NORTHROP

SUSTAINABILITY REPORT

Moriah College

Queens Park Rd, Queens Park NSW 2022,

Ref: SY191961-
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PREPARED FOR
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Sustainability Report

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
27.08.2019	1	Preliminary	I. Van Eerden	
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EXECUTIVE SUMMARY

This Sustainability Report outlines how the proposed redevelopment of the MCMSC Moriah College meets the Secretary's Environmental Assessment Requirements (SEARs) as a state significant development.

The project is targeting the following sustainability objectives:

- The incorporation of ESD principles into the design and ongoing operational phases of the development;
- The inclusion of considered materiality and waste reduction measures, futureproofing and use of low carbon materials, energy and water efficiency, and technology such as renewable energy, to demonstrate alignment to industry best practice frameworks.
- The inclusion of climate change adaption and mitigation measures within the building design.
- Alignment to the best practice ESD standards outlined within the Government Architect of New South Wales (GANSW) Environmental Design in Schools Manual;

Specifically, the report details how the project incorporates the following;

- A strong commitment to energy efficiency with the project design to demonstrate a 40% energy reduction over a standard construction building of its type;
- A highly efficient façade system designed to minimise heat gain into the building while promoting the entry of daylight into classroom spaces;
- Low impact materials selections with the project maximising the reuse of onsite materials and the use of certified materials where applicable;
- The use of highly efficient water fixtures and fittings, alongside a waterless heat rejection system;
- Integration of educational signage, wayfinding and monitoring systems across the site; and
- An optimised air conditioning system to provide good provision of outside air while maintaining thermal comfort in the classroom areas.

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 project SEARs.

1. Introduction

This Sustainability Report accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD-10352) for new school buildings on the existing campus of Moriah College, Queens Park (the site). The site is legally described as 101 York Road, Queens Park/ Lot 22 DP 879582, 1 Queens Park Road, Queens Park/ Lot 1 DP 701512 and 3 Queens Park Road, Queens Park/ Lot 3 DP 701512.

The proposal seeks consent for:

- Staged demolition of existing buildings A, B, C, D, J, E and removal of demountable buildings S, D, Z.
- Staged construction of new school buildings.
- **Stage 1** - Construction of a part 3 and part 4 storey STEAM building containing:
    - science, technology, engineering, art and maths rooms
    - technology and applied science rooms
    - administration offices
    - canteen and cafe
    - independent learning centre (library)
    - meeting rooms and auditorium
    - enhanced pedestrian entry at Gate 3A off Baronga Ave
    - basement parking for staff, waste management and storage rooms
    - modified vehicular circulation internal to the site
    - Redesign of the York Road Gate 4 parking area to create improved circulation and on site staff parking
- **Stage 2** - Construction of a 3 storey Early Learning Centre (ELC) building and administration offices.
- Student population increase from 1680 students on the site to 1970 students across ELC, primary and high school.
- Modification to internal traffic and parking on the site.
- Active and passive landscape upgrades to the site.
- Removal of trees.

1.1 Site Description

Moriah College is bounded by Queens Park Road to the north, Baronga Avenue to the east and York Road to the west and south. The overall Precinct is described as Lot 1 and Lot 3 on DP 705512, and contains a Combined Primary-Secondary School. The Precinct has a total area of approximately 26,206m2. Refer Figure 1 which identifies the three street addresses for the Moriah College precinct.

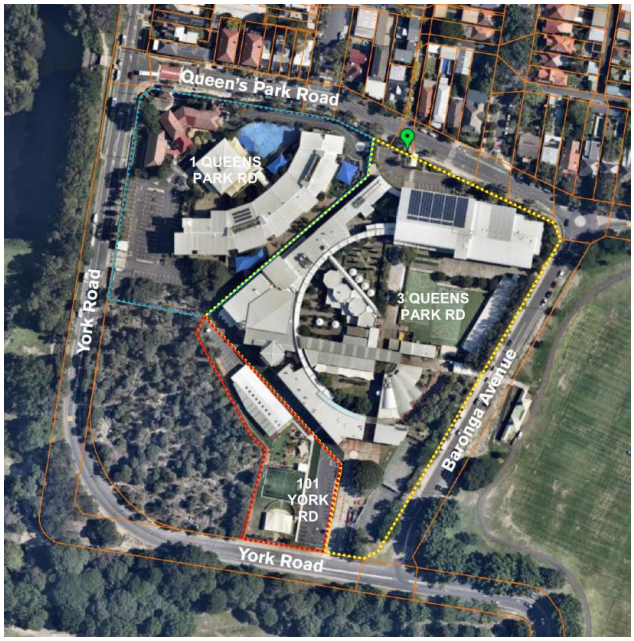


Figure 1 Moriah College Site

1.2 Response to Secretaries Environmental Assessment Requirements (SEARs)

Item 8 of the SEARs lists six 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 incorporation of the GANSW sustainability design recommendations and through a gap analysis against holistic industry sustainability.	Section 2 & 4
Include a framework for how the future development will 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 the GANSW Environmental Design in Schools Manual and against the Green Building Council's holistic sustainability rating system.	Section 4

Include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance.	By targeting the Adaptation and Resilience initiatives outlined within section 5.2.2 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 5.2.2
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 benchmarked against the Government Architects Design Guide and a gap analysis completed to determine additional element that would be required to demonstrate an Australian Best Practice Green Star rating.	Section 5
Provide a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change.	The project design includes consideration of future climate alterations into its design. This is seen through the incorporation of good shading and passive design. A statement will be provided by the architect and confirmed following the development of a project specific Climate Adaptation Plan.	Throughout

2. Sustainability Initiatives

The following section describes how ESD principals (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 operation 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 attempts to incorporate 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, improvement 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 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 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 will be considered throughout the design development process with the following improvements already considered as part of the design process;

2.1.1 Natural Ventilation of Circulation Spaces

The project incorporates new rooftop spaces. These areas will be able to operate as naturally ventilated spaces exploiting their elevated location. Central circulation spaces such as bathrooms and stairs will also look to incorporate natural and passive ventilation opportunities.

2.1.2 Improved building fabric and glazing performance

The building envelope comprises a number of 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 use of well-designed glazing and building materials will assist the projects targets for energy efficiency, acoustic separation and thermal comfort.

2.1.3 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.

2.1.4 Energy Metering and Monitoring

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

2.1.5 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 comfort for the building occupants.

In order 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.

2.1.6 Highly efficient lighting system

The installation of LED lighting in new areas 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.

2.1.7 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 north west facades of the buildings;
- Use of well-designed western glazed areas to exploit overshadowing of adjacent buildings for peak occupancy periods;
- Strong use of thermal mass to regulate temperatures;
- Use of breezeways to promote the flow of prevailing winds through the site;
- Integration of landscaping into the podium designs to minimise heat islanding and promote passive cooling through transpiration; and
- 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 considerations have been considered as part of the building design:

2.2.1 Daylight Access

The design of the building addition aims to allow good 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.

Atrium and light well glazing has also been provided to promote daylight access to the lower levels and internal areas.

2.2.2 Interior noise level control

Internal noise levels will be 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.

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 should be targeted:

- Wash hand basin taps 6 star WELS
- General taps 6 star WELS
- Toilets dual flush 4 star WELS
- 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 endeavor to incorporate native and low maintenance vegetation where possible which will significantly reduce the potable water consumption of the site.

2.3.3 Water Sensitive Urban Design

In line with the aim of the SEARs, the project in incorporating a strong focus on water sensitive urban design with the external landscape design assisting to minimise water use for irrigation. The inclusion landscaping and gravel water capture areas on roofs will also assist in the reduction of site stormwater discharge and assist in the management of the projects broader impact on urban stormwater flows.

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:

- 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 reuse 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 close proximity to Bondi Junction for trains and busses, the project is providing only minimal additional parking as part of the development in order to promote the use of public transport.

2.5.1 Walkability

Walk Score is a number between 0 and 100 that measures the walkability of any address. It is indicative of the number and type of existing amenities located nearby to Moriah College. The project achieves a walk score of 74, a 'Very Walkable" location, in accordance with the website www.walkscore.com using their street smart method of calculation. For the purposes of this calculation at this stage, the address of the site has been taken as Queens Park Rd, Queens Park.

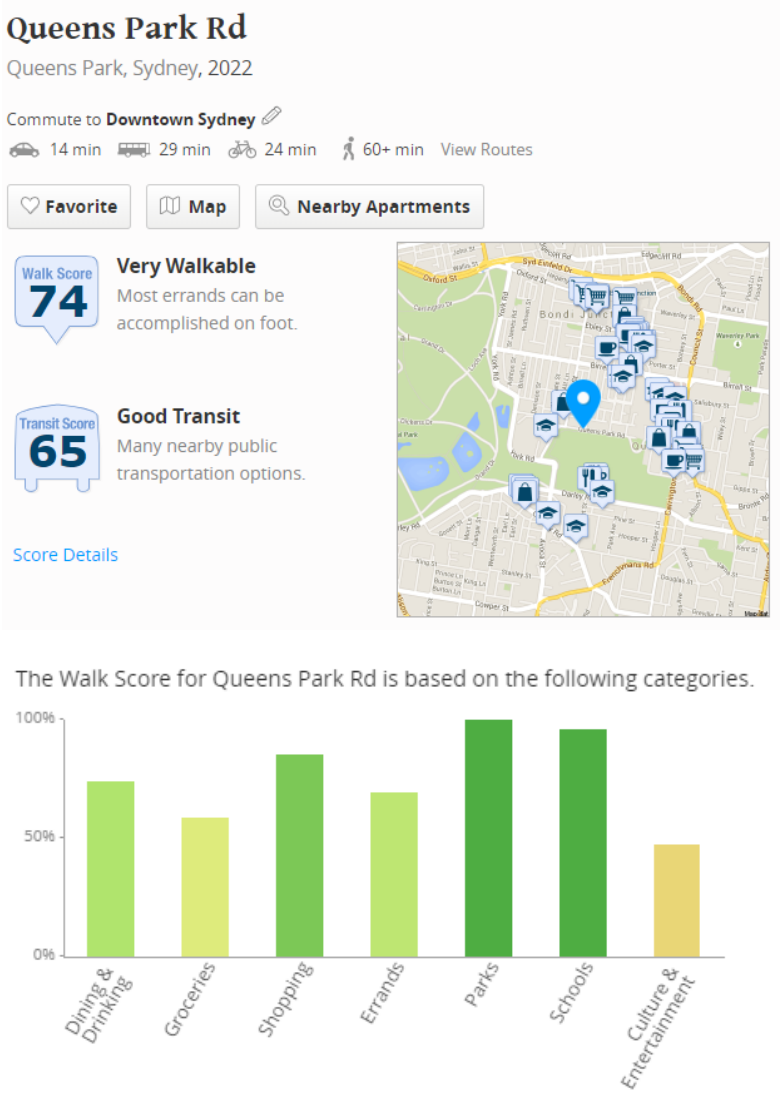


Figure 3. Street Smart Walk Score Results

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 Separated Waste and Recycling Streams

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. Some additional waste management measures are detailed below;

2.6.2 Construction and Demolition Waste Minimisation

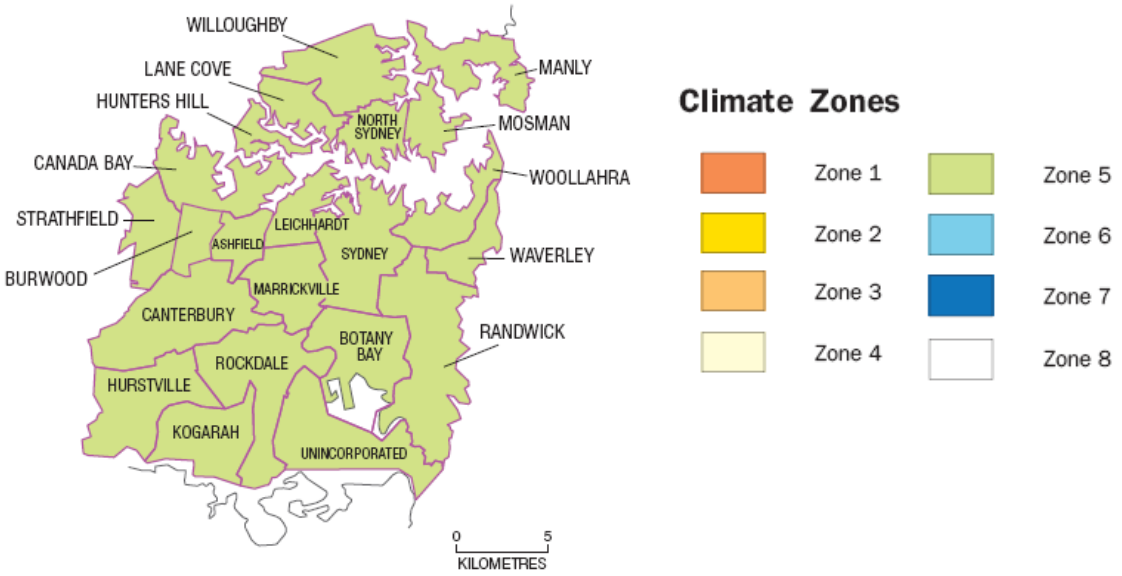
The project will also look to limit the amount of construction and demolition waste sent to landfill with the aim of at least 90% of all waste produced by the project to be sent to recycling facilities or resued.

3. National Construction Code (NCC) SECTION J

3.1.1 Overview

Moriah College Stages 1 and 2 is primarily made up of Class 9b spaces and is in Climate Zone 5.

Figure 2: Map of the BCA Climate Zones for Sydney Urban



There are two methods of achieving Section J compliance. The building can be assessed against the Deemed-to-Satisfy (DTS) provisions of the code; or JV3 performance-based solution.

Broadly the project is aiming to achieve compliance with the code through the incorporation of a high-performance window-wall façade incorporating double glazing and thermally broken frames. Broadly the following performance of systems will be perused.

Table 1: Insulation System requirements for the main building elements

Building Fabrics	Required total R-value	Equivalent insulation / glazing example
Roof and Ceiling	3.7	R3.2 Insulation – 155mm Pink Batts
External Walls	1.5	R1.2 – 70mm Pink Batts
Insulated Partition Walls	1.5	R1.2 – 70mm Pink Batts
Floors	2.0	R1.7 – 40mm PIR Board

4. 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.

4.1 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.

4.1.1 Natural Ventilation Opportunities

Increasing the natural ventilation of the space is a method used to passively cool and ventilate the space and minimize 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.

4.1.1.1 Site conditions

For the site location in Queens Park, predominant winds are from the east. This can be utilised as a guiding factor when considering ventilation strategies. Natural ventilation and therefore passive cooling opportunities will be maximized by implementing a development wide consideration of wind direction and speeds in preparation of natural ventilation strategies and techniques.

This prevailing wind condition was a factor in the indicated orientation of the buidling with the buildings aiming to capture this prevailing wind while not creating wind tunnels within the site. This has also been detailed within the Wind Report provided with the submissions.

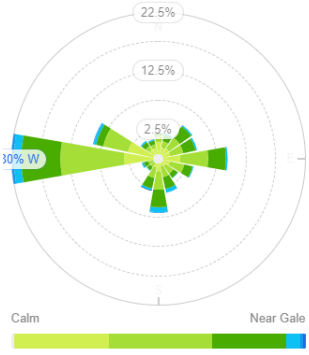


Figure 4 Wind rose for the site

4.2 Comfort Strategy (Comfort)

Good learnings spaces need to be comfortable across the year for staff, students and visitors. In order 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;

4.2.1 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 the majority of heat entering the building throughout the summer period.

The incorporation of the proposed colonnade between the buildings also provides shaded external spaces to support both reduction in heat islanding across the school and shaded areas for outdoor learning.

4.2.2 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.

4.2.3 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 high performance 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

4.2.4 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.

4.2.5 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.

4.3 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.

4.3.1 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.

4.3.2 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.

4.3.3 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.

4.4 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.

4.4.1 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).

4.4.2 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.

4.4.3 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;
- Incorporate ding brushes on windows and doors; and
- Inclusion of soft furnishings and acoustic panels in these areas.

4.5 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.

4.5.1 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.

4.5.2 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.

4.6 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;

4.6.1 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.

4.6.2 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.

4.7 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.

4.8 Materials

The construction and upgrading of buildings consumes a large amount of resources, and measures should be 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.

4.9 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.

4.9.1 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.

4.9.2 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), and piezo electric tiles in common areas will help educate students about energy production.

4.9.3 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.

4.9.4 Interactive Facades

The project will also investigate opportunities to incorporate the use of visually engaging interactive façade across the site. These will provide a tool to educate the public and students about the performance of the buildings, events and provide a highly visual element to the building form.

5. Green Building Council of Australia 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 Government Architects to benchmark the project to Industry Best Practice Sustainability there are a number of 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 more holistically address some elements of Ecologically Sustainable Design Principles.

If assessed against Green Star the project with the initiatives outlined in the preceding sections would likely achieve a rating of 4 Stars or Australian Best Practice Sustainability.

This section provides a brief summary of the additional elements drawn from the Green Star tool that will be investigated for the Moriah College project.

5.2 Management

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;

5.2.1 Commissioning and Tuning

5.2.1.1 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

5.2.2 Adaption and Resilience

5.2.2.1 Implementation of a Climate Action Plan

The project will consider the impacts of climate change through identifying and addressing all high and extreme risks posed over the expected lifecycle of the new buildings at Moriah College. 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

5.3 Sustainable Transport

Sustainable transport criteria aim 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.

5.3.1 Access by Public Transport

The site is well connected to public transport and will look to support these connections to the site and provide strong support for students and staff to mode switch utilize more sustainable transport options.

5.3.2 Reduced Car Parking Provision

The project is incorporating a small number of car parking spaces when compared to a standard practice building. Minimal car parking required by council should be provided.

5.3.3 Bicycle Parking Provision

The project is looking to incorporate bike parking and end of trip facilities to support the staff who use the proposed buildings.

5.4 Water

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

5.4.1 Heat Rejection Water

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

5.4.2 Landscape Irrigation

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

5.5 Materials

The aim of the materials category 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

5.5.1 Responsible Materials

5.5.1.1 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.

5.5.2 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.

5.6 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.

5.6.1 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'.

5.6.2 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;
- 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.

5.7 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.

5.7.1 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.

5.7.2 Reduced Pollution Targets

Additionally the project aims to demonstrate that all stormwater discharged from the site meets the pollution reduction targets in Table 3 below.

Table 3 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%

5.7.3 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.

5.7.4 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.

5.7.5 Microbial Control

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

5.8 Innovation

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

5.8.1 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 project is contributing to a broader market transformation that repositions student health and well-being as a key indicator of sustainability.

5.8.2 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.

5.8.3 Innovation Challenge – Microbial Control in Hot Water Systems

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

6. Conclusion

Through implementing initiatives from this report how the proposed redevelopment of Moriah College meets the Secretary's Environmental Assessment Requirements (SEARs) as a state significant development.

The project is clearly achieving the following sustainability objectives:

- The incorporation of ESD principles into the design and ongoing operational phases of the development;
- The inclusion of considered materiality and waste reduction measures, futureproofing and use of low carbon materials, energy and water efficiency, and technology such as renewable energy, to demonstrate alignment to industry best practice frameworks.
- The inclusion of climate change adaption and mitigation measures within the building design.
- Alignment to the best practice ESD standards outlined within the Government Architect of New South Wales (GANSW) Environmental Design in Schools Manual;

Through actions including the following;

- A strong commitment to energy efficiency with the project design to demonstrate a 40% energy reduction over a standard construction building of its type;
- A highly efficient façade system designed to minimise heat gain into the building while promoting the entry of daylight into classroom spaces;
- Low impact materials selections with the project maximising the reuse of onsite materials and the use of certified materials where applicable;
- The use of highly efficient water fixtures and fittings, alongside a waterless heat rejection system;
- Integration of educational signage, wayfinding and monitoring systems across the site; and
- An optimised air conditioning system to provide good provision of outside air while maintaining thermal comfort in the classroom areas.

Through the inclusion of the measures outlined within this report the project clearly addresses sustainability within the design and adequately equips the project for its long-term operation addressing the project SEARs.