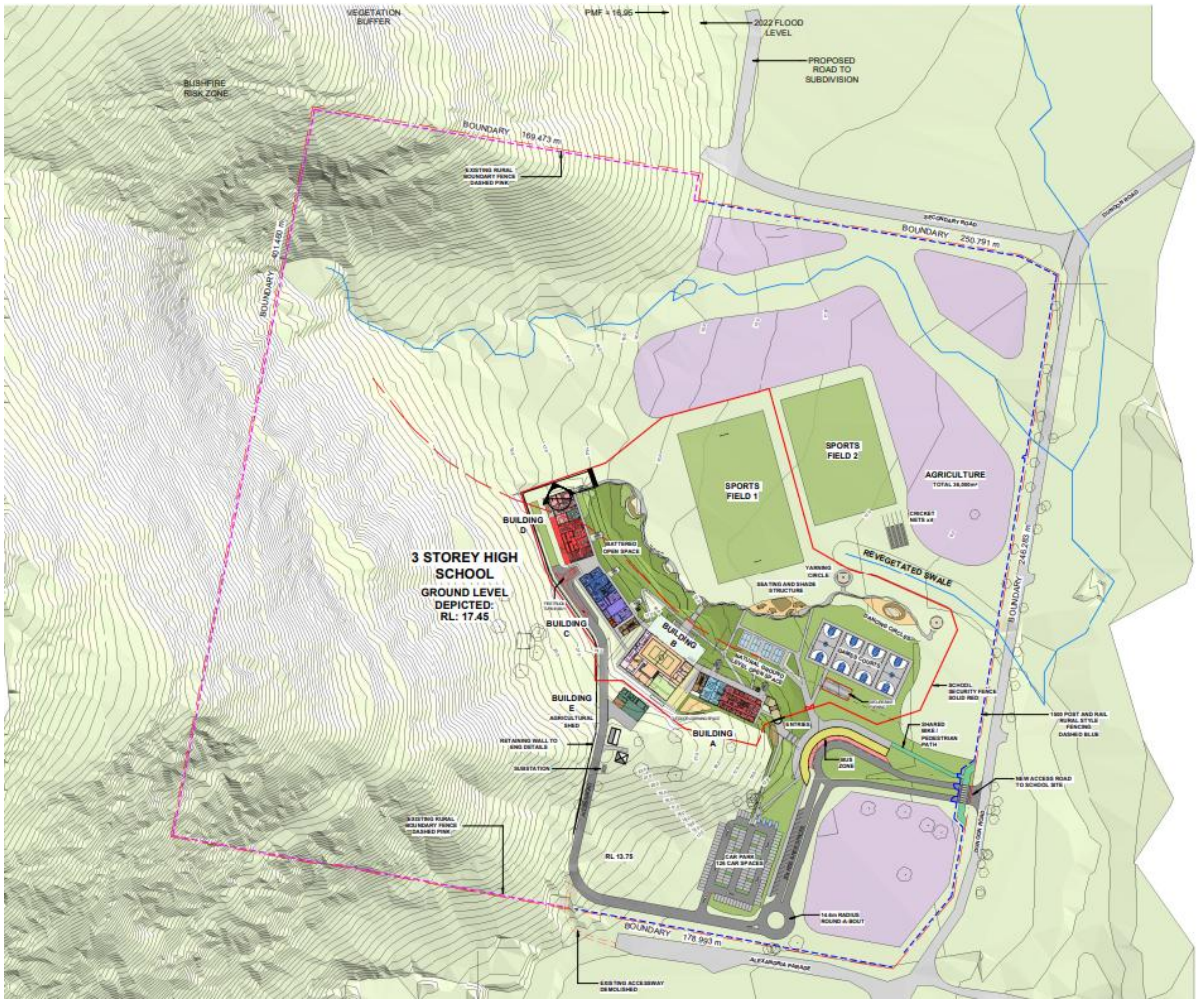


Figure 2: Overall Site Context Plan (Source: EJE Architecture)

4 Sustainability Drivers

To achieve excellence in sustainability, Richmond River High Campus is committed to meeting key statutory requirements and sustainability objectives. All design and future activity work must comply with the following technical specifications and standards to ensure adherence and promote sustainable outcomes, including but not limited to:

- Environmental Planning and Assessment Act 1979
- Environmental Planning and Assessment Regulation 2021 (EP&A)
- SINSW Educational Facility Standards and Guidelines (EFSG)
- National Construction Code – Section J
- Lismore Local Environmental Plan 2012 (LEP), Lismore Development Control Plan 2012 (DCP) and State Environmental Planning Policy (Sustainable Buildings) 2022
- NSW Government Resource Efficiency Policy (GREP)
- 4 Star Green Star Buildings rating
- NSW Climate Change Framework

4.1 Principles of Ecologically Sustainable Development

The following section describes the design responses to the ESD principles as defined in Clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2021. These design principles have been incorporated into the holistic design with input and coordination of the design team.

The principles of Ecologically Sustainable Development are the following –

- the precautionary principle,
- inter-generational equity,
- conservation of biological diversity and ecological integrity,
- improved valuation, pricing, and incentive mechanisms.

4.1.1 The Precautionary Principle

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.

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.*

Activity Response:

The proposed activity will be constructed on agricultural land. During the design and construction phases, the main contractor will implement an independently certified Environmental Management System (EMS), which demonstrates formalised systematic and methodical approach to planning, implementing, and auditing. Throughout the building's operation, adherence to procedures that account for environmental risk and mitigation measures will be met.

4.1.2 Inter-generational Equity

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.

Activity Response:

To uphold inter-generational equity, the proposed activity minimises the consumption of energy and water resources whilst reducing embodied carbon and waste. The ESD principles incorporated into the proposed development facilitates the conservation of energy and water resources through energy and water efficiency measures.

Energy consumption will be designed to achieve a minimum 10% improvement above National Construction Code requirements (NCC 2022 Section J – Energy Efficiency). The building is designed to be fully electric creating a pathway for a future net-zero carbon emissions building when the procured electrical energy comes from a renewable source. Onsite renewable energy from solar PV panels will reduce grid demand.

The reduction in water use will be established through high Water Efficiency Labelling and Standards (WELS) rated water fixtures and fittings.

90% of waste generated during the construction and operational phases will be diverted from landfill to be recycled. An Environmental Management System (EMS) will be established and adhered to throughout construction.

Operational waste streams will be separated to maximise recycled waste once the building is complete and occupied. Refer to waste report for detailed waste strategy.

4.1.3 Conservation of Biological Diversity and Ecological Integrity

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.

Activity Response:

The activity's ESD principles to reduce energy, water and waste consumption have an indirect impact to conserve biodiversity and ecological integrity to the surrounding area. The ecological value of the site post construction will exceed that of preconstruction due to the planting proposed with an emphasis on native trees and plants. This improves habitat for local fauna and increases a connection to nature for occupants. The activity is seeking to drastically improve the canopy cover of the site with trees and shrubs. Refer to landscape plans for detailed strategy regarding regeneration.

4.1.4 Improved valuation, pricing, and incentive mechanisms.

The principle of improved valuation, pricing and incentive mechanisms is that environmental factors should be included in the valuation of assets and services.

Activity Response:

The valuation of the activity's assets and services consider environmental factors through the implementation of various ESD initiatives. An Environmental Management System will be in place throughout the construction to ensure that excessive pollution and waste are minimised, and to establish recycling and avoid landfill waste streams during construction and operational phases. This creates a system where pollution is managed and controlled and creates an incentive to reduce pollution and waste.

The design of the activity will meet and exceed the National Construction Code (NCC) and be benchmarked against a Green Star buildings rating which will provide environmental goals for the activity. Activity requirements stipulate design teams are contractually required to deliver targeted ESD initiatives for the activity.

The activity is being rebuilt as a disaster response to significant damage due to flooding. The new design floor levels have been located to sit 500 mm above the Probable Maximum Flood (PMF) level. Although the site is prone to flooding where the sporting fields are located, the buildings will remain intact assuming the flood level remains below the PMF + 500 mm.

4.2 EFSG Targets

The Educational Facilities Standards and Guidelines (EFSG) have been developed by SINSW to provide a reference guide for the management, planning, design, and construction of new and refurbished/upgraded school buildings.

Ecologically Sustainable Development (ESD) principles must be applied in the design, construction, operation, and end of life, of all state assets and are an important contribution to developing a considered whole of life cost development approach. These principles include:

- Responsible use of energy, water, and resources in the construction, operation, refurbishment, maintenance, management and their ultimate disposal.
- The protection and support biological and ecological diversity.
- Minimising or eliminating the flow of pollutants into our natural environment.

The below table lists the sustainability requirements of the EFSG and outlines the activity's design response to each requirement.

Table 1: EFSG requirements and outlines the activitys design response

Category	Requirement	Response	Section in Report
0.05 Climate Change adaptation	Initial assessment	This is captured in targeting Green Star Credit 16. *Refer to appendix B for climate risk matrix*	Appendix -B
	Comprehensive climate change risk assessment		
0.06 Energy Conservation	Passive design	The proposed passive design strategies for the building include high performance glazing, thermal insulation and daylight harvesting. The building uses natural ventilation through different window systems like sliding and louvre windows. These windows are protected from direct solar gain through purposefully located horizontal and vertical shading devices.	-
	Lighting and Daylight	LED lighting systems, equipped with on and off controls will be used in regularly occupied areas. Daylight will be maximized with the use of different window systems while minimizing glare.	4.6.4
	Views	Minimum 60% of the regularly occupied areas will have high quality internal or external view.	4.6.4
	Glare control and shading	External shading devices are designed to control external glare. This is captured in targeting Green Star credit 11 Light quality.	4.6.4
	Lighting and Heating, Ventilation, and Air Conditioning (HVAC) control	On/off and dimming lighting controls will be provided for reguluarly occupied areas. The mechanical system is designed to have an occupant controlled mixed mode ventilation which provide user access for operation of the systems via a Local Control Point incorporating green, blue, and yellow mode indication lights.	-
	Energy efficient appliances and equipment	The appliances and equipment will comply with the NCC minimum efficiency requirements.	4.6.6
	Renewable energy generation	Solar PV system currently included in the design.	4.6.6
0.07 Water Conservation	Water efficient appliances	WELS rated fixtures and fittings will be implemented in the procurement stage	4.6.6
	Roof water harvesting and tank storage	The activity is designed to maximise rainwater catchment from exposed non-trafficable surfaces. This harvested water will be used for onsite flora irrigation, reducing the need for potable water for this purpose.	4.6.6
	Stormwater Management	Onsite stormwater detention (OSD) is proposed for the activity. The Stormwater	-

		quality treatment will comply with the Lismore City Council DCP 2012 requirements.	
0.08 Sustainable Materials	Timber and low formaldehyde-emitting engineered wood products Low VOC materials	This is captured in targeting Green Star Credit 09 Responsible finishes and credit 13 Exposure to toxins.	4.6.4
0.09 Ecological Conservation	Preserve or re-establish native flora.	This is captured in targeting Green Star Credit 36 Biodiversity Enhancement	4.6.8
0.10 Waste Management	Construction and demolition waste	90% of construction and demolition waste (excluding hazardous and contaminated materials) to be recycled by the head contractor.	4.6.3
	Operational Waste	This is captured in targeting Green Star Credit 4 Responsible resource management. Activity to report on their top three waste streams	4.6.3

4.3 NCC – Section J – Energy Efficiency

The building is seeking to meet and exceed the National Construction Code (NCC) Volume 1, 2022. Section J of the NCC outlines performance requirements so that the building and its services facilitate the efficient use of energy. During the detailed design stage, the architectural design will be assessed to develop thermal requirements for all the aspects of the building's envelope, such as glazing performance, façade & roof colouring, shading and insulation.

4.4 SEPP (Sustainable Buildings) 2022

Chapter 3 of SEPP (Sustainable Buildings) 2022 applies to the proposed activity, the following statements outline how the proposed development aims to address the clauses within the policy.

- ***Demonstrate how the development has been designed to address the provisions set out in Chapter 3.2(1).***

(a) the minimisation of waste from associated demolition and construction, including by the choice and reuse of building materials,

- 90% of construction and demolition waste (excluding hazardous and contaminated materials) to be recycled by the head contractor.

(b) a reduction in peak demand for electricity, including through the use of energy efficient technology,

- Solar panels are designed to be installed on the roof of the new building, providing a portion of the school's operational energy demand, with provisions for future expansion if required.
- Provisions have been considered for the future integration of battery systems, which could enable energy storage and increase operational resilience. This would support the potential for grid independence during peak demand periods.
- Energy-efficient HVAC systems, including demand-driven ventilation and heat recovery, will ensure minimal energy use while maintaining indoor comfort.
- LED lighting systems, equipped with occupancy sensors where necessary, will optimise electricity usage.

(c) a reduction in the reliance on artificial lighting and mechanical heating and cooling through passive design,

- Passive design strategies, such as SINSW Standardised Pattern Book design shading and natural ventilation, are also incorporated.

- Fixed shading systems are optimised for Lismore's climate, protecting windows from high summer sun while allowing low-angle winter sunlight to penetrate.
- Vertical fins reduce glare, enhancing occupant comfort while minimising energy demands for cooling.
- Cross-ventilation pathways allow effective airflow throughout learning spaces.
- Sensor will be installed that monitor outdoor weather conditions. These sensors display a green or red signal, indicating whether the outdoor conditions are suitable or unsuitable for natural ventilation. This helps guide occupants on when to open the windows and insulated doors to allow natural ventilation optimal times.
- High-performance insulation stabilises indoor temperatures, reducing the need for active heating or cooling.
- The mechanical system will be designed that a "Fan Only" mode can be turned on to night purge the building of remanent heat from the day. This allows for a smaller load on the mechanical system the following day.

(d) the generation and storage of renewable energy,

- Solar panels are designed to be installed on the roof of the new building, providing a portion of the school's operational energy demand, with provisions for future expansion if required.
- Provisions have been considered for the future integration of battery systems, which could enable energy storage and increase operational resilience. This would support the potential for grid independence during peak demand periods.

(e) the metering and monitoring of energy consumption,

- A Building Management System (BMS) is to be included in the design to monitor real-time energy use, providing the operator with insights to make data-driven decisions aimed at optimising energy performance and reducing energy waste.

(f) the minimisation of the consumption of potable water.

- The water saving measures include high WELS rating sanitary fixtures reducing the potable water demand for showers, taps, WCs and urinals.

- Provide a NABERS Embodied Emissions Material Form to disclose the amount of embodied emissions attributable to the development in accordance with section 35B of the EP&A Regulation.
  - Refer to Appendix C for NABERS Embodied Emissions Material Form

- Provide a net zero statement (as defined in section 35C of the EP&A Regulation) that includes:
  - Evidence of how the development will either be fossil fuel-free after the occupation of the development commences or transition to be fossil fuel-free by 1 January 2035.
  - Details of any renewable energy generation and storage infrastructure implemented and any passive and technical design features that minimise energy consumption.
  - Estimations of annual energy consumption for the building and amount of emissions relating to energy use in the building (if information is available).
    - Refer to Appendix D for Net Zero Statement

4.5 NSW Government Resource Efficiency Policy 2019

The aim of the NSW Government Resource Efficiency Policy (GREP) is to reduce the NSW Government's operating costs and lead by example in increasing the efficiency of its resource use. The policy will continue to drive resource efficiency by NSW Government agencies in four main areas – energy, water, waste and air emissions from government operations.

The below table lists the requirements of the GREP and outlines the activity's design response to each standard.

Table 2: GREP requirements and outlines the activity's design response

Category	Requirement	Response	Section in Report
Energy	E1: Target to save energy across all government sites	Minimum of 10% reduction in energy against NCC	4.6.6
	E3: Minimum standards for new electrical appliances and equipment	All equipment implemented into the activity will meet or surpass the performance requirements in this standard.	4.6.6
	E4: Minimum standards for new buildings and fit-outs	4 Star Green Star Buildings Rating will be achieved. This significantly surpasses the superseded Star Green Star Design & As Built rating outlined in the GREP.	4.6.2
	E5: Whole-of-government solar target	Solar PV system currently included in the design	4.6.6
	E6: Minimum fuel efficiency standards for new light vehicles	Not applicable to this activity	-
	E7: Purchase 6% GreenPower	Richmond River High Campus is to adhere to this	-
Water	W1: Report on water use	This is captured in targeting Credit 03 – Verification and Handover Verification and Handover – Monitoring Strategy	4.6.3
	W3: Minimum standards for new water-using appliances	These WELS ratings will be implemented in the procurement stage	4.6.6
Waste	P1: Report on top three waste streams	Activity to report on their top three waste stream	4.6.3
Clean air	A1: Air emission standards for mobile non-road diesel plant and equipment	Requirement to pass on to head contractor	-
	A2: Low-VOC materials	This has been targeted in Credit 10 – Clean Air	4.6.4

4.6 Green Star Sustainable Design Initiatives

4.6.1 Green Star Buildings Rating Overview

The development has been registered with the Green Building Council of Australia and is set to achieve a minimum of a 4 Star Green Star Buildings rating. Green Star Buildings is a recently updated holistic building sustainability rating tool. A 4 Star Rating is considered to exhibit 'Best Practice' environmental performer. The outcome meets or exceed the relevant industry recognised sustainability and environmental performance standard.

This new tool includes targets that directly address the UN Sustainable Development Goals and encourages ambitious building design to significantly reduce the impact the built environment has on aggravating climate change. This new tool aligns to meet the Paris Agreement on climate change, create clear expectations for new buildings and ensures transparency in supply chains to ensure complete understanding of materials and products used in the activity.

The Green Star Buildings rating system assessing buildings through the following categories:

Figure 3: Green Star Buildings Categories (Source: Green Star Buildings v1)

4.6.2 Sustainability Benchmarking

Points are awarded for a building activity's ability to secure as many credits as possible from each category. Each credit targets the environmental impact of a specific design feature. The total number of points awarded determines if the level of certification. A 4 Star building requires minimum 15 points. See the below table which breaks up the pathway per category.

Table 3 - Green Star Points per Category

Category	Points Available	4 Star Target (Activity Target)
Responsible	**17**	**4**
Healthy	**14**	**7**
Resilient	**8**	**2**
Positive	**30**	**0**
Places	**8**	**0**
People	**9**	**4**
Nature	**14**	**4**
Sub-total	**100**	**21**
Leadership	**10**	**0**
Total	**110**	**21**

This table is indicative of level of outcome that the activity will pursue but exact selection of credits may change through the design and construction process.

The following sustainable design principles have been proposed for the Richmond River High Campus building and can be addressed through the categories outlined within the Green Star Buildings v1 rating system.

4.6.3 Responsible

The Responsible category recognises activities that ensure the building is designed, procured, built, and handed over in a responsible manner.

Materials - This category has a strong focus on the materials that have been used in a building. The building finishes will be selected based on their responsible product value. The vision of the responsible product framework is to drive the supply chain to deliver transparent, healthy, low-impact, and net zero carbon products that are part of a circular economy. Not only does this reduce the resource consumption impact of the activity but also ensures clean supply chains, something that the building industry has turned a blind eye to for a long time.

Verification and handover – These criteria make sure the building has been optimised and handed over to deliver a high level of performance in operation. The building is set up for optimum ongoing management due to its appropriate metering and monitoring systems. The building has set environmental performance targets, designed and tested for airtightness, been commissioned, and will be tuned. The activity team create and deliver operations and maintenance information to the facilities management team at the time of handover. Information is available to building users on how to best use the building.

Waste - The responsible category also looks at waste, both in the building's construction and operation. The activity will divert at least 90% of construction and demolition waste from landfill (excluding hazardous and contaminated materials) with a focus on reusing material. The building will also be designed for a functional waste system with recycling systems, adequate space and appropriate pick-up locations. Look to activity's waste report for further details.

Education and Information - Education and information are notions that are carried within the responsible category. The head contractor when the building is in construction phase will educate the workers on site around climate change and the importance of sustainable design, construction and operation is critical in climate change mitigation. Information about the activity's build and associated costs towards sustainability will be disclosed to the Green Building Council to further understand the response and viability of their framework.

4.6.4 Healthy

Building occupant health is a primary objective for the activity. This improves the morale and productivity of the staff and students enhancing their health and wellbeing.

Clean Air - The ventilation systems for occupants of the activity must provide a 50% improvement of outdoor air required by AS 1668.2:2012 – "The use of ventilation and air conditioning in buildings" to ensure occupants have plenty of fresh air and do not have a feeling that the environment is stuffy or odorous.

Light Quality - Where appropriate the façade will accommodate for generous natural daylight to improve occupant wellbeing. Artificial lighting will be flicker free with appropriate lux levels and uniformity per space. The use of daylight. Daylight will be maximized with the use of different window systems while minimizing glare.

Acoustic Comfort – The activity will implement a design strategy to control of intrusive/ high levels of noise, privacy, noise transfer, speech intelligibility. Refer to acoustic assessment carried out for the activity.

Exposure to toxins – Low volatile organic compound products and finishes will be used in the activity to ensure toxins are mitigated from the space. All the engineered wood products used in the activity will meet specified formaldehyde emission limits as per green star guidelines.

Connection to Nature – A biophilic connection has proven to reduce stress and improve mental wellbeing. By implementing nature inspired design and integrated landscape into the activity, the occupants will fulfil the sense of natural connection.

4.6.5 Resilient

A buildings resilience is a major lens to assess how sustainable it is. Buildings that are not resilient to external pressures are usually first to be rebuilt, shortening the life of the building. By shortening the life of a building, all embodied material within the building may not have reached its service life and the emissions per year for each material increases. Also, future costs to uplift a building to withstand the future pressures is an expensive exercise. To ensure the activity is resilient to future pressures a range of assessments will be completed.

Climate Change Assessment - will be made highlighting components of the buildings design where risks lie. A follow up plan for mitigating these risks from the design will then be implemented. This will attempt to future proof the activity from climate pressures such as floods, high temperatures, drought, and storms. The buildings footings that are affected by the PMF flood waters will also be assessed from pressures associated with flooding.

Urban Heat Island - To prevent the urban heat island effect locally onsite, vegetation and materials with a high solar reflective index will be used.

4.6.6 Positive

Upfront Carbon Reduction - The activity aims to reduce upfront carbon emissions by 10% compared to a standard reference building by procuring responsible materials. A standard reference building is a matching design made from business as usual materials.

Energy Use - Onsite solar PV arrays will be maximized on roof surfaces and the building's energy consumption will be reduced by 10% compared to a reference NCC Section J 2022 compliant building. Monitoring and metering will be critical for the building's efficient operation. LED lighting will be used throughout, with efficient monitoring strategies to ensure responsiveness.

Water Conservation - The activity acknowledges the importance of preserving water resource and has designed measures to minimise the building's potable water usage. Low flow rate end uses will be implemented throughout the building to reduce unnecessary water wastage, especially for sanitary needs.

In addition to minimising potable water usage, the activity is designed to maximise rainwater catchment from exposed non-trafficable surfaces. This harvested water will be used for onsite flora irrigation, reducing the need for potable water for this purpose.

4.6.7 Place

Movement and Place - The building’s design and location encourage occupants and visitors to use active, low carbon, and public transport options instead of private vehicles. The building includes showers and changing facilities for students and staffs. The facilities are accessible, inclusive, and located in a safe and protected space.

4.6.8 People

Indigenous Design - By aligning the design method with the principles of the Australian Indigenous Design Charter, a true representation of Aboriginal heritage can be evoked in the design. This reminds the occupants that the land they are on was habited tens of thousands of years before their arrival and educate them on the rich history. Refer to Connecting with Country within EJE’s architectural report.

4.6.9 Nature

An obvious sustainable approach to building design is integrating into the local environment as possible. By implementing native and endemic species onsite, the local ecology can enhance from habitat and food. The local ecology extends to flora and fauna.

Impacts to Nature - Reduce the negative impacts associated with buildings to the nature by reducing light pollution, and the building by not built on a significantly impacted site with a high ecological value.

Biodiversity Enhancement - Integrating into the local environment is a key aspect of sustainable building design. One approach to achieving this is by implementing native and endemic species onsite. By doing so, buildings can enhance the local ecology by providing habitat and food sources for local flora and fauna.

Refer to Appendix A 4 Star Green Star Pathway. The LCI spreadsheet displays information regarding a brief description of each credit, respective compliance requirements and the provide simple and easy to use documents.

4.7 NSW Climate Change Framework

The NSW Climate Change Framework provides a comprehensive approach to addressing climate change by focusing on reducing emissions, preparing for future impacts, and enhancing resilience across the state. By encouraging sustainable activity, supporting the transition to a low-carbon economy, and promoting collaboration across sectors, the framework aims to make NSW more climate-resilient and sustainable for future generations.

Refer to Appendix B for the Climate Change Risk Assessment and the Mitigation Strategies identified for the activity.

5 Evaluation of Environmental Impacts

After an initial review and assessment of the proposed activity, LCI confirms that the project will not have a significant impact on the environment and is not expected to cause any substantial adverse effects. The report has identified potential impacts related to the activity, and it has been determined that these impacts can be effectively mitigated through sustainability initiatives to be implemented during the detailed design, construction, and operation phases of the project. These measures will reduce the environmental footprint, ensuring that impacts during design, construction, operation, and decommissioning are not considered significant.

Some of the mitigation measures that have already been designed or will be implemented in the later stages of the project are outlined in the table on the following page.

Climate change resilience mitigation measures have been made explicitly detailed in Appendix B. This analysis looks further in climate related resilience measures than the table on the following page.

Mitigation Number/Name	Aspect/Section	Mitigation Measure	Reason for Mitigation Measure
Finished Floor Height 500mm above PMF	Climate Change Resilience	The building design incorporates a Finished Floor Level (FFL) of 500mm above the Probable Maximum Flood level. Additional climate-related challenges, such as high temperatures, drought, and storms, will be addressed during the detailed design phase.	Climate Change Resilience, Building Longevity
Onsite Solar PV	Renewable Energy	Onsite solar photovoltaic (PV) arrays will be on roof surfaces, with the building's energy consumption reduced by 10% compared to a National Construction Code (NCC) 2022 compliant reference building.	Reducing Greenhouse Gas Emissions
Future Integration of Battery	Renewable Energy/Energy Reduction	Provisions will be made for the future integration of battery systems, enabling energy storage and enhancing operational resilience.	Reducing Greenhouse Gas Emissions
A Minimum of 80% of Construction and Demolition Waste Diverted from Landfill	Waste Reduction	A minimum of 80% of construction and demolition waste (excluding hazardous and contaminated materials) to be diverted from landfill by the head contractor	Waste Reduction
Haz-mat Reduction	Healthy Site	A hazardous materials survey will be conducted on existing buildings at the project site. If asbestos, lead, or PCBs are found, these materials will be stabilized or removed and disposed of according to best practice guidelines.	Occupant Health
Reduction in light pollution	Impact to nature	Measures will be taken to minimise the negative impacts of light pollution on the surrounding natural environment.	To avoid illuminating natural land and neighbouring spaces.
Urban Heat Island Reduction	Outdoor Thermal Comfort	To combat the urban heat island effect, vegetation and roofing materials with a high solar reflective index will be used onsite.	Human health, minimise reliance of spending time indoor in air conditioning, reducing energy and greenhouse gases
Potable water reduction and water reuse	Water Efficiency	Low flow-rate fixtures will be installed throughout the building to minimize unnecessary water wastage, particularly for sanitary purposes. Rainwater tank used for irrigation	Resilience in times of drought, community resilience allowing more fresh water to be available during times of drought.

Mitigation Number/Name	Aspect/Section	Mitigation Measure	Reason for Mitigation Measure
Healthy Indoor Spaces	Human Health	Indoor environmental quality strategies will be implemented to enhance occupant comfort and wellbeing, addressing visual, thermal, and acoustic comfort, as well as indoor air quality.	Ensure the health of the student and staff not harmed from occupying the school. Bolsters learning opportunity with high indoor environment quality.
Lower Embodied Carbon Materials	Embodied Carbon	Materials will be carefully selected with a focus on reuse, recycling, reduced embodied energy, and transparency.	Reducing greenhouse gases.
Verification and Handover	Management	The design and construction team create and deliver operations and maintenance information to the facilities management team at the time of handover.	The asset can be used as designed and be operated as efficient as possible.

6 Conclusion

After conducting a comprehensive review and assessment of the proposed activity, it is concluded that the activity will not have a significant effect on the environment. The report has identified potential impacts associated with the activity, and it has been determined that these impacts can be adequately mitigated through the Sustainability initiatives adopted in the activity. These measures are designed to reduce the environmental footprint of the activity to a level where impacts during the design, construction, operation, and end of life of the activity are not considered significant.

Appendix A – Green Star Buildings Pathway

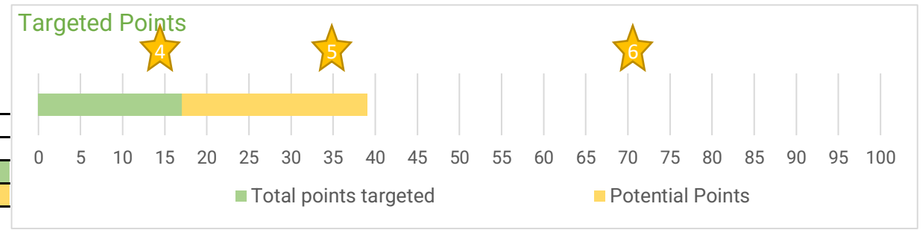
The following 4 Star Green Star Pathway will be continually updated throughout the design phase to capture commentary and design activity.

Project Name	Richmond River High School
Project Number	230772
Revision	01
Date	13/06/2024

Scorecard

Targeted Green Star rating		**4 Star**
Minimum expectations met	◆	Yes
Net zero in operations targeted	*	No
Credit Achievement points targeted		17
Exceptional Performance points targeted		0

Core points targeted	17
Leadership points targeted	0
Buffer Points	2
Total points targeted	17
Potential Points	22



	Credit Name	Minimum Expectation (ME)	Credit Achievement (CA)	Exceptional Performance (EP)	Targeted Performance	Points Targeted	Stage of Implementation	Credit Requirements Summary *For full requirements refer to Green Star Buildings Submission Guidelines*
Responsible			**11**	**6**		**2**		
1	Industry Development		**1**		Credit Achievement	1	All	1. Appoint a GSAP from the time of registration. 2. Complete the Financial Transparency disclosure template. 3. Complete a Case Study, detail how the building will market its sustainability. achievements to stakeholders and Green Star signage to be prominently displayed in a public/ visitor location.
2	Responsible Construction	◆	**1**		Minimum Expectation	◆	Tender, Construction	1. The head contractor must have an environmental management system (EMS) in place. 2. Site must have an environmental management plan (EMP). 3. The head contractor provides training on the sustainability targets of the building. 4. Waste contractors and waste facilities to complete a Disclosure Statemen. 5. 80% of construction and demolition waste diverted from landfill. (CA - 90% of construction and demolition waste diverted from landfill + Waste contractors and waste facilities must comply with the Green Star Reporting Criteria)
3	Verification and Handover	◆	**1**		Credit Achievement	1	Design, Tender, Construction, Handover, Use	1. (ME) Metering and monitoring strategy. 2. (ME) Environmental performance targets. 3. (ME) Services and maintainability review. 4. (ME) Commissioned and tuning including airtightness testing. 5. (ME) Operations and maintenance (O&M). 6. (ME) Building logbook. 7. (ME) Building users guide (BUG). 8. Engage an ICA or Soft Landings Approach.
4	Responsible Resource Management	◆			Minimum Expectation	◆	Design, Handover, Use	Building must provide bins or storage containers to building occupants to enable them to separate their waste. An adequate spaces for storage and collection of waste streams that is easy and safe to access by collection vehicles. A waste specialist and/or contractor must sign-off on the design.
5	Responsible Procurement		**1**				Strategy, Design, Tender, Construction	
6	Responsible Structure		**3**	**2**			Design, Tender, Construction	Sepp 2022 (sustianable buildings) - EPA protection of environment policy (sustainable construction)
7	Responsible Envelope		**2**	**2**			Design, Tender, Construction	
8	Responsible Systems		**1**	**1**			Design, Tender, Construction	
9	Responsible Finishes		**1**	**1**			Design, Tender, Construction	

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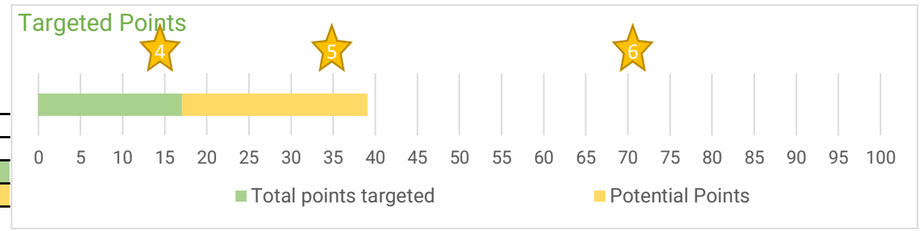
Targeted Green Star rating		**4 Star**
Minimum expectations met	◆	Yes
Net zero in operations targeted	*	No
Credit Achievement points targeted		17
Exceptional Performance points targeted		0

Core points targeted	17
Leadership points targeted	0
Buffer Points	2
Total points targeted	17
Potential Points	22



	Credit Name	Minimum Expectation	Credit Achievement	Exceptional Performance	Targeted Performance	Points Targeted	Stage of Implementation	Credit Requirements Summary *For full requirements refer to Green Star Buildings Submission Guidelines*
Healthy			**11**	**3**		**9**		
10	Clean Air	◆	**2**		Minimum Expectation	◆	Design, Tender, Construction, Handover, Use	1. Separation distances between pollution sources and outdoor air intakes must comply with ASHRAE 62.1:2013 or AS 1668:2012. 2. All new and existing ductwork must be cleaned prior to occupation. 3. Pollutants from printing and photocopying equipment, cooking processes and equipment are removed or exhausted directly to the outside. 4. Outdoor air to achieve 50% improvement over AS 1668.2:2012 or CO2 levels must be maintained at maximum 800 ppm. (CA - Outdoor air to achieve 100% improvement or CO2 levels of 700 ppm + adequate access for ventilation systems maintenance)
11	Light Quality	◆	**2**	**2**	Credit Achievement	2	Design, Tender	1. (ME) LED lights - have no observable effect as per IEEE 1789-2015, flicker free, Colour Rendering Index (CRI) ≥85, meet AS/NZS 1680.1:2006 & AS/NZS 1680.4 and must have a MacAdam Ellipse or a Standard Deviation Colour Matching (SDCM) ≤ 3. 2. (ME) Provides adequate levels of daylight. 3. (ME) Limit glare from light sources and mitigate external glare. 4. Best practice artificial lighting or best practice access to daylight including external glare control. (EP - must to comply with both)
12	Acoustic Comfort	◆	**2**		Credit Achievement	2	Design, Tender, Construction, Handover	1. (ME) Qualified consultant to prepare an Acoustic Comfort Strategy to include the following criteria: quiet enjoyment of space, functional use of space, control of intrusive/ high levels of noise, privacy, noise transfer and speech intelligibility. Meet the applicable acoustic comfort criteria specific to project type as per Technical manual. 2. On-site measurements in accordance with AS/NZS 2107:2016.
13	Exposure to Toxins	◆	**2**		Credit Achievement	2	Design, Tender, Construction, Handover	1. (ME) 95% of internally applied paints/ adhesives/ sealants (by volume)/ carpets (by area) must have Low VOC as per Technical manual.. 2. (ME) 95% engineered wood products meet specified formaldehyde emission limits as per Technical manual. 3. (ME) Lead, Asbestos and PCBs -hazardous material survey carried out on any existing buildings or structures onsite in accordance with OH&S legislation. 4. On-site testing of VOC and formaldehyde levels.
14	Amenity and Comfort		**2**		Credit Achievement	2	Strategy, Design, Tender, Handover, Use	The building has dedicated amenity rooms to act as a parent room, relaxation room, or an exercise room accessible to all staff and occupants. The room size calculated at ratio of 1m2 per 10 staff/ occupants an no smaller than 10m2. The room must be separated from bathrooms, showers, lockers and active facilities. The room MUST meet the following credits: - Light Quantity - Acoustic Comfort - Equal Access to the Building criterion from Design for Inclusion
15	Connection to Nature		**1**	**1**	Credit Achievement	1	Strategy, Design, Tender, Handover, Use	1. 60% of regularly occupied areas have a high quality internal or external view. 2. Provide indoor plants (at least 500 cm2 per 15m2) and incorporates nature-inspired design (5 interventions) or 5% of the regularly occupied areas or site area (whichever is greater) must be planted area and accessible. (EP - need to comply with both)

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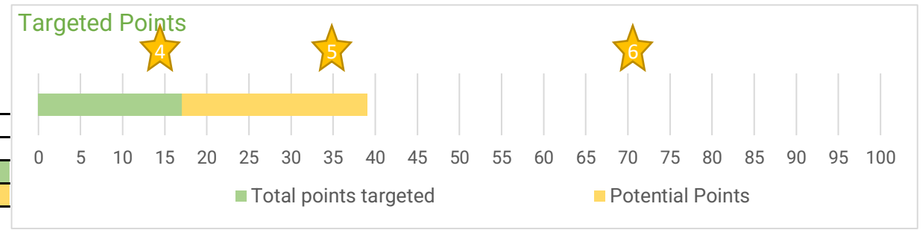

	Credit Name	Minimum Expectation	Credit Achievement	Exceptional Performance	Targeted Performance	Points Targeted	Stage of Implementation	Credit Requirements Summary *For full requirements refer to Green Star Buildings Submission Guidelines*
Resilient			**8**	**0**		**2**		
16	Climate Change Resilience	◆	**1**		Credit Achievement	1	Strategy, Design	1. Climate Adaptation Plan developed by qualified professional including medium term and long term time scales. 2. Extreme and high risks are addressed through specific design responses (minimum 2 risks). (ME - Complete Climate Change Pre-screening Checklist + signed off by the client/ building owner)
17	Operations Resilience		**2**				Strategy, Design	
18	Community Resilience		**1**				Strategy, Design	
19	Heat Resilience		**1**		Credit Achievement	1	Design, Tender, Construction	At least 75% of the whole site comprises of one or a combination of the following strategies that reduce heat island effect: - vegetation - green roofs - roofing material including shading structures - unshaded hard-scaping elements with a 3 year SRI of minimum 34 OR initial SRI of minimum 39 - hardscaping elements shaded by overhanging vegetation - water bodies and/ or water courses
20	Grid Resilience		**3**				Strategy, Design, Handover, Use	

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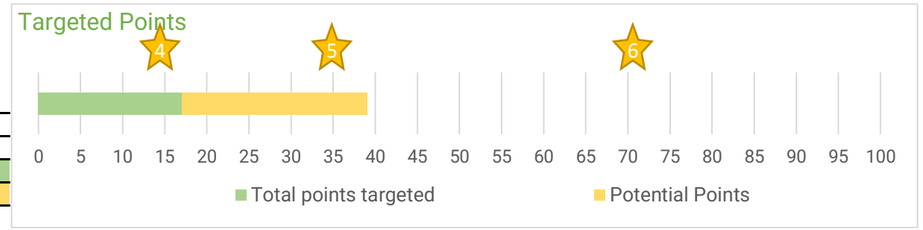

	Credit Name	Minimum Expectation	Credit Achievement	Exceptional Performance	Targeted Performance	Points Targeted	Stage of Implementation	Credit Requirements Summary *For full requirements refer to Green Star Buildings Submission Guidelines*
Positive			**16**	**14**		**0**		
21	Upfront Carbon Emissions	◆	**3***	**3**	Minimum Expectation	◆	Strategy, Design	10% reduction of upfront carbon emissions through design and material selection when compared to a reference building. (CA - 20% reduction and demolition works are offset - minimum requirement for 6 star) (EP - 40% reduction and demolition works are offset)
22	Energy Use	◆	**3***	**3**	Minimum Expectation	◆	Strategy, Design, Tender	Section J - Building energy use is 10% less than a reference building, not including PV Systems or NABERS Commitment Agreement (Office) - 5.5 Stars (CA - 20% less or 5.5 Stars NABERS with 25% modelling margin) (EP - 30% less or 6 Stars NABERS)
23	Energy Source	◆	**3***	**3***	Minimum Expectation	◆	Strategy, Design, Tender	1. Develop a Zero Carbon Action Plan (including refrigerants) with target date by when the building is expected to operate as net zero carbon. 2. It must be signed off by the client/ building owner. (CA - 100% renewable electricity) (EP - 100% renewable electricity end energy - minimum requirement for 6 star).
24	Other Carbon Emissions		**2***	**2**			Design, Tender, Construction	
25	Water Use	◆	**3**	**3**	Minimum Expectation	◆	Design, Tender, Construction, Use	Efficient water fixtures: - 5 star WELS = Taps/ Urinals/ Dishwashers - 4 star WELS = Toilets/ Clothes Washing Machine - 3 star WELS = Showers or The building uses 15% less potable water compared to a reference building (CA - 45% less potable water + provide infrastructure for recycled water connection) (EP- 75% less potable water + provide infrastructure for recycled water connection)
26	Life Cycle Impacts		**2**				Strategy, Design, Tender, Construction	30% reduction in life cycle impacts when compared to standard practice (Life Cycle Assessment) The reduction must be against the following impact categories: climate change, net use of fresh water, stratospheric ozone depletion potential, acidification potential of land and water, eutrophication potential, photochemical ozone creation potential, mineral depletion, fossil fuel depletion. The calculated impact in any category can not exceed the normalised and weighted score by more than 10%.

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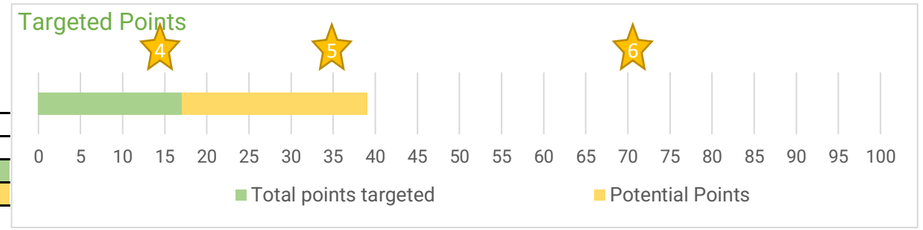

	Credit Name	Minimum Expectation	Credit Achievement	Exceptional Performance	Targeted Performance	Points Targeted	Stage of Implementation	Credit Requirements Summary *For full requirements refer to Green Star Buildings Submission Guidelines*
Places			**8**	**0**		**0**		
27	Movement and Place	◆	**3**		Minimum Expectation	◆	Strategy, Design, Tender, Construction	Changing facilities - provide showers and lockers based on the regular occupancy of the building. - access must be: safe, well lit and easily located. (CA - Bicycle parking facilities, Sustainable Transport Plan, Reducing private fossil fuel powered vehicle use, Encouraging walkability)
28	Enjoyable Places		**2**				All	
29	Contribution to Place		**2**				Strategy, Design, Construction	
30	Culture, Heritage and Identity		**1**				Strategy, Design, Handover, Use	

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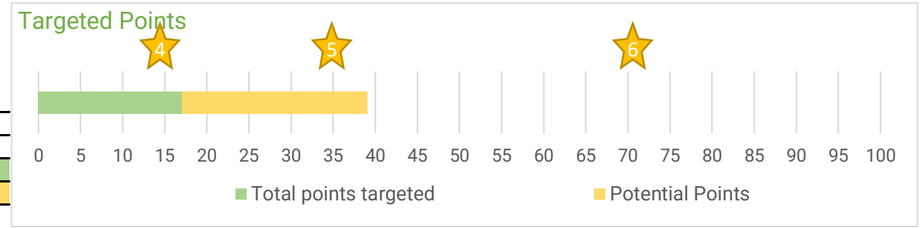

	Credit Name	Minimum Expectation	Credit Achievement	Exceptional Performance	Targeted Performance	Points Targeted	Stage of Implementation	Credit Requirements Summary *For full requirements refer to Green Star Buildings Submission Guidelines*
People			**7**	**2**		**4**		
31	Inclusive Construction Practices	◆	**1**		Minimum Expectation	◆	Strategy, Tender, Construction	Head contractor - provides gender inclusive facilities and gender specific fit for purpose personal protective equipment (PPE) for diverse body sizes and types. - implement policies to address issues of discrimination, racism and bullying onsite. - introduce on-site redress procedures for any breaches. - empower a diverse lead team to manage policies onsite. - provide training to all contractors and sub-contractors on these policies. (CA - carry out a needs analysis of potential site workers, physical and mental health programs by the head contractor and provide an evaluation report of the effectiveness of the training)
32	Indigenous Inclusion		**2**		Credit Achievement	2	Strategy, Design, Tender, Construction	Reconciliation Action Plan (RAP) - key member of the Project Team is a part of organising RAP Working Group - at least 90% of the RAP targets have been met - all implemented actions related to the RAP are publicly reported or Inclusion of Indigenous Design - demonstrate that the Australian Indigenous Design Charter guiding principles are incorporated in the design of the building.
33	Procurement and Workforce Inclusion		**2**	**1**	Credit Achievement	2	Tender, Construction	1. Develop and implement a Social Procurement Strategy or Plan and includes targets and annual reporting requirements. 2. At least 2% (EP is 4%) of the buildings total contract value has been directed to generate employment opportunities for disadvantaged and under-represented groups.
34	Design for Inclusion		**2**	**1**			Design, Tender, Construction, Handover, Use	

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Exceptional Performance points targeted		0

Core points targeted	17
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Buffer Points	2
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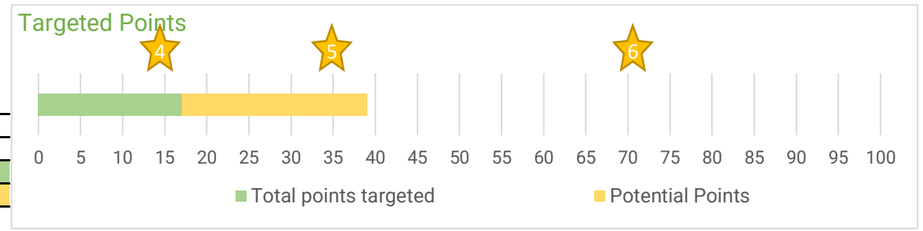
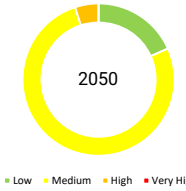


	Credit Name	Minimum Expectation	Credit Achievement	Exceptional Performance	Targeted Performance	Points Targeted	Stage of Implementation	Credit Requirements Summary *For full requirements refer to Green Star Buildings Submission Guidelines*
Nature			10	4		0		
35	Impacts to Nature	◆	**2**		Minimum Expectation	◆	Strategy, Design	1. Site Ecological Value - at the date of site purchase or option contract, land clearing does not occur on the following site: - old-growth forest - prime agricultural land - any wetland listed as being of 'High National Importance, - aspects considered 'Matters of National Environmental Significance' If the project site is adjacent, within 100 meters, or contains the above and these are being protected, the construction and future operations of the site takes measures to reduce their impact. 2. The building's light pollution to neighbouring bodies and to night sky has been minimised. 3. Wetland Management Plan prepared by a qualified Ecologist or other qualified professional. (CA - Ecological assessment report prepared by an ecologist + design response how ecological values will be protected.)
36	Biodiversity Enhancement		**2**	**2**			Design, Use	
37	Nature Connectivity		**2**				Strategy, Design	
38	Nature Stewardship		**2**				Strategy, Design	
39	Waterway Protection		**2**	**2**			Design, Construction, Handover	1. 40% (EP is 80%) reduction in average annual stormwater discharge (ML/yr) 2. Achieve water pollution targets listed below: - TSS = 85% (EP is 90%) - Gros Pollutants = 90% (EP is 95%) - TN = 45% (EP is 60%) - TP = 65% (EP is 70%) Minimise the risk of chemical pollutants and other toxicants entering the stormwater system.

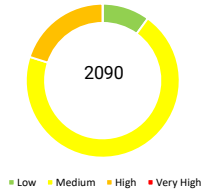
Appendix B – Climate Change Adaptation and Mitigation Matrix

Category	Risks Registered	2020-2039	2040-2050	2070-2090
Temperature	18	0.78	1.7	4.11
Precipitation	4	-53.09	-44.05	-22.14
Sea-level Rise	0	+ 0.3 m	+ 0.3 m	+ 0.8 m
Relative Humidity	3	-1.02	-1.59	-3.1
Drought	4	Max. no. of consecutive dry days: 6.39	Max. no. of consecutive dry days: 7.86	Max. no. of consecutive dry days: 10.99
Flood	7	Max. no. of consecutive wet days: -1.13	Max. no. of consecutive wet days: -1.3	Max. no. of consecutive wet days: -1.53
Wind+Storm	6	Wind Speed: + 4%	Wind Speed: + 4%	Wind Speed: +5%
Bushfire	12	SPEI Index: -0.16	SPEI Index: -0.17	SPEI Index: - 0.76
Cyclones	6	Data not available. Medium Level of Confidence for Increase		
Total Risks	**60**			

	2050
Low	11
Medium	46
High	3
Very High	0



	2090
Low	6
Medium	42
High	12
Very High	0



	Residual
Low	14
Medium	37
High	0
Very High	0

					2050			2090				Residual		
Ref	Category	**Impact**	**Risk**	**Risk Owner**	**Likelihood**	**Consequence**	**Risk 2030**	**Likelihood,**	**Consequence8**	**Risk 2090**	**Mitigation/ Management Strategy**	**Likelihood.**	**Consequence14**	**Risk Final**
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Damage to ventilation system due to particulate matter carried by increased wind	Mechanical	Unlikely	Moderate	Medium	Likely	Moderate	Medium	O/A intake located in shielded locations. Heat recovery ventilators to have filters.	Unlikely	Moderate	Medium
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Façade elements to cope with increased wind loads (roof, long cantilevers etc) at risk of uplift.	Architectural/Façade/Structural	Unlikely	Major	Medium	Unlikely	Major	Medium	Facade to be detailed designed with consideration of more severe storms and consider the increased liklihood of a cyclone to pass the site in the future.	Unlikely	Major	Medium
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Inceased storm/wind to impact landscaped areas	Landscape	Unlikely	Minor	Low	Likely	Minor	Medium	Landscape plant selection to be native to the areas. During the establishment of the landscape in the first few years extra irrigation provided to ensure plant does not dry out due to wind.	Unlikely	Minor	Low
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Damage to exterior equipment during a period of high wind	Electrical/ Mechanical	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Similar mitigation strategy to above - Outdoor equipment to be in shielded locations that are designed to withstand wind loading that considers increased intensity of storms	Unlikely	Moderate	Medium
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Increased wind, dust and hail damage to (Services Plant and Solar PV)	Electrical/Mechanical	Likely	Moderate	Medium	Likely	Moderate	Medium	Since the pitch of the roof on RRHC is quite slight, there would need to scheduled observation of the PV panels to determine whether they require cleaning. There are no strategies for protecting solar PV panels from hail damage without compromising their efficiency. Solar panels within Australia are rated to withstand hail stones of 35mm diameter. Outdoor/External lighting luminaires to have suitable IP/IK ratings to withstand rain and hail.	Likely	Moderate	Medium
W	Wind+Storm	More frequent and intense extreme storms, increase in wind speed	Concerns for the outdoor furniture	Architectural	Likely	Moderate	Medium	Likely	Moderate	Medium	Outdoor furniture to be permant fixtures that are mounted to the ground sruface beneath them to prevent uplift from wind.	Very Unlikely	Moderate	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	The heat rejection to the street, may cause an increase in localised heat island effect	Mechanical	Unlikely	Minor	Low	Likely	Minor	Medium	Major buildings at RRHC (Building A & D) have Level open plant rooms, dispersing heat rejection up high, unlikely to be noticed by people within the area. Smaller buildings have the outdoor units tucked away from general pedestrian paths.	Unlikely	Minor	Low

T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Blackout or brownout of the building during heatwaves or periods of prolonged high temperatures	Electrical/ Mechanical/ Facilities Manager	Likely	Major	High	Very Likely	Major	High	Substation to be uprated to ensure significant buffer between the forecasted projects peak demand and the power available.	Unlikely	Major	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Annual temperature range outside of mechanical operating range	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	System to be designed such that future upgrading in capacity is possible through upgrading indoor and outdoor units and not requiring to upgrade ductwork, HRVs and pipework. Therfore futureproofing the design for later increased temperatures.	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Building Systems Failure due from blackouts/ brownouts	Electrical/ Mechanical/ Facilities Manager	Likely	Major	High	Very Likely	Moderate	High	Substation to be uprated to ensure significant buffer between the forecasted projects peak demand and the power available. Provisions for temporary generators to be connected when required.	Likely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Buckling of materials (eg pavement, roads ect)	Civil	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	This is unlikely due to most hardstands being shaded by the building itself or canopy cover. Areas that are exposed to sunlight will be constructed with appropriate expansion joints to prevent cracking	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	A reduction in the use of outdoor spaces and amenities.	Landscape	Very Likely	Minor	Medium	Almost Certain	Moderate	High	Project is targeting a 40% canopy cover, this combined with a large undercroft should provide the site with plenty shaded and cool space.	Very Likely	Minor	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Conduction risk in the glass reducing the thermal comfort for the occupants	Mechanical	Likely	Minor	Medium	Likely	Minor	Medium	Currently the Section J analysis proposes double glazed systems for the fixed outer perimeter windows which are the ones that will experince direct solar radiation. Double glazing will prevent this risk. Also these external windows have appropriate horizontal and vertical shading around them to prevent direct solar radiation. Operable windows are mostly shaded by the walkway and would not experiece long durations of direct solar radiation - therefore this issue low risk.	Unlikely	Minor	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Degradation and damage to building envelope (e.g. façade, roof) due to exposure to high temperatures (superficial peeling, cracking, corrosion, etc.)	Architect / Façade	Unlikely	Minor	Low	Unlikely	Minor	Low	Most façade elements will be relatively light in colour, reflecting a large portion of solar radiation, extending their life. Façade element procured to consider lifetime of the coating compared to the building design life.	Unlikely	Minor	Low
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Degradation and damage to Building Systems due to exposure to high temperatures higher frequency system replacement requirements	Electrical	Likely	Moderate	Medium	Very Likely	Moderate	High	Plant area to be covered to reduce the effects of direct solar radiation.	Likely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Electrical equipment failure during heatwaves or projected increased temperatures.	Electrical	Unlikely	Major	Medium	Likely	Major	High	Substation to be uprated to ensure significant buffer between the forecasted projects peak demand and the power available.	Unlikely	Major	Medium

T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increase in hot days and heatwaves may impact the ability to maintain thermal comfort	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	System to be designed such future upgrading in capacity is possible through upgrading indoor and outdoor units and not requiring to upgrade ductwork, HRVs and pipework. Therfore futureproofing the design for later increased temperatures. 40% canopy cover will help local heat temperatures. Irrigation from rainwater to occur on peak days to reduce the temperature of the site.	Likely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease	Increase in water demand from both occupants and landscape	Hydraulic/ Landscape	Likely	Minor	Medium	Very Likely	Minor	Medium	Rainwater tank to supply irrigation	Likely	Minor	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increased heat island effect	Mechanical/Architectural	Likely	Moderate	Medium	Very Likely	Moderate	High	40% Canopy cover for entire RRHC site and low solar absortance roof provided.	Likely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increased temperatures impact on HVAC peak loads and and Mechanical Plant capacity.	Mechanical	Likely	Moderate	Medium	Very Likely	Moderate	High	System to be designed such future upgrading in capacity is possible through upgrading indoor and outdoor units and not requiring to upgrade ductwork, HRVs and pipework. Therfore futureproofing the design for later increased temperatures.	Unlikely	Moderate	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Increased temperature in pipework may increase legionella risk	Hydraulic	Likely	Major	High	Likely	Major	High	Hot water storage and reticulation loop to be kept at temperature > 60 deg C such that Legionella cannot survive. Cold water pipes to have deadlegs flushed after long periods of no use - ie school holidays	Unlikely	Major	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Mechanical equipment may fail under higher temperatures	Mechanical	Unlikely	Major	Medium	Likely	Major	High	Mechancial design to consider short term effects of climate change that match the design life of the VRF system. System to be designed such future upgrading in capacity is possible through upgrading indoor and outdoor units and not requiring to upgrade ductwork, HRVs and pipework. Therfore futureproofing the design for later increased temperatures.	Unlikely	Major	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	The natural ventilation system may not be able to be used for as much of the year as predicted	Architectural/Mechanical	Likely	Minor	Medium	Very Likely	Minor	Medium	40% tree canopy cover and low solar absorptance roof will assist this.	Very Likely	Minor	Medium
T	Temperature	Increase in daily temperature (min, max and mean), solar radiation and heatwaves. Decrease in cold nights	Thermal comfort of occupants in naturally ventilated spaces.	Mechanical	Likely	Minor	Medium	Very Likely	Minor	Medium	40% tree canopy cover and low solar absorptance roof will assist this.	Very Likely	Minor	Medium
RH	Relative Humidity	Slight decrease in RH	Condensation and moisture in the façade	Architectural/Façade	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Air tightness consultant to be procured, condensation unlikely to occur due to sufficient air changes.	Unlikely	Moderate	Medium
RH	Relative Humidity	Consecutive days of intense rainfall, high RH, high temperature	HVAC system undersized for dehumidifaction. HVAC cannot simulataneously heat and cool	Mechanical	Likely	Minor	Medium	Likely	Minor	Medium	Schools operate on VRF systems that are not capable of dehumidification	Likely	Minor	Medium

RH	Relative Humidity	Fluctuating RH during different ENSO cycles	Increased humidity during La Nina, Decreased humidity during El Nino, impacting thermal comfort, health risk and moisture indoors	Mechanical	Likely	Moderate	Medium	Likely	Moderate	Medium	Schools operate on VRF systems that are not capable of dehumidification	Likely	Moderate	Medium
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Drainage from public system to not cope with intense flows	Civil	Very Unlikely	Moderate	Low	Unlikely	Moderate	Medium	Generally this should be ok for short duration rainfalls. For times during extended rainfall the river will rise to a point that will make any drainage from the area redundant. This risk is superceded by flooding risk	Unlikely	Moderate	Medium
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Increased rainfall variability may impact the annual capcity of rainwater used for irrigation	Hydraulic	Unlikely	Minor	Low	Likely	Minor	Medium	The planting selection is mostly native to the area plants which will not require significant irrigation after being established. When considering the effects of prolonged drout, the Rainwater tank will supply irrigation only. The roof provides a large catchement area relative to the spaces being irrigated. Approximately twice the size.	Likely	Minor	Medium
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Operation of natural ventilation louvers during rain events	Mechanical/Architectural	Likely	Moderate	Medium	Likely	Moderate	Medium	The natural ventilation openings have mechanical louvres on them which will act as a barrier to rain to a certain extent. The eave of the roof will also protect these openings from rain. If the rain and wind is too much that it is flying into the spaces it is likely that they will simply be shut and the mech system will be operating	Unlikely	Minor	Low
P	Precipitation	Increased rainfall variability, less frequent but more severe storms events	Penetrations through roofing.	Architectural	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Penetrations through the roof will be from roofing screws which are to have a rubber/neopreme washer or the like to prevent water ingress. Similarly PV system must be fastened to ensure waterproofing on the penetrations	Unlikely	Moderate	Medium
F	Flood	More severe and prolonged flood events	Access to the building restricted by flood	Civil	Unlikely	Major	Medium	Unlikely	Major	Medium	Yes this would be the case but Lismore as a town has experienced many significant floods and it is unlikely that school would continue to operate in a severe flood	Unlikely	Major	Medium
F	Flood	More severe and prolonged flood events	Death of flora due to flooding	Landscape	Likely	Minor	Medium	Likely	Minor	Medium	This is dependent on when the flood occurs. If the flood occurs after the plants are well established, this would be considered a lower risk. If flooding occurs shortly after planting, this is high risk for plant survival.	Likely	Minor	Medium

F	Flood	More severe and prolonged flood events	Flood damage to building structure	Structural	Very Unlikely	Severe	Medium	Very Unlikely	Severe	Medium	Project FFL is 500mm above PMF	Very Unlikely	Severe	Medium
F	Flood	More severe and prolonged flood events	Flooded underground utilities (e.g. stormwater outflow points, basement facilities or storage)	Civil	Unlikely	Major	Medium	Unlikely	Major	Medium	The stormwater system will be inevitabaly be inundated during flooding events. The project does not have basement facilities or storage on the site level, these are all lifted above the PMF	Unlikely	Major	Medium
F	Flood	More severe and prolonged flood events	Flooding causes power outage	Electrical/Mechanical/Civil/Landscape/Facilities Manager	Very Unlikely	Severe	Medium	Very Unlikely	Severe	Medium	Flooding itself would not cause a power outage persay, unless it were above the PMF. The energy operator would turn of the power to the site and surrounding area in the case of a flood. The electrical infrastructure is to be designed such that it remains intact and undamaged if a flood occurs at the project specified flood height (PMF + 500mm).	Very Unlikely	Severe	Medium
F	Flood	More severe and prolonged flood events	Overland flow during flood events	Civil	Unlikely	Major	Medium	Unlikely	Major	Medium	The school would be closed during a flood making this risk redundant.	Unlikely	Major	Medium
F	Flood	More severe and prolonged flood events	Undersized systems for drainage, gutters, osd (if needed)	Hydraulic/Civil	Likely	Moderate	Medium	Likely	Moderate	Medium	Gutters are sized to 5 min duration at 5%AEP. The gutters are not critical if they are overflowing as the water would be falling to the site ground rather which is well below the buildings floor level.	Likely	Minor	Medium
D	Drought	More severe and prolonged drought events	Damage to landscaping due to drought.	Architectural	Likely	Minor	Medium	Likely	Minor	Medium	The planting selection is mostly native to the area plants which will not require significant irrigation after being established. When considering the effects of prolonged drout, the Rainwater tank will supply irrigation only. The roof provides a large catchement area relative to the spaces being irrigated.	Unlikely	Minor	Low
D	Drought	More severe and prolonged drought events	Decreased availability of potable water. Local laws in place for preventing the use of potable water for non-potable uses.	Landscape	Likely	Moderate	Medium	Very Likely	Moderate	High	Irrigation and toilet flushing are the two non-potable water uses on this site. Irrigation is connected to the rainwater tank. Toilet flushing is kept to town mains but will not become illegal.	Unlikely	Moderate	Medium

D	Drought	More severe and prolonged drought events	Reduction in water availability for rainwater reuse in the building due to droughts	Hydraulic	Likely	Moderate	Medium	Likely	Moderate	Medium	Non-potable water demand not extremely high. Irrigation would want to use rainwater during times of extreme drought. Locally in a basin, regionally in a large basin. Overall humidity crashing to dry desert conditions is very unlikely.	Unlikely	Moderate	Medium
D	Drought	More severe and prolonged drought events	Water scarcity during drought periods affecting towns water supply	Hydraulic	Unlikely	Major	Medium	Unlikely	Major	Medium	This would be challening and likely something that would need to be tackled on a town wide level. Due to the large catchment for Wilsons river, it is very unlikely it would dry up and could be used for non-potable uses while importing drinking water.	Unlikely	Major	Medium
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Blockage of drainage systems during large storm events	Hydraulic/Civil	Likely	Moderate	Medium	Likely	Moderate	Medium	Gutters to have debris blocking devices on them. Stormwater to have appropriate access points for maintenance unblockages	Likely	Moderate	Medium
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Damage to landscaping and trees	Landscape	Likely	Moderate	Medium	Likely	Moderate	Medium	Long term vision of landscape to be assessed such that large shallow rooted trees such as gumtrees and fig trees are kept at a distance further than their mature height to ensure that the trees will not fall on the buildings in the event of a cyclone	Likely	Moderate	Medium
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Hail damage to façade	Architect / Façade	Very Unlikely	Moderate	Low	Unlikely	Moderate	Medium	Glazing is the weak point of the façade. Glazing to be thick enough to handle a certain level of impact resistance.	Very Unlikely	Moderate	Low
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Hail damaging the roof tiles/ strucutres	chitectural/Facilities Manager/Faca	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Roof will be made from Colourbond steel or the like. Hail storms are very unlikely to cause any structural/performance issues of the roof. There is a mild risk of dents being formed from the hail stones. Since the roof cannot be seen in detail from the street or on the building, this is considered a low risk issue.	Unlikely	Minor	Low
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Hail damaging the solar panles	Electrical	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Australian Code that Solar panels tested and certified to withstand hail up to 25mm falling at 23 m/s	Unlikely	Moderate	Medium
C	Cyclones	Less frequent but more severe tropical Cycles reaching further South	Lighting Strikes to the building	All	Unlikely	Major	Medium	Unlikely	Major	Medium	Height of the building in the regional surrounding geographical area lowers the risk.	Unlikely	Major	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Access to site blocked, preventing, or restricting access and egress to the site caused by bushfire	Landscape / Civil / Architectural	Very Unlikely	Moderate	Low	Very Unlikely	Moderate	Low	The western side of the site is bushfire prone land but the development is located outside the Asset Protection Zone.	Very Unlikely	Moderate	Low
B	Bushfire	Increased frequency and intensity of bushfires	Damage to buildings/ landscape/ occupants	Landscape	Very Unlikely	Major	Medium	Unlikely	Major	Medium	The western side of the site is bushfire prone land but the development is located outside the Asset Protection Zone.	Unlikely	Major	Medium
B	Bushfire	Increased frequency and intensity of bushfires	False alarms from smoke ingress during bushfire periods	Architect / Façade	Likely	Moderate	Medium	Likely	Moderate	Medium	The western side of the site is bushfire prone land but the development is located outside the Asset Protection Zone.	Likely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Increase of particulate matter/ ash from bushfires in recycled water system	Hydraulic	Likely	Minor	Medium	Likely	Minor	Medium	The western side of the site is bushfire prone land but the development is located outside the Asset Protection Zone.	Likely	Minor	Medium

B	Bushfire	Increased frequency and intensity of bushfires	Ingress of smoke through natural ventilation louvers causing building system damage and increase health risks to the building occupants	Architectural/Mechanical	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Natural ventilation will not be occuring during bushfire event. Outdoor air to be filtered through mechanical system.	Unlikely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Internal smoke damage as a result of unsealed areas	Architectural/Mechanical	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	The western side of the site is bushfire prone land but the development is located outside the Asset Protection Zone.	Unlikely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Particulate matter compromising the filtration of the mechanical system	Mechanical	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	As an operational response, filters are to be inspected with consideration of replacement after bushfire events or during bushfire events if they are of long duration.	Unlikely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Particulate matter effect occupants during times of increased activity	Mechanical	Very Unlikely	Moderate	Low	Very Unlikely	Moderate	Low	Operationally, activity such as sport and dance should be kept at a minimum during bushfire effects events.	Very Unlikely	Moderate	Low
B	Bushfire	Increased frequency and intensity of bushfires	Particulate matter from bushfires increasing the soiling of PV panels	Electrical	Unlikely	Minor	Low	Unlikely	Minor	Low	Operationally, roof to be inspected after bushfire event with consideration of cleaning PV panels.	Unlikely	Minor	Low
B	Bushfire	Increased frequency and intensity of bushfires	Reduced air quality within internal areas - IAQ (PM)	Mechanical	Very Unlikely	Moderate	Low	Very Unlikely	Moderate	Low	Natural ventilation will not be occuring during bushfire event. Outdoor air to be filtered through mechanical system. As an operational response, filters are to be inspected with consideration of replacement after bushfire events or during bushfire events if they are of long duration.	Very Unlikely	Moderate	Low
B	Bushfire	Increased frequency and intensity of bushfires	Reduced air quality within open space areas and increase health impacts - Outdoor AQ	Architectural	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	The western side of the site is bushfire prone land but the development is located outside the Asset Protection Zone.	Unlikely	Moderate	Medium
B	Bushfire	Increased frequency and intensity of bushfires	Smoke and embers impacting ventilation and air-conditioning systems	Mechanical	Very Unlikely	Moderate	Low	Very Unlikely	Moderate	Low	The western side of the site is bushfire prone land but the development is located outside the Asset Protection Zone.	Very Unlikely	Moderate	Low

Appendix C – NABERS Embodied Emissions Material Form

Appendix D – Net Zero Statement

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Subject	Net Zero Statement
Project	230772 – Richmond River High Campus Redevelopment
Author	Austin So
Date	28/11/2024

Site Description

The site is located at Dunoon Road, North Lismore, also known as 163 and 170 Alexandra Parade, North Lismore. The site comprises of 3 separate lots, located to the north of Alexandra Parade, with Dunoon Road running parallel to the eastern boundary of the site. The proposed development comprises the relocation and rebuild of the Richmond River High Campus from its existing temporary location alongside The Rivers Secondary College Lismore High Campus at East Lismore to the proposed site at 163 and 170 Alexandra Parade, North Lismore.

The site area is approximately 33.53 hectares. The proposed activity will be undertaken mainly within the north-eastern portion of the site. The site is outlined in Figure 1.

Figure 1: RRHS Site Location

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Net Zero Statement

This statement outlines the strategies to achieve Net Zero operations at Richmond River High School in compliance with section 35C of the Environmental Planning and Assessment (EP&A) Regulation. The development demonstrates a clear pathway to becoming fossil fuel-free and achieving operational Net Zero emissions.

Fossil Fuel-Free Development:

The development is designed to be capable of transitioning to a net zero in operations building at the discretion of the building operator by 1st January 2035, with the necessary infrastructure in place to support this transition. The strategies include:

- **Electrification of Building Services:**
  - The development will feature electric-powered systems for domestic hot water provisions, utilizing either instantaneous heating or element-based storage systems, depending on operational requirements.
  - High-efficiency chillers will be utilised for space cooling
  - Kitchens will operate with induction cooking systems, eliminating the use of gas.
- **Passive Design Integration:**
  - To further reduce energy consumption, passive design strategies, such as Pattern Book design shading and natural ventilation, are incorporated. These features are detailed in the 'Passive Design Features' section at the end of this memo.

Renewable Energy and Technical Features:

1. **Solar PV Installation**:
   - Solar panels are designed to be installed on the roof of the new building, providing a portion of the school's operational energy demand, with provisions for future expansion if required.
2. **Battery Storage Readiness**:
   - Provisions have been considered for the future integration of battery systems, which could enable energy storage and increase operational resilience. This would support the potential for grid independence during peak demand periods.
3. **Energy Efficiency Measures**:
   - High-performance building envelopes will reduce heating and cooling demands.
   - Energy-efficient HVAC systems, including demand-driven ventilation and heat recovery, will ensure minimal energy use while maintaining indoor comfort.
   - LED lighting systems, equipped with occupancy sensors where necessary, will optimise electricity usage.
4. **Operational Strategies**:
   - A Building Management System (BMS) may be included in the design to monitor real-time energy use, providing the operator with insights to make data-driven decisions aimed at optimising energy performance and reducing energy waste.
   - Educational programs will engage staff and students, fostering behavioural changes to further minimise energy consumption.
5. **Backup Power Transition**:

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- Diesel generators are currently considered as the backup power source for potential use during outages. The design includes infrastructure to accommodate temporary diesel-powered generators, which can be brought to the site and connected when necessary. Furthermore, provisions have been made to allow for a future transition to battery-based backup systems by 2035, aligning with Net Zero goals and reducing reliance on diesel.

6. **Offsets for Residual Emissions**:
    - Any emissions that cannot be eliminated through operational measures are intended to be offset through verified carbon offset programs, helping to achieve and maintain Net Zero operations in the future. These residual emissions would include refrigerant leakage, diesel consumed for backup power during outages, and any fossil fuel-based electricity procurement

Annual Energy Consumption & Emissions

Whole-building energy consumption calculations are not yet available as the project has not reached the level of design to complete comprehensive modelling. Energy figures will be developed during the detailed design phase, with ongoing efforts to minimise energy use and emissions wherever possible.

Passive Design Features

Passive design plays a critical role in minimising energy consumption at Richmond River High School.

1. **Pattern Book Design Shading:**
    - Fixed shading systems are optimised for Lismore's climate, protecting windows from high summer sun while allowing low-angle winter sunlight to penetrate.
    - Vertical fins reduce glare, enhancing occupant comfort while minimising energy demands for cooling.
2. **Natural Ventilation:**
    - Cross-ventilation pathways allows effective airflow throughout learning spaces.
    - Sensor will be installed that monitor outdoor weather conditions. These sensors display a green or red signal, indicating whether the outdoor conditions are suitable or unsuitable for natural ventilation. This helps guide occupants on when to open the windows and insulated doors to allow natural ventilation optimal times.
3. **Insulation:**
    - High-performance insulation stabilises indoor temperatures, reducing the need for active heating or cooling.
    - The mechanical system will be designed that a "Fan Only" mode can be turned on to night purge the building of remanent heat from the day. This allows for a smaller load on the mechanical system the following day.

Signed:

Name: Zac Duryea

Title: Senior ESD Engineer

Company: LCI Consultants

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