NORTHROP

ESD REPORT

Epping West Public School

96 Carlingford Rd, Epping NSW 2121

PREPARED FOR

Hansen Yuncken
Sydney Corporate Park, Building 1, Level 3
78-85 O'Riordan Street
Alexandria NSW 2015
Tel: 02 9770 7600

Ref: S200619-S02
Rev: 1
Date:

ESD Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
01.04.2021	1	Preliminary	I.Van Eerden	
13.04.2021	2	For Review	I. Van Eerden	
20.04.2021	3	Amend	R. McShane	

Northrop Consulting Engineers Pty Ltd

ACN 064 775 088 | ABN 81 094 433 100

Level 11, 345 George Street, Sydney NSW 2000

02 9241 4188 | sydney@northrop.com.au | www.northrop.com.au

Table of Contents

Executive Summary

This report describes how ESD principals (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the Epping West Public School Alterations and Additions Project, how the project incorporates measures to minimise consumption of water and energy, how the will reduce its ecological impact and how the project will achieve alignment to the GANSW Environmental Design in Schools Manual. This report also outlines how the Educational Facilities Services Guide (EFSG) has been used to benchmark the project to industry best practice.

Specifically, the outcomes of the report can be summarised within the following categories.

- The precautionary principle – through the implementation of environmental management, maintainability and climate change adaption planning the project is actively including adaptability and resilience within the project. These plans and corresponding design responses demonstrate that the design is actively considering the concepts behind the precautionary principle to create a space that can both accommodate for changes that may eventuate in the future and one that carefully evaluates and avoids serious or irreversible damage to the environment.

- Inter-generational equity to ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations – through the inclusion of zero ozone depleting materials, sustainably sourced timber, low impact steel and concrete, alongside a focus on native vegetation, water sensitive urban design and support for better connection with nature, the project demonstrates a strong commitment to the preservation of environmental health, diversity an productivity for future generations.

- Conservation of biological diversity and ecological integrity – through the planting of endemic native vegetation, improvement of stormwater runoff from the site and use of landscaping that blends with the surrounding parklands, the project will act to improve, conserve and support the local biological diversity and integrity.

- Improved valuation, pricing and incentive mechanisms - the project has involved significant input from the Quantity Surveyor who will continue to be involved throughout the entire design process to ensuring that the project both remains on budget and effectively considers environmental factors in the valuation of assets and services. Furthermore, the project will look at maintainability and the operational costs associated with individual design initiatives and the overall design.

Through the inclusion of the above and the sustainability initiative outlined within this report the project clearly addresses sustainability within the design and adequately equips the project for its long-term operation thereby addressing the requirements of the SSDA and those set internally by the Department of Education.

1. Introduction

Schools Infrastructure NSW (SINSW) are preparing a State Significant Development Application for the 'Epping West Public School Alterations and additions' project located on the corner of Carlingford Street and Ward Street. This report addresses how the project will meet the requirements of item 7 of the Secretaries Environmental Assessment Requirements (SEARs) with a specific focus on how the project incorporates compliance against the EFSG benchmark requirements.

The proposed development can be described as alterations and additions to an existing educational establishment. In summary, the proposed works will include:

- Demolition works;
- Construction of a three (3) storey building in the south-eastern corner of the site and a two (2) storey building further north adjacent to the site's eastern boundary;
- Refurbishment and renovation works to existing buildings, with a small addition to the western side of an existing building;
- Removal of demountable buildings currently located predominantly on the northern part of the site and associated make good works to reinstate the oval and play space which is predominantly on the northern part of the site.

An existing building known as Building G (located between buildings F and H) is proposed to be demolished, Building G is a single storey classroom building.

Figure 1 - Site plan

1.1 Response to Secretaries Environmental Assessment Requirements (SEARs)

Item 7 of the SEARs lists four requirements which are outlined below, alongside is listed where the response to each can be found within this report;

Item	Action to Address the Requirement	Report Location
Detail how ESD principals (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the project.	This ESD report details how the project aims to address the ESD Principles and their incorporation into the design and ongoing operation of the project through the EFSG sustainability requirements and the certified Green Star rating.	Section 2 & 4
Describe the proposed measures to minimise the consumption of resources, water (including waters sensitive urban design) and energy	Significant resource efficiency measures are being included within the project design these include natural and mixed mode ventilation, energy metering, efficient lighting, water sensitive design and waste management measures.	Section 2.1, 2.3 & 2.6
Detail how the future development would be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on a materiality assessment and include waste reduction design measures, future proofing, use of sustainable and low-carbon materials, energy and water efficient design (including water sensitive urban design) and technology and use of renewable energy.	The project is being assessed against Department of Education Educational Facilities Services Guide (EFSG) which provides a clear framework to benchmark educational facilities against Industry Best Practice Sustainability. Additionally, the project will be certified to a “Best Practice” level as assessed by the Green Building Council of Australia (GBCA) Green Star system	Section 3 & 5
Show how environmental design will be achieved in accordance with the GANSW Environmental Design in Schools Manual (GANSW, 2018).	The project is being assessed against the GANSW Environmental Design in Schools Manual. This is detailed within Section 6 of this report.	Section 6
Include an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level	The project has been assessed against the Green Star rating system from the GBCA at a 4 Star or “Best Practice” level.	Section 5
Include a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change.	By targeting the Adaptation and Resilience initiatives outlined within section 5.2.3 of this report the project commits to addressing all high and extreme risks posed to the project by Climate Change over the forecast building lifetime.	Section 8
An Integrated Water Management Plan detailing any proposed alternative water	A water sensitive management plan has been produced by the project’s	2.3.3

supplies, proposed end uses of potable and non-potable water, and water sensitive urban design.	civil designer.	

1.2 Sustainability Objectives

Northrop has been engaged to provide input to Epping West Public School Alterations and Additions project to meet the objectives outlined by the Department of Education and as a result of this how the project addresses the SEARs. The project is targeting the following sustainability outcomes:

EFSG Outcomes

- Compliance with the Educational Facilities Standards and Guidelines (EFSG) by the Department of Education (DoE).
- Exceeding the requirements of Section J of the National Construction Code (NCC) by 10% as per the Government Resource Efficiency Policy.
- Incorporation of Ecologically Sustainable Development principles considered to be best practice within the Australian building industry.

SEARS Outcomes

- Demonstration of how ESD principles will be incorporated into the design and ongoing operation of the development.
- Detail proposed measures to minimise consumption of resources, water (including water sensitive urban design) and energy.
- Detail how the future development would be designed to consider and reflect national best practice sustainable building principles and improve environmental performance and reduce ecological impact; and
- Detail how environmental design will be achieved in accordance with the GANSW Environmental Design in Schools Manual (GANSW 2018).

As the EFSG requirements provide a project specific design guide benchmarked to Australian Best Practice ESD. This standard will ensure that the project is designed to address future climate related events, and allows the project to address the above.

The project team have harnessed the strong alignment between all the targeted goals and have used the EFSG framework alongside Green Star to demonstrate how this facility both incorporates industry recognised best practice sustainability and ESD, as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

1.3 Disclaimer

Due care and skill has been exercised in the preparation of this advice. No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact Northrop for detailed advice, which will take into account that party's particular requirements.

2. Sustainability Initiatives

The following section describes how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) are being incorporated in the design and ongoing operational phases of the project. These initiatives illustrate how the project addresses the following.

- The precautionary principle – through the implementation of environmental management and building maintainability, the project incorporates a focus on adaptability and resilience into the project design. The concepts behind the precautionary principle is to create spaces that can both; accommodate for changes, which may eventuate in the future, and avoid the risk of serious or irreversible damage to the environment.
- Inter-generational equity to ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations – through the inclusion of zero ozone depleting refrigerants, best practice PVC and low impact paints, sealants and adhesives, alongside a focus on providing greater vegetation and support for the buildings connection with nature, the project demonstrates a strong commitment to the preservation of environmental health, diversity and productivity of the local area.
- Conservation of biological diversity and ecological integrity – through the planting of native vegetation, reduction of stormwater runoff from the site and use of integrated landscaping, the project will act to improve, conserve and support the local biological diversity and integrity.
- Improved valuation, pricing and incentive mechanisms - the project has involved significant input from the Quantity Surveyor who will be involved throughout the entire design process to ensuring that the project both remains on budget and effectively considers environmental factors in the valuation of assets and services. Furthermore, the project has looked more broadly and considered the economic cost benefits that will stem from the project both short and long term.

Through the inclusion of the above and the sustainability initiative outlined within this report the project clearly addresses the ESD Principles as defined in clause 7(4) of schedule 2 of the Environmental Planning and Assessment Regulation 2000. Further details of the general sustainability initiatives are outlined below.

2.1 Energy Efficiency:

Energy efficiency has been considered throughout the project schematic design and will continue to heavily influence the design development process with the following improvements already considered as part of the design process.

2.1.1 Natural Ventilation of Circulation Spaces

Most circulation areas within the project will be able to operate as naturally ventilated spaces exploiting the buildings design to promote flow of air. The slim buildings and distributed nature of the design allows air to flow throughout the campus and provide free cooling of most spaces.

2.1.2 Improved building fabric and glazing performance

The building envelope comprises several different façade types, with the proposed scheme using a combination of building materiality and glazing to lower heat gains throughout summer while maintaining good views and daylighting throughout of the building. The operable windows and doors on the façade also contribute strongly to the natural/mixed mode ventilation strategy allowing for minimal use of space conditioning across the year.

The use of high-performance glazing and building materials will assist the projects targets for energy efficiency, acoustic separation, and thermal comfort. Additionally, the selection of pale roofing and façade elements will help to limit heat gain throughout the school's operational periods falling within summer. It is noted that school holidays generally occur over the hottest periods of summer and this provides the design some flexibility in optimising for the shoulder seasons.

2.1.3 Mixed Mode HVAC

The mechanical systems are to be mixed mode to account for opportunities to use the operable windows, cross ventilation, and adaptive thermal comfort approach to the site. Space conditioning will still be provided to accommodate heating and cooling during peak periods across the year, but the systems design will be to minimise its use when external conditions are able to meet the occupant comfort needs.

In order to accommodate potential future needs the HVAC systems will also look to include full outside air supply systems and a simplified economy cycle, which will reduce heating and cooling demands during periods where out door air supply can meet the loads within a space.

2.1.4 HVAC System Control

The proposed HVAC system will incorporate individual room control for thermal comfort conditions allowing building occupants to maintain comfort conditions suitable to the use and occupancy of spaces. This system assists in optimising the sites energy efficiency while maintaining comfortable conditions within the conditioned areas and ensures that vacant spaces are not conditioned.

2.1.5 Adaptive Thermal Comfort Control

Through consideration of space uses and expected clothing use when HVAC systems are active, they will be set to drift within a larger than standard dead band to reduce overcooling and heating of spaces. These set points will be determined for each space through consideration of the expected comfort bands across the year, considering things such as external temperatures, school uniforms, activity, and room layouts.

2.1.6 Energy Metering and Monitoring

An energy metering and monitoring strategy will be considered to effectively monitor the main energy uses within the project, alongside the lighting and small power use. This aims to provide high level fault detection and monitoring of the different areas of the project.

This system will also provide an educational tool to the school to assist in creating behavioral change for students and staff.

2.1.7 Improved outdoor air provision

The project will aim to improve the outdoor air provided to regularly occupied spaces. This will minimise CO2 build up and improve cognition for the building occupants.

To address energy use concerns the design will also look to incorporate on an outdoor air economy cycle which will allow the building to exploit periods where the buildings external conditions can effectively provide thermal comfort in the space reducing the run times of the air-conditioning system.

2.1.8 Highly efficient lighting system

The installation of LED lighting throughout all areas of the building will assist in the minimisation of lighting energy use. Improved lighting energy also reduces the heat loads within the spaces and therefore lowers the energy used to condition the building.

2.1.9 Onsite Renewable Energy

The project has been designed to include a rooftop solar array (anticipated to be circa 99kW) providing energy production onsite to both reduce energy costs and provide educational outcomes for students and staff.

2.1.10 Passive Design Measures

A focus has been placed on good passive design within the building and shading systems for the project. Examples of this includes the following;

- Incorporation of shading on the north, east and west facades of the buildings.
- Use of well-designed glazed areas to exploit overshadowing of the circulation balcony areas for peak occupancy periods.
- Strong use of thermal mass to regulate temperatures. This is achieved through the selection of a concrete materiality for the balconies and structural elements.
- Integration of landscaping into the building designs to minimise heat islanding and promote passive cooling through transpiration.
- Use of high performance thermal and acoustic insulation for the project facades.

2.2 Indoor Environment Quality

Indoor environment quality is always an important consideration in Education projects. The following initiatives have been considered as part of the building design:

2.2.1 Daylight Access

The design of the building aims to allow excellent daylight penetration into both internal and external spaces. This access to daylight throughout the building will both minimise energy used for lighting and will improve occupant connection to their external environment.

The slim building design has also been incorporated to promote daylight access to the lower levels and internal areas of classrooms.

2.2.2 Interior noise level control

Internal noise levels have been actively considered with the building layout and systems design considering how noise will reverberate through the building. The use of acoustic insulation and sound isolation will ensure that interior noise levels to be maintained below acceptable limits.

2.2.3 Access to views

Access to external views allows the switch between short and long focal lengths reducing eye strain for students. There is significant evidence to support that eyestrain and related health problems can be significantly reduced in situations where the eyes can be refocussed periodically on a distant object. This is easier to achieve where there is a nearby window with a view.

The overall design of the project promotes the provision of views to all classrooms where students are expected to concentrate for extended periods of time.

2.2.4 Material selection

Materials selection for the project aims to improve the internal environment of the site with materials with low volatile organic compound and formaldehyde content preferred to help minimise respiratory issues for building occupants. Additionally the use of natural materials such as stone, timber, rubber

floors will be prioritized during the detailed design, these materials help to facilitate a biophilic response in occupants and have been shown to improve educational outcomes.

Maximum TVOC limits for paints, adhesives and sealants are detailed in the table below:

Table 1 Maximum TVOC Limits for Paints, Adhesives and Sealants

Product Category	Max TVOC content in grams per litre (g/L) of ready to use product
General purpose adhesives and sealants	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

All engineered wood products used in the building will meet the relevant limits specified in the table below as per the specified test protocol or have product specific evidence that it contains no formaldehyde.

Table 2 Formaldehyde Emission Limit Values for Engineered Wood Products

Test Protocol	Emission Limit/Unit of Measurement
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤1mg/ L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1mg/ L
AS/NZS 4357.4 - Laminated Veneer Lumber (LVL)	≤1mg/ L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL	≤1mg/ L

JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	≤1mg/ L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	≤1mg/ L
JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates)	≤0.1 mg/m²hr
ASTM D5116 (applicable to high pressure laminates and compact laminates)	≤0.1 mg/m²hr
ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates	≤0.1 mg/m²hr (at 3 days)
ASTM D6007	≤0.12mg/m³
ASTM E1333	≤0.12mg/m³
EN 717-1 (also known as DIN EN 717-1)	≤0.12mg/m³
EN 717-2 (also known as DIN EN 717-2)	≤3.5mg/m²hr

2.3 Water Efficiency

A strong focus has been put on the effective management of water within the building with the following initiatives being included in the design in all areas throughout the project:

2.3.1 Water efficient fixtures and fittings

Water Efficient fixtures and fitting will reduce the water consumption of the site. As an indication, the following is being be targeted:

- Wash hand basin taps 6 star WELS
- General taps 6 star WELS
- Toilets dual flush 4 star WELS (other than DDA toilets)
- Urinals 0.8 L per flush 6 star WELS
- Shower heads 7-9 L per minutes 3WELS

Figure 2 WELS Label

2.3.2 Use of low maintenance landscaping

The sites landscaping will incorporate native and low maintenance vegetation where possible which will significantly reduce the potable water consumption of the site. This use of native vegetation will also help support local flora and fauna, create a strong connection to space and incorporate learning opportunities for the school community.

2.3.3 Water Sensitive Urban Design

In line with the aim of the SEARs, the project is incorporating a strong focus on water sensitive urban design with the external landscape design assisting to minimise water use for irrigation. The inclusion of vegetation within both the building and the surrounding site, assists in the reduction of site stormwater discharge and in the management of the projects broader impact on urban stormwater flows. Onsite water detention and treatment will has been included within the projects design to minimise the impacts on council stormwater systems.

A further rainwater storage system and a permeable landscaping design has been provided in the play areas to manage stormwater flow in the project.

2.4 Improved Ecology

Through planting native vegetation and promoting improved interaction with the natural environment, the project will look to improve the site's ecology and minimise the ongoing environmental impact of the project. The project is currently implementing the following:

- Incorporation of a green plants and vegetated areas within the building itself.
- Minimisation of light spill from the facility which impacts on migratory animals and insects.
- Reduced dissolved pollutants in stormwater discharged from the site, and
- Adaption and expansion of a previously developed site.

2.5 Sustainable Transport

The project design is currently well located to support the use of active and sustainable transport. The site is walkable, with proximity to Epping Station for trains and busses, the project is some parking as part of the development however will use the proximity to the station and connection of the site with footpaths to promote the use of active and public transport.

The project will also look to increase the existing servicing of the site with the inclusion of additional services between the school and Epping station (provided by TfNSW consideration), the provisioning for Bike parking spaces and the provision of improved footpath facilities within the proximity of the school. These initiatives are detailed within the School Transport Plan provided as part of the SSDA.

2.6 Waste Management

Effective waste management throughout demolition, construction and operation of the site will help to promote resource efficiency and minimise the adverse environmental impacts of the project. The following are being considered as part of the design process:

2.6.1 Operational Waste

The provision of separated waste and recycling streams allows for more effective recycling of the projects operation waste. Providing separate bins for cardboard/paper waste, glass, food wastes, comingled recycling and general waste will improve the buildings operational efficiency and result in significant environmental benefits.

Figure 3 Waste bin colours

2.6.2 Construction and Demolition Waste Minimisation

The project will also aim to limit the amount of construction and demolition waste sent to landfill with the aim of at least 90% of all waste produced by the project to be sent to recycling facilities or reused onsite.

2.7 Massing and Site Layout

The site has considered the likely operation of the project and how the overall site massing and layout could affect sustainability outcomes. The massing and site layout has looked to consider and balance the often-competing outcomes of daylighting, comfort, energy consumption and useability of the site.

2.7.1 Orientation

The site orientation has considered the site solar access across the day with the idea of creating a balanced solar access with daylight entry promoted over each of the site's spaces across the day. This variation in daylight entry helps to ensure that all there is change in daylight levels throughout the day in all areas and that spaces are not over lit when occupied. The orientation has also considered

the connection of the project to the adjacent park to create a good grounding of the site within the broader area.

2.7.2 Shading

To accommodate the requirements for site connection and the passive ventilation needs optimised shading analysis was completed to consider good glare and heat control during occupied periods.

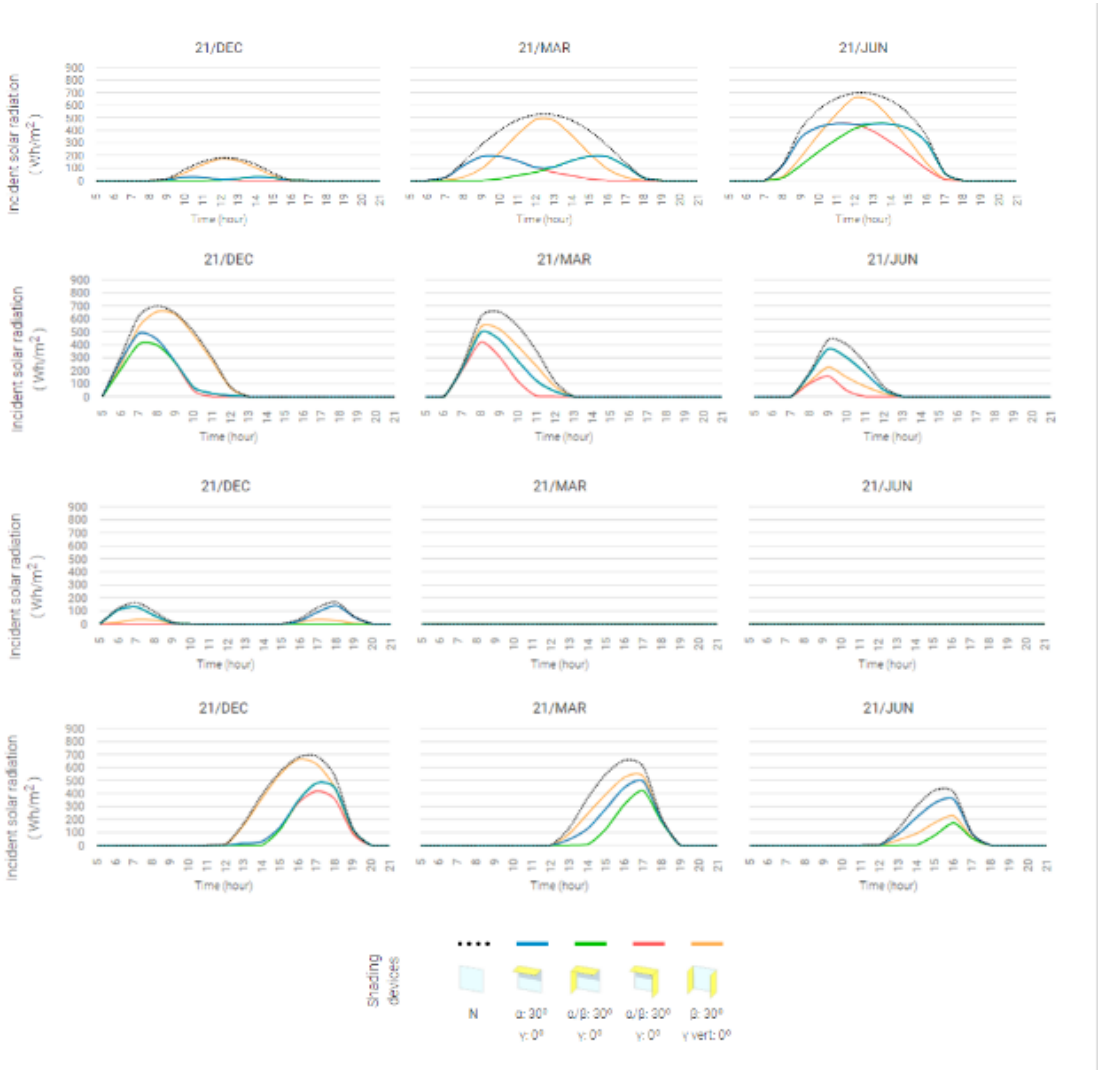


Figure 4 - Comparative assessment of the hourly profile of direct beam radiation between four facade orientations (from the top of the figure: N,E,S,W)

Given the sites temperate climate the use of horizontal shading that blocks significant heat gains throughout summer during school hours (until 3pm) but allows this entry during winter helps to minimise heating load in winter while still allowing diffuse daylight to penetrate the space. This consideration was used to inform the use of horizontal shading and balance daylight and space thermal comfort specifically addressing the needs of this project as a school.

The above analysis shows the horizontal shading provided to the east and west controls glare and heat gains almost entirely between the hours of 9am and 3pm.

3. EFSG Sustainability Requirements

3.1 Overview

The Educational Facilities Standards and Guidelines (EFSG) have been developed by the NSW Department of Education (DoE) to assist the management, planning, design, construction and maintenance of new and refurbished school facilities. The EFSG is to be treated as a reference guide that provides a benchmark framework to allow for a consistent best practice standard of delivery across various types of school developments.

The EFSG Design Guide considers a framework incorporating several aspects of design including extensive Ecologically Sustainable Development (DG02) requirements. The following categories are covered within the EFSG DG02 Design Guide:

- NSW Government Resource Efficiency Policy
- Environmental Design Policies
- Environmental Design Features of Educational Facilities
- Insulation
- Ventilation
- Pesticides
- Water Conservation

The proceeding sections outline the requirements for the above categories of the EFSG DG02 Design Guideline.

3.2 NSW Government Resource Efficiency Policy (GREP)

The GREP aims to both lead by example and reduce the Government's operating costs by increasing resource productivity. This policy drives resource efficiency by Government agencies in energy, water and waste and reducing harmful air emissions from associated operations.

The policy ensures to:

- Meet the challenge of rising prices expected for energy, fuel, water and waste management.
- Use purchasing power to drive down cost of resource efficient technologies and services.
- Demonstrate leadership by incorporating resource efficiency in decision making.
- Design Buildings that achieve a 10% reduction on a minimum National Construction Code Complaint Building. This will generally be exceeded for an EFSG compliant school.

3.3 Environmental Design Policies

3.3.1 Green Building Design and Green Star

The EFSG notes that the current Green Star rating tool should be used at time of project design, as such Northrop has selected initiatives from the most recent Green Star Design & As Built v1.3 tool for implementation on the project. The details of this tool are included in Section 5 of this report.

3.3.2 Framework Requirements

The DoE requires that any new school building on a new or existing site achieve best practice sustainability within the Australian building industry. Policies set out by the EFSG are expected to achieve this standard against the GBCA framework most relevant to the project.

A potential compliance pathway has been developed and its implementation is being considered as part of the design development process to ensure that Epping West Public School Alternations and Additions Project incorporates the Australian Best Practice Sustainability. The measures under consideration are outlined in Section 5 of this report to address areas not covered by the EFSG.

3.3.3 Environmental Management Plan

It is mandatory that all new projects prepare a site-specific Environmental Management Plan (EMP) prior to the commencement of the relevant site works. Contractors will be required to prepare an EMP as a condition of contract.

For projects equal to $10 million or greater, including projects under $10 million which are environmentally sensitive, contractors will be required to develop a corporate Environmental Management System (EMS) accredited by a NSW government construction agency.
The head contractor is also required to implement an environmental management system certified to ISO14001. This will be a requirement imposed on the successful D&C contractor for the project.

3.3.4 Timber

The project is to contain no rainforest timbers (unless plantation grown), no timbers from high conservation forests and use only recycled timber, engineered and glued timber composite products, timber from plantations or sustainably managed regrowth forests.

This requirement will be included in the project specifications to ensure that compliance is achieved.

3.3.5 Ecologically Sustainable Development

The project must:

- Ensure the preservation, maintenance and sustainable use of the community's natural and mineral assets.
- Protect and support biological and ecological diversity.
- Restrict the flow of pollutants into our natural environments.

Through planting native vegetation and promoting improved interaction with the natural environment, the project is aiming to improve the site's ecology and minimise the ongoing environmental impact of the project.

The project is currently implementing the following:

- Extensive native vegetation endemic to the local area;
- Minimisation of light spill from the facility which impacts on migratory animals and insects; and
- Reduced dissolved pollutants in stormwater discharged from the site.

3.3.6 Environmentally Friendly Materials / Products

The project must encourage the use of materials and products which:

- Adequately and economically perform their intended functions while having low adverse environmental impacts throughout their life cycle.

- Contain reduced or no hazardous substances (low VOC)
- Reduce the demand for rare or non-renewable resources.
- Are made form or contain recycled materials or can be recycled at the end of their useful life.

3.3.7 Conservation of Biological Diversity

The project must conserve for future generations, the biological diversity of genetic materials, species and ecosystems. Project and purchasing impacts must be assessed on the natural environment during all project phases and adopt a precautionary approach where risk is high.

3.3.8 Pesticides

No chemical pesticides and/or termiticides are to be used on the project. Physical design measures must be taken to prevent and minimise risks.

3.3.9 Waste

The EFSG DG02 requires consideration to eliminate unnecessary waste by better planning and more efficient use of natural and manufactured resources. The project will incorporate several waste initiatives as part of the detailed design.

Effective waste management throughout demolition, construction and operation of the site will help to promote resource efficiency and minimise the adverse environmental impacts of the project. The following should be implemented as part of the design:

- Dedicated waste recycling spaces;
- Provision of accessible water sources for drinking water to reduce the use of bottled water on site;
- Provision of waste education resources linking with waste companies;
- Minimisation of construction and demolition waste sent to landfill; and
- Provision of separated waste streams for recycling and general waste.

3.4 Environmental Design Features of Educational Facilities

3.4.1 Natural Light

The intention of incorporating good daylighting is to minimise energy consumption and ongoing running costs and ultimately provide natural light to the students and staff. Natural daylight improves the indoor environmental quality of spaces and encourages beneficial learning. The EFSG DG02 Design Guideline requires that:

- Natural daylight is to be provided to all teaching spaces unless otherwise identified.
- Natural daylight can be provided via windows, skylights and roof-lights. Where a room is required to have a brownout function, roof-lights and skylights will need to include a method to sufficiently adjust light levels.
- Include daylight sensors to rooms to reduce light output or turn off lights when sufficient daylight is provided within the space.
- When the space is large, it is recommended that perimeter lighting adjacent to windows be on a separate zone to make maximum use of daylight.

3.4.2 Sun Shading

On exposed facades of the project which are subject to direct sunlight, external window shading should be considered as part of the building design to ensure energy efficiency and thermal comfort.

3.4.3 Period Bells

Energy consumption should be minimised in the development where possible. An area that is to be addressed as part of the new development is to include the following initiatives as part of the period bells design:

- Period Bell Light switching systems are to be in all new schools, major conversions and additions.
- All luminaries in rooms are to automatically turn off five minutes after the period bell rung and all students have left the room. Alternatively, systems should be in place to turn off lights in a room when not in use.
- A conscious decisions is required to turn the lights on again.

3.4.4 Appliances and Equipment

Minimum standards for new electrical appliances and equipment is to be compliant with the NSW Government Resource Efficiency Policy Part E3 and must have the minimum Greenhouse and Energy Minimum Standards (GEMS) star ratings as stipulated in the policy.

3.4.5 Air Cooling and Heating Systems

Air cooling and heating systems for the project are to include the following:

- Timed or sensor operation functionality for all air cooling systems.
- Centralised control of HVAC plant with programmable schedules for the school year.
- Consider one single infrastructure for heating and cooling where it demonstrates whole life cycle cost savings.

3.4.6 Electricity Meters

Electricity meters for the project are to be installed with capacity for monitoring in order to lower electricity maintenance costs by selecting a fit-for-purpose meter and allowing better access to energy consumption data at the school.

3.4.7 Renewable Energy Generation

A photovoltaic (PV) solar power grid-connect rooftop system must be provided for new schools to offset power consumption and costs. The EFSG Design Guide section DG66.3.1recommends a system capacity of up to 70kW depending on the size of the student population. The designer and/or installer of the PV system must be fully accredited by the Clean Energy Council of Australia and adhere to the system design requirements given in within the EFSG Design Guideline.

Allowances have bene made in the concept design for a solar PV system to be implemented at Epping West Public School. At least 350m2 of roof space has been designated to house a system of at least 40kW capacity.

3.5 Insulation

Insulation is to be compliant with the Building Code of Australia under Section J, Part J1 – Building Fabrics of the National Construction Code. It is required that the project utilise passive building elements such as insulation to keep heat out of classrooms during summer and reduce heat loss during winter.

3.6 Ventilation

Natural ventilation is to be used where possible to maintain good environmental air quality through all school areas. Natural ventilation principals are required to be incorporated into the project design where possible. Mechanical ventilation should only be used in areas where natural ventilation cannot be achieved, such as school performances spaces, duplicating rooms, dark rooms and internal toilets.

Single loaded covered walkways are encouraged as a means of maximizing cross ventilation, while roof turbo ventilators can be employed to enhance natural ventilation of a single storey or upper storey of a multi-storey building.

3.7 Pesticides

The project should be designed, constructed and maintained, without using chemicals for termite and other pest control. See section 3.3.8.

3.8 Water Conservation

The EFSG requires that measures be taken to implement practical water conservation systems for new educational facilities. These include:

- All fixtures and fittings are to have a minimum WELS rating as given in W3 of the NSW Government Resource Efficiency Policy.
- Internal flow controllers that minimise water usage for staff amenities.
- Timed flow taps for student facilities.
- Dual flushing cisterns with a minimum WELS rating of 4 stars in all toilets.
- Manual flushing systems are preferred.
- Rainwater harvesting and storage tank facilities for non-potable end uses.

4. National Construction Code 2019 (Amendment One)

The Deemed-to-Satisfy (DTS) provisions of Section J apply to building elements forming the envelope of the building. The development is located in NCC Climate Zone 5 and is classified as a Class 9b assembly building. The DTS requirements for Section J1 (building fabric & glazing) are described in the following sections.

4.1 Building Fabric

4.1.1 Roofs and Ceilings:

The roof areas of conditioned spaces must achieve;

- Minimum total R-Value of 3.2m2.K/W if roof solar absorptance is not more than 0.45

4.1.2 External Envelope Walls:

The external envelope walls of the conditioned spaces must achieve a minimum Total R-Value of 1.4m2.K/W inclusive of the impacts of thermal bridging.

4.1.3 Internal Envelope Walls:

The internal envelope walls must achieve a minimum Total R-Value of 1.0m2.K/W.

4.1.4 Floors – Suspended Slab:

Floors require a minimum Total R-Value of 2.0 m2/K/W in the downwards direction.

4.2 Glazing

The glazing in the external fabric facing each orientation in each story, including any mezzanine, will be assessed separately in accordance with the DTS Glazing Calculators as issued by the BCA.

Compliance is determined by the glazing area, the façade orientation, the area of the facade, horizontal shading provided, and the glazing performance. Vertical shading cannot be entered in to the Glazing Calculator. Glazing performance is measured by Total U-Value (the total U-Value for the glazing unit including the frame) and the Solar Heat Gain Coefficient (SHGC).

It is the intent of the design to achieve a result that utilises a high-performance single glazing solution uniform across the school. The targeted glazing properties are.

- Glazing performance: U-value (Uw): 4.2 W/m²K, SHGC: 0.45

This will be confirmed in design development JV3 modelling during the detailed design phases of the project however have been determined as feasible within the current stage through the use of the DTS Glazing Calculator.

5. Green Star Framework

5.1 Overview

The Green Building Council of Australia's provides an internationally recognised system to assess sustainable outcomes throughout the life cycle of the built environment. It was developed by the Australian Building Industry through the Green Building Council of Australia (GBCA), which is now the nation's leading authority on sustainable buildings and communities. Although the Project is utilizing the EFSG to benchmark the project to Industry Best Practice Sustainability there are several initiatives covered by the Green Star tool that are additional to the requirement of the EFSG. As such the project is looking to implement some additional elements drawn from this tool to address some elements of Ecologically Sustainable Design Principles more holistically.

This section provides a brief summary of the additional elements drawn from the Green Star tool being applied at Epping West Public School. The Green Star system incorporates ESD principals across nine major categories:

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials
- Land Use and Ecology
- Emissions
- Innovation

It is noted that a Certified 4 Star Green Star rating is being targeted at this stage.

5.2 Score Card

Category	Points Targeted	Points Available
Management	11	14
Indoor Environment Quality	10	17
Energy	8	22
Transport	2	7
Water	4	12
Materials	5.5	12
Land Use & Ecology	2	6
Emissions	4	5
Innovation	6	10
Total	**52.5**	**110**

5.3 Management

The credits within the Management category promote the adoption of environmental principles from project inception, design and construction phase, to commissioning, tuning and operation of the building and its systems. The following credits are currently being considered for incorporation;

5.3.1 Accredited Professional

The project team have engaged with an accredited professional to provide advice, support and information related to sustainability principles and processes, at all stages of the project.

5.3.2 Commissioning and Tuning

5.3.2.1 Services and Maintainability Review

The project team will perform a comprehensive services and maintainability review led by the head contractor or the owner's representative (or the ICA) during the design stage and prior to construction.

The services and maintainability review is to facilitate input from the design team, the facilities manager and operations staff, and any relevant suppliers and subcontractors. The review looks to address the following aspects of the project:

- Commissionability;
- Controllability;
- Maintainability;
- Operability, including ‘Fitness for Purpose’; and
- Safety

5.3.2.2 Building Commissioning

The project team will demonstrate that the pre-commissioning and commissioning activities have been performed based on the approved standards and guidelines.

5.3.3 Adaption and Resilience

5.3.3.1 Implementation of a Climate Action Plan

The project will consider the impacts of climate change through identifying and Epping West Public School. This will be done through the creation of a Climate Adaption Plan

Climate Adaption Plan

The Climate Adaption Plan will contain as a minimum the following information:

- Summary of project's characteristics (site, location, climatic characteristics);
- Assessment of climate change scenarios and impacts on the project using at least two time scales, relevant to the project’s anticipated lifespan. This must include a summary of potential direct and indirect (environmental, social and economic) climate change impacts on the project;
- Identification of the potential risks (likelihood and consequence) for the project and the potential risks to people. This risk assessment is to be based on a recognised standard;
- A list of actions and responsibilities for all high and extreme risks identified; and
- Stakeholder consultation undertaken during plan preparation and how these issues have been

5.4 Indoor Environment Quality

5.4.1 Lighting Comfort

5.4.1.1 Minimum Lighting Comfort

The project lighting design has ensured that all lights in teaching spaces are flicker free and accurately address the perception of colour in the space.

Flicker-free lighting refers to luminaires that have either:

- A minimum Class A1 & A2 ballast;
- High frequency ballasts for all fluorescent lamps, or
- Electronic ballasts in High Intensity Discharge (HID) lighting.

5.4.1.2 General Illuminance and Glare Reduction

The project team has also ensured that, in the nominated area, lighting levels comply with best practice guidelines for Office Spaces; corresponding to Table 3.1 of AS 1680.2. and that glare is eliminated through the use of baffles, louvers, translucent diffusers, ceiling design, or other means that obscures the direct light source from all viewing angles of occupants.

5.4.2 Indoor Pollutants

5.4.2.1 Paints, Adhesives, Sealants and Carpets

In addition to the indoor pollutants elements of the EFSG at least 95% of all internally applied paints, adhesives, sealants and carpets meet the below stipulated 'Total VOC Limits' (TVOC).

Maximum TVOC limits for paints, adhesives and sealants are detailed in the table below:

Table 3 Maximum TVOC Limits for Paints, Adhesives and Sealants

Product Category	**Max TVOC content in grams per litre (g/L) of ready to use product**
General purpose adhesives and sealants	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

To demonstrate compliance for the use of carpets all products will be certified under a recognised Product Certification Scheme or other recognised standards. With the certification current at the time of specification.

5.4.2.2 Engineered Wood Products

At least 95% of all engineered wood products including: particleboard, plywood, Medium Density Fibreboard (MDF), Laminated Veneer Lumber (LVL), High-Pressure Laminate (HPL), Compact Laminate and decorative overlaid wood panels meet stipulated formaldehyde limits or no new engineered wood products are used in the building.

All engineered wood products used in the building will meet the relevant limits specified in the table below as per the specified test protocol or have product specific evidence that it contains no formaldehyde.

Table 4 Formaldehyde Emission Limit Values for Engineered Wood Products

Test Protocol	**Emission Limit/Unit of Measurement**
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤1mg/ L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1mg/ L
AS/NZS 4357.4 - Laminated Veneer Lumber (LVL)	≤1mg/ L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL	≤1mg/ L
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	≤1mg/ L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	≤1mg/ L
JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates)	≤0.1 mg/m²hr*
ASTM D5116 (applicable to high pressure laminates and compact laminates)	≤0.1 mg/m²hr
ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates	≤0.1 mg/m²hr (at 3 days)
ASTM D6007	≤0.12mg/m³**
ASTM E1333	≤0.12mg/m³***
EN 717-1 (also known as DIN EN 717-1)	≤0.12mg/m³
EN 717-2 (also known as DIN EN 717-2)	≤3.5mg/m²hr

*mg/m²hr may also be represented as mg/m²/hr.

**The test report must confirm that the conditions of Table 3 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.

***The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.

5.5 Energy

The 'Energy' category aims to facilitate reductions in greenhouse gas emissions by facilitating efficient energy usage and encouraging the utilisation of energy generated by low-emission sources.

5.5.1 Greenhouse Gas Emissions – Comparison to a Reference Building Pathway

The current project design is targeting a 40% reduction in the predicted energy consumption and GHG emissions compared to a minimum code compliant building exceeding the requirements of the GREP.

Prediction of the building performance against this benchmark is to be confirmed using building performance modelling that assesses potential energy use for building services systems including:

- Mechanical Services
- Electrical Services
- Communications, AV and security systems
- Hydraulic Services
- Vertical Transportation Systems

5.5.2 Peak Electricity Demand Reduction – Reference Building

Through the use of efficient systems and on-site generation sources the project is targeting a reduction in peak electricity demand by at least 30%. Peak electricity demand is the predicted annual peak calculated as the sum of all distribution boards (to include all miscellaneous loads) relevant to the building as shown in the as-installed electrical schematics.

5.6 Sustainable Transport

Sustainable transport criteria aims to provide design and operational measures that reduce the carbon emissions arising from occupant travel to and from the project, when compared to a benchmark building. In addition, it also promotes the health and fitness of commuters, and the increased accessibility of the location.

5.6.1 Access by Public Transport

The site is not particularly well connected to public transport. However, through the expansion of the sites bus bays and installation of waling connections to the site it is providing strong support for students and staff to mode switch utilize more sustainable transport options.

5.6.2 Reduced Car Parking Provision

The project is incorporating a reduction in the number of car parking spaces when compared to a standard practice building. Minimal car parking required by council will be provided.

5.7 Water

The aim of the credit is to encourage building design that minimises potable water consumption in operations. The potable water credit will be considered for implementation as follows;

5.7.1 Sanitary Fixture Efficiency

The project is looking to further improve fixture water efficiency to achieve WELS ratings within one star or those stated in the table below:

Table 5 Sanitary Fixture Efficiencies

Fixture / Equipment Type	WELS Rating
Taps	6 Star

Urinals	6 Star
Toilet	5 Star
Showers	3 Star (> 4.5 but <= 6.0)
Clothes Washing Machines	5 Star
Dishwashers	6 Star

5.7.2 Heat Rejection Water

A waterless heat rejection system is utilised on site minimizing water use for air-conditioning.

5.7.3 Landscape Irrigation

Rainwater supported drip irrigation with moisture sensor override is to be installed to minimise potable water used for the project irrigation.

5.8 Materials

The aim of the materials credits is to reward projects that include building materials that are responsibly sourced or have a sustainable supply chain. Should these be targeted the project would need to consider

5.8.1 Responsible Materials

5.8.1.1 Permanent Formwork, Pipes, Flooring, Blinds and Cables

90% (by cost) of all cables, pipes, flooring and blinds in the project will either:

- Do not contain PVC and have an Environmental Product Declaration (EPD); or
- Meet Best Practice Guidelines for PVC.

5.8.2 Construction and Demolition Waste – Percentage Benchmark

This project should target 90% of the waste generated during construction and demolition being diverted from landfill. Compliance verification summaries should also be provided for the waste contractor and waste processing facilities.

5.9 Land Use and Ecology

The 'Land Use & Ecology' category aims to reduce the negative impacts on sites' ecological value as a result of urban development and reward projects that minimise harm and enhance the quality of local ecology.

5.9.1 Endangered, Threatened or Vulnerable Species

At the date of site purchase or date of option contract, the project site did not include old growth forest or wetland of ‘High National Importance’, or did not impact on ‘Matters of National Significance’.

5.9.2 Heat Island Effect Reduction

At least 75% of the whole site area (when assessed in plan view) comprises of one or a combination of the following:

- Vegetation;
- Green roofs;

- Roofing materials, including shading structures, having the following:
    - For roof pitched <15°– a three year SRI >64; or
    - For roof pitched >15°– a three year SRI >34.
- Only where the three year Solar Reflectance Index (SRI) for products is not available, use the following:
    - For roof pitched <15° – an initial SRI > 82; or
    - For roof pitched >15° – an initial SRI > 39.
- Unshaded hard-scaping elements with a three year SRI > 34 or an initial SRI > 39;
- Hard-scaping elements shaded by overhanging vegetation or roof structures, including solar hot water panels and photovoltaic panels;
- Areas directly to the south of vertical building elements, including green walls and areas shaded by these elements at the summer solstice.

5.10 Emissions

The 'Emissions' category aims to assess the environmental impacts of 'point source' pollution generated by projects. Negative impacts commonly associated with buildings include damage to the environment through refrigerant leaks or disturbances to native animals and their migratory patterns as a result of light pollution.

5.10.1 Stormwater

5.10.1.1 Reduced Peak Discharge

The project is aiming to achieve a post-development peak event discharge from the site which does not exceed the pre-development peak event discharge using the design Average Recurrence Interval (ARI) that corresponds to the associated flooding risk identified in the Climate Change and Adaption Assessment undertaken as part of the Adaption and Resilience credit.

5.10.1.2 Reduced Pollution Targets

Additionally the project aims to demonstrate that all stormwater discharged from the site meets the pollution reduction targets in Table 6 below.

Table 6 Minimum Pollution Reduction Targets

Pollutant	Reduction Target (% of the Typical Urban Annual Load)
Total Suspended Solids (TSS)	80%
Gross Pollutants	85%
Total Nitrogen (TN)	30%
Total Phosphorus (TP)	30%
Total Petroleum Hydrocarbons	60%
Free Oils	90%

5.10.2 Light Pollution

5.10.2.1 Light Pollution to Neighbouring Bodies

The project design ensures that all outdoor lighting on the project complies with AS 4282:1997 at all inhabited boundaries, apart from boundaries with roads.

5.10.2.2 Light Pollution to Night Sky

Outdoor lighting has been designed to achieve the following;

- Control of upward light output ratio (ULOR) by demonstrating that no external luminaire on the project has a ULOR that exceeds 5%, relative to its actual mounted orientation.

5.10.3 Microbial Control

The project achieves will be no water-based heat rejection systems preventing the buildup of microbes in these systems.

5.11 Innovation

The 'Innovation' category aims to recognise the implementation of innovative practices, processes and strategies that promote sustainability in the built environment.

5.11.1 Market Transformation

The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world. Through the targeting of world leading sustainability principles at Epping West Public School is contributing to a broader market transformation that repositions tenant health and well-being as a key indicator of sustainability.

5.11.2 Innovation Challenge – Financial Transparency

This Innovation Challenge aims to encourage owners, developers, and operators to disclose the costs of sustainable building practices, and to agree to participate in a yearly report developed by GBCA that will inform the building industry on the true costs of sustainability.

5.11.3 Innovation Challenge – Microbial Control in Hot Water Systems

The projects hot water systems have been designed to manage the risk of microbial contamination.

5.11.4 Innovation Challenge – Provision of Community Facilities

As part of the design development the project assessed the community needs is performed and community facilities have therefore been incorporated into the building design.

6. Government Architect NSW Design Guide

The Government Architect NSW (GANSW) provides strategic design leadership in architecture, urban design and landscape architecture. In order to improve school design and incorporate the seven objectives for the design of the built environment set out in Better Placed: An integrated design policy for the built environment of NSW, the GANSW has produced the Environmental Design in Schools guide. This document considers the following objectives;

- Better Fit – A project that is contextual, local and of its place
- Better Performance – A project that is sustainable adaptable and durable
- Better for the community - A project that is inclusive connected and diverse
- Better for people - A project that is safe, comfortable and livable
- Better working - A project that is functional, efficient and fit for purpose
- Better Value - A project that creates and adds value
- Better look and feel - A project that is engaging, inviting and attractive

The guide sets out a process for assessment which includes three basic steps these are as follows with general strategies to address the goals of the design guide outlined in the following sections;

- Understand the project surroundings;
- Understand how our surroundings effect people
- Adopt strategies that will benefit people.

In order to demonstrate environmental design has been achieved in accordance with this guide the project team provide the following discussion outlining how the project has included a strong focus on passive, biophilic and environmental design.

6.1 Ventilation Strategy (Air)

Good air quality in schools can improve student and staff wellbeing and performance, the project aims to incorporate mixed mode systems and natural ventilation where viable increasing the outdoor air provided to lower CO2 buildup and pollutant levels.

Additionally, through the use of variable refrigerant flow systems the humidity within learning spaces will be passively controlled minimizing the mold growth within systems and remove this source of pollutants.

6.1.1 Natural Ventilation Opportunities

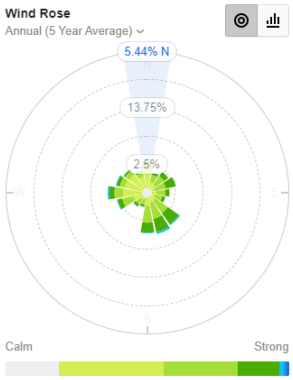
Increasing the natural ventilation of the space is a method used to passively cool and ventilate the space and minimise the use of mechanical air conditioning systems and thus an effective way to minimise energy consumption in the building. Ensuring that windows are openable and designed to capture prevailing winds into classroom spaces will help to ensure that the natural ventilation can be maximized.

By specifically providing openings on multiple sides of the buildings or at low and high levels the window design will promote the flow of air though the spaces bringing in fresh air and passive heating and cooling.

Where feasible the project will look to also provide window coverings, which can be used to block out unwanted summer sun (east-facing windows in the morning, and west-facing windows in the afternoon). In winter, these can also be closed window coverings at the end of the day to help rooms stay warmer overnight.

6.1.1.1 Site conditions

For the site location in Epping, predominant winds are from the south east however are relatively balanced from all directions. This has been considered within the ventilation strategies. Natural ventilation and therefore passive cooling opportunities have been optimised using multidirectional building elements including spacing out of the building to funneling breezes through the vegetated areas of the site and into the built spaces.



This omnidirectionallity of the wind present at the site will also assit the project to minimise wind tunnelling effects at the site.

Figure 5 Wind rose for the site

6.2 Comfort Strategy (Comfort)

Good learnings spaces need to be comfortable across the year for staff, students and visitors. To ensure that the proposed buildings achieve this the project has proposed a mixed mode ventilation strategy that can provide conditioning when required and natural, or mechanically assisted, ventilation when external conditions are favorable. Additional to this the design of the buildings has focused on good passive design elements including the following.

6.2.1 Passive Solar Design & External Shading

The project design incorporates a strong focus on the use of optimised glazing and window shading to exploit the suns relative position in the sky. This allows solar heat gains through winter while blocking most of the heat entering the building throughout the summer period.

The incorporation of the proposed indoor-outdoor spaces on within the balcony areas also provides shaded external spaces to support both reduction in heat islanding across the school and shaded areas for outdoor learning.

6.2.2 Thermal Mass

Thermal mass is the ability of a material to absorb and store heat energy for use during cooler times. The project has included the use of a concrete structure to capture energy throughout the day and release this at night minimizing the internal temperature variation across the day.

6.2.3 Glazing Selection

The types of glass used within the project windows can lead to unwanted heat gain in summer and heat loss in winter or help retain heat in winter and limit unwanted heat gain in summer. The project is aiming to use double glazing throughout with a low-e spectrally selective coating to help to maximise daylight penetration into the spaces while effectively managing heat gains and losses across the year.

To add to this passive control of heat entry, blinds should also be provided to external windows

6.2.4 Natural Shading devices

The external landscaping incorporates the use of vegetation to help reduce the temperature of prevailing breezes and provided shaded areas to support the use of external areas across the year.

6.2.5 Incorporation of Fans

Where possible the project will consider the use of ceiling fans to help control the room comfort conditions by moving air around. In summer, with the windows open, ceiling fans can help to push hot

air outside. In winter, with the windows shut, if you have high ceilings and mechanical heating, ceiling fans can help to make a room feel warmer by gently pushing warm air down from the ceiling level.

6.3 Lighting Strategy (Light)

Daylight and natural light can minimise electricity usage, however direct sunlight can also bring unwanted heat gain should be balanced across the year.

6.3.1 Daylight Access

The current design of the site aims to maximize daylight penetration into both internal and external spaces. This access to daylight throughout the building will both minimise energy used for lighting and will improve occupant connection to their external environment.

In educational environments research also indicates that students in classrooms with access to natural light perform better in all academic fields, have longer attention spans and achieve better health outcomes than those without ready access to daylight.

6.3.2 Highly efficient lighting system

The installation of LED lighting throughout the facility will assist in the minimisation of lighting energy use with a target a lighting power density of less than 5W/m2.

Improved lighting energy also reduces the heat loads within the spaces and therefore lowers the energy used to condition the classroom areas.

6.3.3 Melanopic Lux Consideration

The project lighting design will consider the impacts that lighting has on melatonin production in the brain and will look to create a lighting layout to promote good provision of light matching solar lux levels. This has been shown to improve sleep patterns and educational outcomes.

6.3.4 Motion, photoelectric (PE) and timer controls for circulation space lighting;

The project is will install motion and PE controls on lighting throughout the circulation and recreation spaces. This will ensure that lighting is not used when spaces are unoccupied. Lighting systems will also be linked to the period bells for the school and timers to ensure that lighting does not remain on after hours and is active when students are entering circulation spaces.

6.4 Acoustics Strategy (Noise)

Noise can have an impact on student performance and has been considered in the layout of the buildings to create quiet and noisy spaces for a variety of leaning styles.

Within learning spaces the acoustic environment should also be managed through the use of soft furnishings or surfaces, like wall treatments or floor rugs. These will be considered in alongside passive strategies, for example, opening windows.

6.4.1 Interior noise level control (sound masking + treatment)

Acoustic considerations have been included into the design of the building layout and systems design with interior nose levels to be maintained below the acceptable limit of 45dB (this is in line with industry accepted practice).

6.4.2 Reverberation through the building

Reverberation of noise throughout the building will be considered throughout the detailed design phases of the project with isolation measures to prevent the transition of noise through the building structure.

6.4.3 Acoustic separation

Acoustically sensitive spaces such as counseling rooms and quiet spaces will incorporate measures to separate these areas from noise transmission, this will include actions like;

- Taking walls to the underside of slabs;
- Incorporating brushes on windows and doors; and
- Inclusion of soft furnishings and acoustic panels in these areas.

6.5 Water

Taking responsibility for water usage is key to its preservation and the project will incorporate quality management of water throughout the construction and operation of the building. Details of the water efficiency measures proposed can be found in Section 2.3. Some additional elements are included below around water sensitive urban design and rainwater capture and storage.

6.5.1 Small rainwater tanks for education and minor irrigation purposes

A small rainwater capture, and storage system will be considered for installation to provide educational support around water efficiency and to provide for the sites minor irrigation needs. Space provisions have been made within the design to accommodate this system.

6.5.2 Water Sensitive Urban Design

The project in incorporating a strong focus on water sensitive urban design with the external landscape and pavement design facilitating surface water recharge, minimisation of irrigation and promotion water sensitive plant and materials selection.

A stormwater control tank and a further rainwater storage will be provided to assist in managing water flows onsite. Furthermore, permeable surfaces have been incorporated into the landscaping design to assist in managing stormwater runoff from the site.

6.6 Energy

Simple strategies like turning off lights and adjusting air-conditioning set points over the year will assist with operational energy use. Details of the energy efficiency measures being considered in the design can be found in Section 2.1. further measures are detailed below:

6.6.1 Improved building fabric and glazing performance

The building envelope comprises a number of different façade types, with the proposed scheme using a combination of glass, screens and shading devices to achieve low solar heat gains while providing views and daylighting into learning and circulation spaces.

The use of high-performance glazing and building materials will also assist to maximise the projects energy efficiency while managing acoustic and thermal comfort considerations.

6.6.2 Energy efficient domestic hot water

The use of solar thermal, gas boost or heat pump hot water systems will be explored throughout the detailed design process with an efficient solution incorporated into the final design.

6.6.3 Photovoltaic (PV) Energy Systems

The project will investigate the installation of PV array within the project, initial investigation suggests that a 99kW system should be considered as a minimum. A PV system will provide onside renewable energy and will reduce the sites electricity consumption from the grid.

Building integrated PV applied as shading devices and building elements can also be investigated as an option for expanding the size of the onside generation.

6.7 Landscape

Through planting native vegetation and promoting improved interaction with the natural environment, the project will improve the site's ecology and minimise the ongoing environmental impact of the project. The project is currently implementing the following:

- Extensive native vegetation endemic to the local area;
- Minimisation of light spill from the facility which impacts on migratory animals and insects;
- Reduced dissolved pollutants in stormwater discharged from the site; and
- Adaption of a brownfield site.

Additionally, landscaping plays an important part in the education of students around local biodiversity and natural systems.

6.8 Materials

The construction and upgrading of buildings consume a large amount of resources, and measures have been taken within the design to maximize the expected lifespan of the installed fixtures and finishes. This will assist in project longevity and help to mimise waste going to landfill.

Additional to this the building has been designed to be highly adaptable with spaces easily altered and structural elements kept to the external elements of the building. This will enable the building to be easily altered to meet changing needs over time and minimise the potential need to demolish and rebuild in the future.

6.9 Education

Given the educational focus of the project, the following initiatives will help to promote an understanding of sustainability and building operation within the school population.

6.9.1 Energy, water, waste and indoor environment monitoring

The project is investigating the inclusion of in class displays with monitoring results from energy, water, waste and indoor environmental measurements will assist in understanding the operational performance of the facility. It will also promote the connection between utility services and outputs e.g. when the air conditioner is on the energy consumption increases.

6.9.2 Integrated Garden Landscaping

The inclusion of engaging gardens promote an understanding of food production and heathy eating decisions. This understanding will help to reinforce other initiatives throughout the school curriculum. This space will also help to build school identity and create a welcoming space for students to study and relax.

6.9.3 Educational tools

The project is investigating the installation of new energy technologies to illustrate the connection between energy production and use, equipment such as green gym facilities (which produce energy), solar panels and piezo electric tiles in common areas will help educate students about energy production.

6.9.4 The provision of WiFi Connectivity across the site

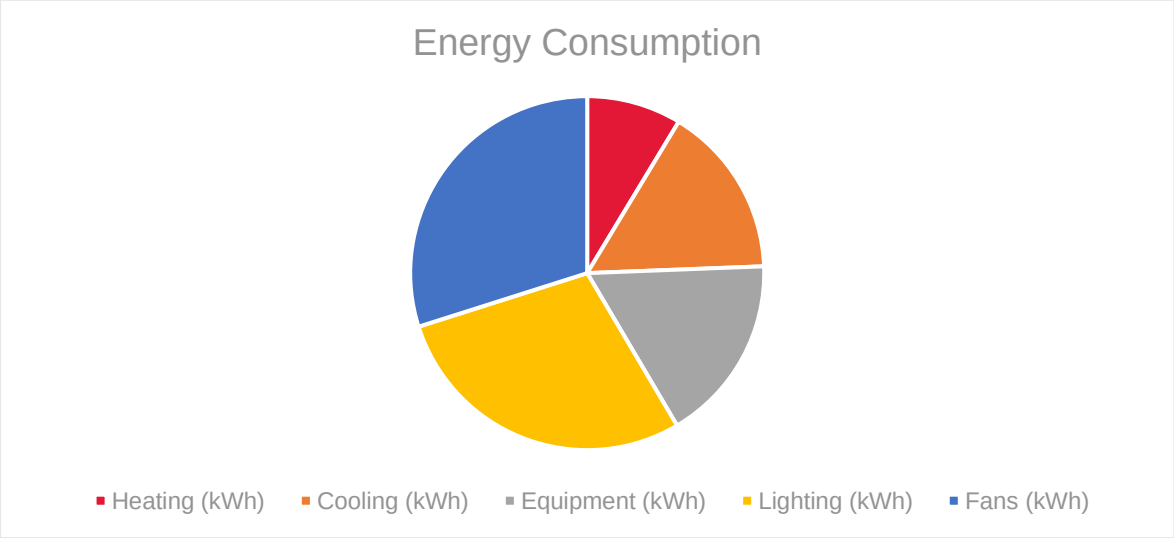
High speed WiFi will be installed throughout the entire site to provide support for next generation educational tools including tablets and laptop learning.

7. Demand Forecast

High level simulation has been completed to assess the likely breakdown of energy and water consumption across the site with key energy and water consumption broken down between end uses as per the following section.

7.1 Energy

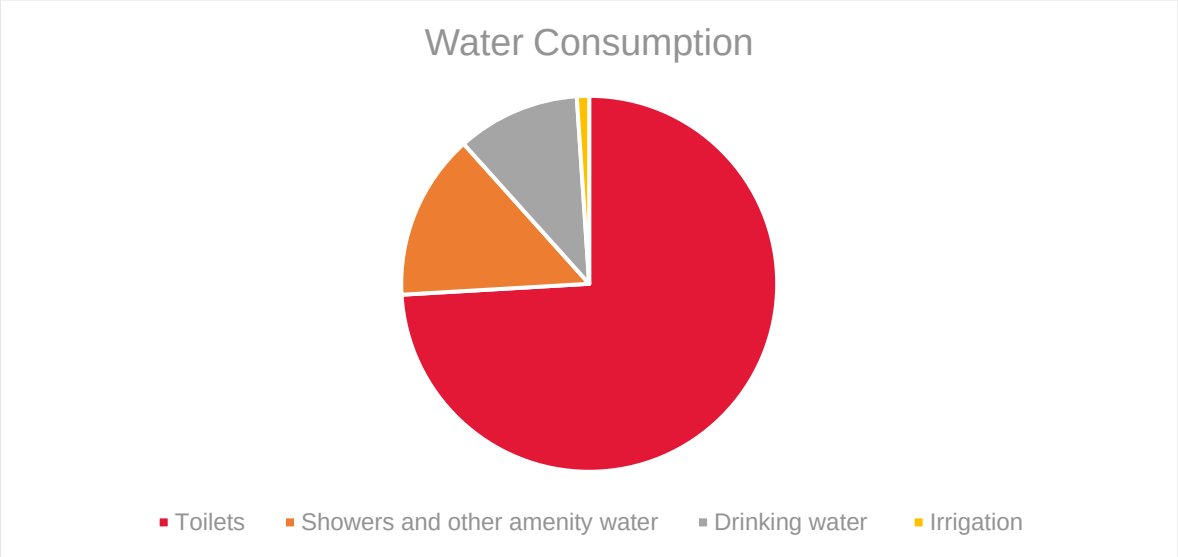
Based on the National Construction code modelling guidelines, energy simulation shows that the school is likely to have an energy breakdown by end use as per the below.



The solar power system will reduce the overall energy use for the site offsetting energy use overall, furthermore the efficient use of heating and cooling systems will reduce overall consumption of these end uses.

7.2 Water

Water use across the school will be predominantly focused on ablution facilities with irrigation and drinking water consuming the remainder of the sites water consumption. High level simulations show the following breakdown;



8. Climate Adaption

As identified in the previous section the design team will go through a full climate adaption planning process which will look at longer term risks and adaption opportunities on a recurring basis over the building lifetime. This assessment of the site initial design has included a risk assessment and the following provides an overview of how the design of the development is responsive to the CSIRO projected impacts of climate change.

8.1 Climate Region

The site lies within Climate Zone 6 as identified by the Building Code of Australia (BCA), Australian Building Codes Board (ABCB) as seen in Figure 4 below. Climate Zone 6 relates to mild temperate conditions, characterised by mid to cool winters with low humidity and hot to very hot summers with moderate humidity. Four distinct seasons are present, where summer and winter have the potential to exceed human comfort range and spring and autumn are ideal for human comfort.

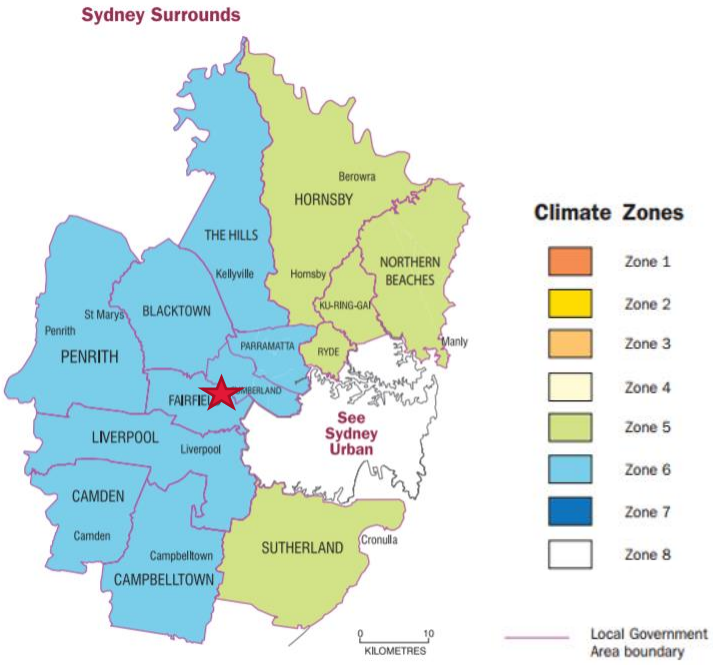


Figure 6 ABCB Climate Zone Map

8.2 Current Climate Hazards

The project initially assessed the current climate hazards relevant to the site, based on the site conditions and building characteristics for the proposed development. The exposure and vulnerability to floods, hail, bushfire and extreme winds (or cyclones) were identified with the assistance of the Insurance Council of Australia's Building Resilience tool. Exposure relates to the building location relevant to the site characteristics. The outcome of the assessment can be seen in table 3.

Table 7 Identified Climate Hazards

Climate Hazards	Exposure	Vulnerability Risk	Comments
Extreme Heat	Medium	Medium	Development is located in Climate Zone 6 – mild temperate conditions. Subject to hot summers.
Floods	Low	Low	The site is classified as being partly within Low Flood Risk Precinct and partly not affected by flood.
Bushfire	No exposure	Low	Site is not located on bush fire prone land as identified by the NSW Rural Fire Service (RFS)
Severe Thunderstorms/ Hail	Medium - high	Medium	More than 19 severe storms occur here annually, a 5% probability. During the 100yr storm event over 275mm of rainfall is predicted to fall in 24hrs.
Extreme Winds	Low	Medium	The site is in a built-up urban area with medium to high density surrounds
Cyclones	Low	Low	The site is not located in a cyclone prone region

8.3 Climate Change Effects

The following list provides a summary of the primary climate effects and the risks associated due to secondary climate effects applicable to the development. The climate change projection data relevant to the climate and site conditions of the project identified within the CSIRO projected impacts of climate change were utilised to establish the below scenarios for the development and how they have been addressed within the design of the project.

8.3.1 Changing Surface Temperature

- An increase in the average surface temperature could lead to reduced thermal comfort for the building occupants over time – reflective and vegetated surfaces have been included throughout the site to minimise urban heat island effects; the building has been designed to capture multidirectional breezes and promote movement of air across the site; mixed mode ventilation and conditioning strategy allows the building to ramp up space conditioning to accommodate the thermal comfort needs of occupants when required.
- An increase in extreme heat could lead to an increase in energy and water demand and associated utility and maintenance costs – the incorporation of native low water use vegetation and not water based heat rejection systems will minimise water demand for key systems; the use

of a flexible mixed mode system supported by onsite solar power generation will work to balance increased energy costs for space conditioning.

- An increase in extreme heat could place additional stress on building services including air conditioning equipment – an increased average outside design temperature will be used to size the air conditioning systems to ensure that they are sufficiently sized for the potential increases in temperature; adaptability of theses systems will also be considered with the potential to add additional cooling capacity if required in the future.

8.3.2 Changing Precipitation

- An increase in rainfall intensity could increase local flood events limiting access to the building for vehicles, building occupants and pedestrians – the onsite stormwater management systems will be designed for the forecast increases in rainfall intensity; the landscape design incorporates significant vegetation to assist in the management of stormwater runoff and the project will improve the permeability of the site.

- Increased severe thunderstorms and intensity could result in blockages in roof drainage systems from build-up of hail and debris, causing stormwater to overflow and damage the building asset, goods and equipment owned by the school – the projects hydraulic design will consider this risk and increase the capacity of roof drainage to accommodate.

- Power outages during major storm events could lead to a potential disturbance to building systems including security, lighting etc, posing a safety issue to occupants on site – the flexible mixed mode ventilation systems and project focus on good daylight penetration will enable the building to continue operation across most of the year in the occasion of power outages; emergency lighting and safety systems will have redundancy to minimise safety risks posed to building occupants.

8.3.3 Changing Wind Speed

- An increase to wind speed intensity could lead to damaged building assets including windows and roof elements – this is considered within the structural and landscaping design of the site.

- Increased wind speed intensity could result in damaged vegetation, creating a disturbance to the local ecosystems and increased maintenance costs for the property – this risk is considered within the landscaping design with the use of endemic native species well suited to the site and these future risks

- An increase in wind speed intensity could potentially damage power lines, resulting in a power outage for the building - the flexible mixed mode ventilation systems and project focus on good daylight penetration will enable the building to continue operation across most of the year in the occasion of power outages

8.3.4 Changing Humidity

- Decrease in humidity could relate to higher risks of fires – the inclusion of a rainwater supplied drip irrigation system for landscaping and the general location of the site should minimise this risk.

- Decrease in humidity could lead to changes in the micro-climate, impacting the local ecology (flora and fauna) of the site – the use of endemic native vegetation will act as a buffer to this impact as will the provision of the rainwater supplied irrigation systems.

8.4 Statement on Design

The project design has included specific measures detailed within section 2-4 of this report to respond to the CSIRO and Insurance Council's projected impacts of climate change. These measures include

simple alteration such as building orientation and site layout to promote airflow through the building and site, colour selection and the use of vegetation, through to more complex solution such as the proposed HVAC controls and mixed mode ventilation strategy. Overall, these measures alongside the adaptability of the building and its systems shows a strong consideration within the design of potential future climate change adaptation needs.

9. Conclusion

Through the initiatives outlined in this report the project demonstrates how Epping West Public School Alterations and Additions project meets both the objectives outlined by the Department of Education and those required by the SEARs. These are as follows

- Compliance against the Educational Facilities Standards and Guidelines (EFSG) by the Department of Education (DoE).
- Compliance with the requirements of Section J of the National Construction Code.
- Demonstration of how ESD principles will be incorporated into the design and ongoing operation of the development.
- Detail proposed measures to minimise consumption of resources, water (including water sensitive urban design) and energy.
- Detail how the future development would be designed to consider and reflect national best practice sustainable building principles and improve environmental performance and reduce ecological impact; and
- Detail how environmental design will be achieved in accordance with the GANSW Environmental Design in Schools Manual (GANSW 2018).

The EFSG and Green Star requirements provide a project specific design guide benchmarked to Australian Best Practice ESD, and work to ensure that the project is designed to address future climate related events. Therefore, the use of these standards demonstrates the achievement of the SEARs and SINSW objectives. Further sustainability outcomes have also been drawn from the general sustainability sections of this report and demonstrate SINSW strong focus on delivering social, environmental, and economic sustainability from this project.

Green Star - Design & As Built Scorecard

Project:	Epping West Public School	**Round:**	1
Targeted Rating:	4 Star - Best Practice		

Core Points Available	Total Score Targeted
100	53

NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA		POINTS AVAILABLE	POINTS TARGETED	Required by the EFSG
	Management					14		
	Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.1	Accredited Professional		1	1	Yes
	Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets		-	Complies	Yes
			2.1	Services and Maintainability Review		1	1	
			2.2	Building Commissioning		1		Yes, excluding air tightness testing
			2.3	Building Systems Tuning		1	1	Yes
			2.4	Independent Commissioning Agent		1		
	Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan		2	2	Yes
	Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Information		1	1	Yes
	Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental	5.1	Environmental Building Performance		1	1	Yes
			5.2	End of Life Waste Performance	A. Contractual Agreements	1	1	Yes
	Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering		-	Complies	
			6.1	Monitoring Systems		1	1	
	Responsible Construction Practices	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan		-	Complies	Yes
			7.1	Environmental Management System		1	1	Yes
			7.2	High Quality Staff Support		1		
			8A	Performance Pathway: Specialist Plan		0		

	Operational Waste	B. Prescriptive Pathway	8B	Prescriptive Pathway: Facilities		1	1	Yes
	Total					**14**	**11**	

	Indoor Environment Quality					**17**		
☐	**Indoor Air Quality**	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes		1		
☐			9.2	Provision of Outdoor Air	☐ A. Comparison to ☐ B. Performance I ☐ C. Natural Ventila	2		
☐			9.3	Exhaust or Elimination of Pollutan	☐ A. Removing the ☐ B. Exhausting the	1	1	Yes
☐	**Acoustic Comfort**	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels		1	1	Yes
☐			10.2	Reverberation		1	1	Yes
☐			10.3	Acoustic Separation	A. Sound Reduction	1	1	Yes
	Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort		-	Complies	Yes
☐			11.1 General Illuminance and Glare Reduction	11.1.1 General Illuminance	☐ A. Non Residenti ☐ B. Residential Sp	1	1	Yes
				11.1.2 Glare Reduction	☐ A. Prescriptive M ☐ B. Prescriptive M ☐ C. Performance I			
☐			11.2	Surface Illuminance	☐ A. Prescriptive M ☐ B. Performance I ☐ C. Residential Sp	1		
☐			11.3	Localised Lighting Control		1		
	Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	☑ A. Fixed Shading ☐ B. Blinds or Scre ☐ C. Daylight Glare	-	Complies	Yes
☐			12.1	Daylight	☐ A. Prescriptive M ☐ B. Compliance U ☐ C. Compliance U	2	1	Yes
			12.2	Views		1	1	
☐	**Indoor Pollutants**	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1 Paints, Adhesives, Sealants and Carpets	13.1.1 Paints, Adhesives and Sea	☐ A. Product Certifi ☐ B. Laboratory Te ☐ C. No Paints, Ad	1	1	Yes
☐				13.1.2 Carpets	☐ A. Product Certifi ☐ B. Laboratory Te ☐ C. No Carpets			
☐			13.2	Engineered Wood Products	☑ A. Product Certifi ☐ B. Laboratory Te	1	1	Yes
☐	**Thermal Comfort**	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	☐ A. Naturally Vent ☐ B. Mechanically V ☐ C. Residential Sp	1	1	Yes
☐			14.2	Advanced Thermal Comfort	☐ A. Naturally Vent ☐ B. Mechanically V ☐ C. Residential Sp	1		
	Total					**17**	**10**	

	Energy					**22**		
	Greenhouse Gas Emissions	E. Reference Building Pathway	15E.0	Conditional Requirement: Reference Building Pathway	☐	-	Complies	Yes
			15E.1	GHG Emissions Reduction: Building Fabric		4	1	
			15E.2	GHG Emissions Reduction		16	5	Yes
			15E.3	Off-Site Renewables		8		
			15E.4	District Services		7		
			15E.5 Additional Prescriptive Measures	15E.5.1 Transition Plan		1		
				15E.5.2 Fuel Switching		2		
				15E.5.3 On-Site Storage		1		
	Peak Electricity Demand Reduction	B. Performance Pathway	16A	Prescriptive Pathway: On-Site Energy Generation		0		
			16B	Modelled Performance Pathway: Reference Building		2	2	
	Total					**22**	**8**	

	Transport					**10**		
	Sustainable Transport	B. Prescriptive Pathway	17A	Performance Pathway		0		
			17B.1	Access by Public Transport		3	1	Yes
			17B.2	Reduced Car Parking Provision		1		
☐			17B.3	Low Emission Vehicle Infrastructu	A. Parking for Fuel-Efficient Vehicles	1		
☐			17B.4	Active Transport Facilities		1		
			17B.5	Walkable Neighbourhoods	A. Proximity to Amenities	1	1	
	Total					**7**	**2**	

	Water					**12**		

Potable Water	A. Performance Pathway	18A	Potable Water - Performance Pathway		12	4	Yes
		18B.1	Sanitary Fixture Efficiency		0		
		18B.2	Rainwater Reuse		0		
		18B.3	Heat Rejection		0		
		18B.4	Landscape Irrigation		0		
		18B.5	Fire Protection System Test Water		0		
Total					12	4	

Materials					14		
Life Cycle Impacts	B. Prescriptive Pathway - Life Cycle Impacts	19A.1	Comparative Life Cycle Assessment		0		
		19A.2	Additional Reporting	☐ A. Additional Life ☐ B. Material Selec ☐ C. Construction ☐ D. LCA Design R	0		
		19B.1 Concrete	19B.1.1 Portland Cement Reduction		2		
			19B.1.2 Water Reduction		0.5	0.5	
			19B.1.3 Aggregates Reduction	A. Course Aggregate Reduction	0.5		
		19B.2 Steel	B. Reduced Use of Steel Reinforcement		1	1	
		19B.3	Building Reuse	19B.3.1 Façade Reuse	2		
				19B.3.2 Structure Reuse	2		
		19B.4	Structural Timber	19B.4.0 Responsible Sourcing	-		
				19B.4.1 Reduced Embodied Impacts	3		
Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Structural and Reinforcing Steel	20.1.0 Responsible Steel Maker	-	Complies	
				A. Responsible Steel Fabricator	1	1	
		20.2	Timber	☑ A. Certified Timb ☐ B. Reused Timbe	1	1	Yes
		20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	A. Products That Do Not Contain PVC	1	1	Yes
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustai	☐ A. Reused Produ ☐ B. Recycled Con ☐ C. Environmenta ☐ D. Third Party Ce ☐ E. Stewardship P	3		
Construction and Demolition Waste	B. Percentage Benchmark	22.0	Reporting Accuracy	A. Compliance Verification Summary	-	Complies	
		22A	Fixed Benchmark		0		
		22B	Percentage Benchmark		1	1	
Total					12	5.5	

Land Use & Ecology					6		
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vuln	A. EPBC	-	Complies	
		23.1	Ecological Value		3		
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement		-	Complies	Yes
		24.1	Reuse of Land	A. Previously Developed Land	1	1	
		24.2	Contamination and Hazardous Ma	☐ A. Site Contamin ☐ B. Hazardous Ma	1		
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.1	Heat Island Effect Reduction		1	1	
Total					6	2	

Emissions					5		
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Stormwater Peak Discharge		1	1	Yes
		26.2	Stormwater Pollution Targets		1	1	Yes
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies		-	Complies	Yes
		27.1	Light Pollution to Night Sky	A. Control of Upward Light Output Ratio (ULOR)	1	1	
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28	Legionella Impacts from Cooling S	B. Waterless Heat Rejection Systems	1	1	Yes
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.1	Refrigerants Impacts	A. Calculating TSDEI	1		
Total					5	4	

Innovation				10		
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world.	30A	Innovative Technology or Process		1	Yes
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	30B	Market Transformation		1	Yes
Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks	10	1	
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge		2	
Global Sustainability	Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star rating tools.	30E	Global Sustainability		1	Yes
Total				**10**	**6**	

TOTALS	AVAILABLE	TARGETED
CORE POINTS	100	46.5
CATEGORY PERCENTAGE SCORE		46.5
INNOVATION POINTS	10	6.0
TOTAL SCORE TARGETED		52.5