SJA Construction Pty Ltd

BUDAWANG SCHOOL

17 Croobyar Road, Milton NSW 2538

Ecologically Sustainable Development Assessment

Report No: S-R2021022200

16th April 2021

REVISION STATUS

Report No	S-R2021022200	Revision	[04]	Date	16/04/2021

Revision	Description of Revision	Date	Checked	Approved
00	ESD Assessment Schematic Design	26/02/2021	ES	AA
01	ESD report – Schematic Design (Internal Issue)	29/03/2021	ES	AA
02	ESD report – Schematic Design (Client comments and minor edits)	29/03/2021	ES	AA
03	ESD Report – Schematic Design (Minor edits from Client)	06/04/2021	ES	AA
04	ESD Repot – CSIRO Statement Updated	16/04/2021	ES	AA

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1 INTRODUCTION

This report supports a State Significant Development (SSD) application submitted to the Department of Planning and Environment (DP&E) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

This report has been prepared to outline key Ecologically Sustainable Design (ESD) requirements and drivers and the proposed project specific Sustainability Framework which defines the principles that will be incorporated into the future design, construction and operation of the site and to specifically respond to the Secretary's Environmental Assessments Requirements (SEARs) for SSD 8845345 issued on 10th December 2020 which states in Section 7 that the Environmental Impact Statement (EIS) shall:

- Detail how ESD principles (as defined in clause 7(4) Schedule 2 of the EP&A Regulation 2000) will be incorporated in the design, construction and ongoing operation of the development.
- Include a framework for how the proposed development will reflect leading national and international best practice sustainable building principles to improve environmental performance, including energy and water efficient design and technology and use of renewable energy
- How environmental design will be achieved in accordance with the GANSW Environmental Design in Schools manual

1.1 DOCUMENTS REFERENCEED

This report is based on following documentation from the project team.

- Group GSA – architectural drawings

1.2 SCOPE AND LIMITATIONS

This report: has been prepared by Thermal Environmental and INTELLE Building Services (INTELLE) for SJA Construction Services (Project Managers) on behalf of School Infrastructure NSW and may only be used and relied on by the Budawang School for the purpose agreed between Thermal Environmental / INTELLE and the SJA Construction Services / School Infrastructure NSW as set out in this report.

Thermal Environmental / INTELLE otherwise disclaims responsibility to any person other than Budawang School arising in connection with this report. Thermal Environmental and INTELLE also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by Thermal Environmental and INTELLE in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Thermal Environmental and INTELLE has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

2 DEVELOPMENT AND SITE DESCRIPTION

2.1 PROJECT DESCRIPTION

The existing Budawang School is currently located on Camden Street in Ulladulla. This project relocates the existing school to occupy a part of the 7.6Ha site of the former Shoalhaven Anglican School at 17 Croobyar Road in Milton NSW 2538. Budawang's new facilities will provide 7 homebases in the first phase, with scope within the masterplan and core facilities to increase provision to 10 homebases in the future if required. The remainder of the site may be used for a potential future educational facility.

Budawang caters for Special Needs students from Kindergarten to year 12; students are typically taught in classes of 6 to 8 students with two staff members. These high staff to student ratios are typical for special needs schools. The current Budawang School has only 35 students.

The relocation site consists of garden, play zones, landscaped area and 5 blocks of varying size buildings:

- Block A1 – Library, staff and administration building
- Block A2 – Multipurpose hall and life skills
- Block B – 3 Homebases
- Block C – 4 Homebases
- Block D – Hydrotherapy

The location of the proposed site is shown in Figure 1.

Figure 1: Site Location

2.2 DESIGN STRATEGIES/SITE AND LOCAL CLIMATE

Passive measures, optimisation of the building envelope considering energy impact, daylight, glare, thermal comfort will be investigated in detail for the current architectural scheme. These passive design measures will be further investigated from a Green Star perspective and regulatory code compliance – section J on insulation, glazing, shading etc.

The schematic design review and strategies investigated are detailed in the following section and will be further refined through the detailed design stages.

The building form and location provided a number of opportunities and constraints which will influence the sustainable design features.

The proposed building is located in the National Construction Code (NCC) climate zone 6 – Mild / Temperate. This climate zone has periods of hot days in summer and cool temperatures in winter, high diurnal temperature range and four distinct seasons, cold winter and low humidity. The air temperature and humidity are typically within comfort conditions for approximately 65% of the year meaning the building will be able to benefit from free cooling using natural ventilation or economy cycles in place of mechanical cooling during these times.

The site is relatively exposed to the sun for the majority of the year. The roof area receives largely unobstructed sunlight providing opportunity for inclusion of Solar PV. The east, west and north façade elevations are also exposed to solar radiation which requires consideration for façade thermal performance to manage solar heat gains. A preliminary analysis of the site resources and constraints are summarised in Figure 2, with more detailed discussion on climate conditions below.

Figure 2: Site Analysis and Resources/Constraints

2.2.1 Local Temperature and Diurnal Average

Figure 3 shows the outdoor air temperature (mean, maximum and low) and the thermal comfort range for Nowra, NSW (which is about 60 km north of the proposed site). The thermal comfort range shown is taken from the Adaptive Comfort Model in ASHRAE Standard 55-2015. The monthly diurnal average temperature along with the solar radiation (both diffuse and direct) data is also presented as shown in Figure 3.

Climate conditions are suitable to provide thermal comfort for 65% of the year. However, some form of active heating and cooling will be required for winter and summer respectively.

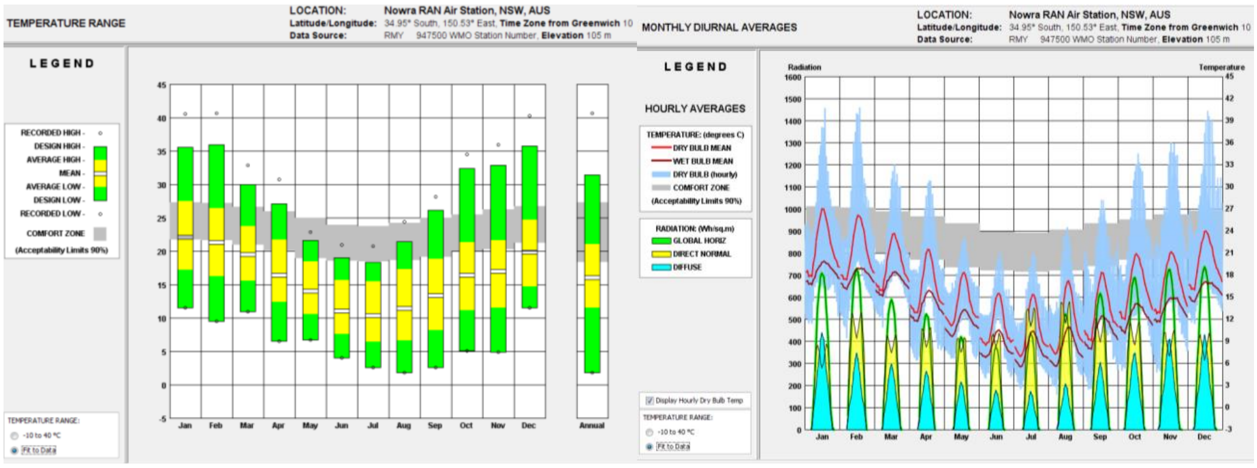


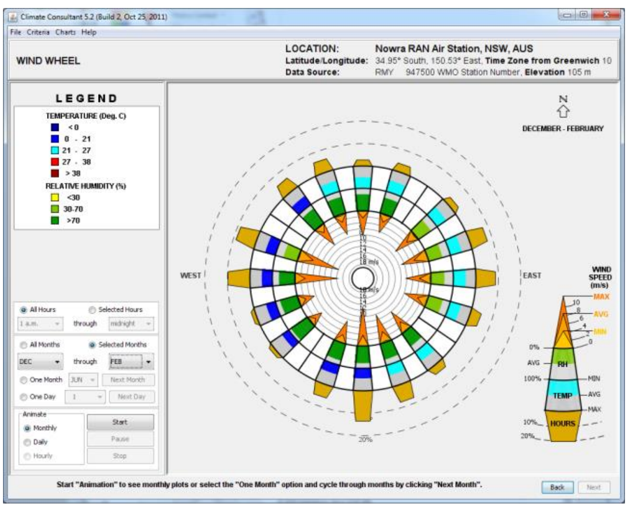
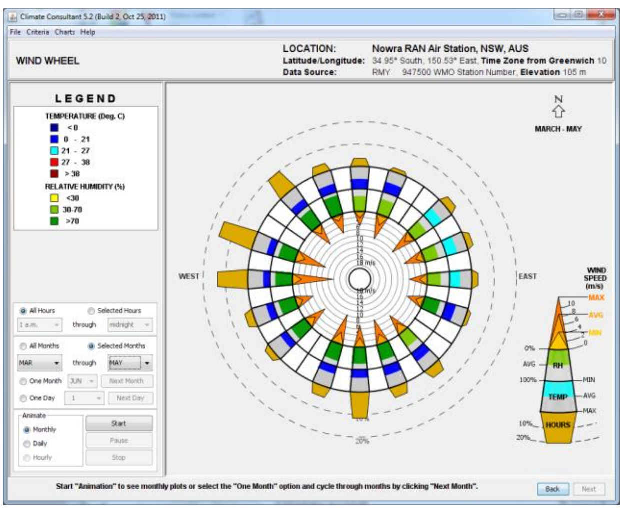
Figure 3: Local Temperature, Solar Radiation and Comfort Band

Monthly diurnal averages highlight the difference in temperature between daytime and night time. The analysis of the diurnal temperature range indicates that night time cooling can be used on the proposed Budawang development during the summer months.

The average solar radiation for the site exceeds 600 W/m^2 during summer and about 400 W/m^2 during winter. The excess level of heat in summer will be mitigated through appropriate façade and shading device design. In winter this heat load could be used to supplement the heating required where feasible and appropriate. The available solar radiation indicates good potential for solar hot water heating and energy generation via photovoltaic options.

2.2.2 Local Wind Pattern

Australia's two prevailing wind streams are determined by the seasonal movement of high pressure systems (i.e. anticyclones). Variations in wind direction and speed are greatest at the coastal areas due to the influence of the diurnal and sea breeze affects. The local wind pattern of all months of the year for Nowra is shown in Figure 4.

	
Summer (Dec, Jan, Feb)	**Autumn (Mar, Apr, May)**

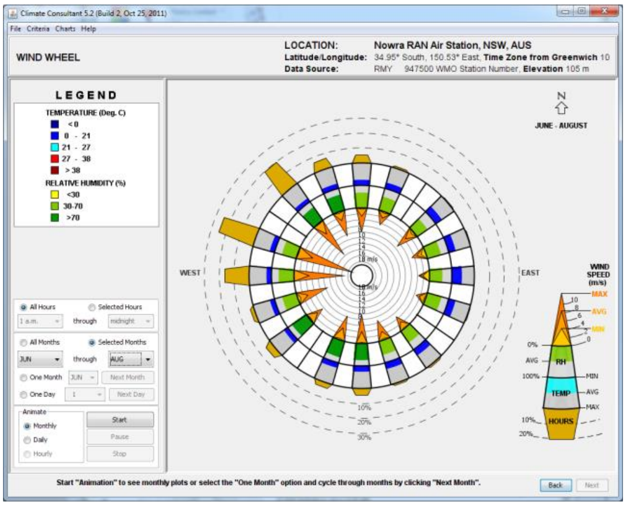
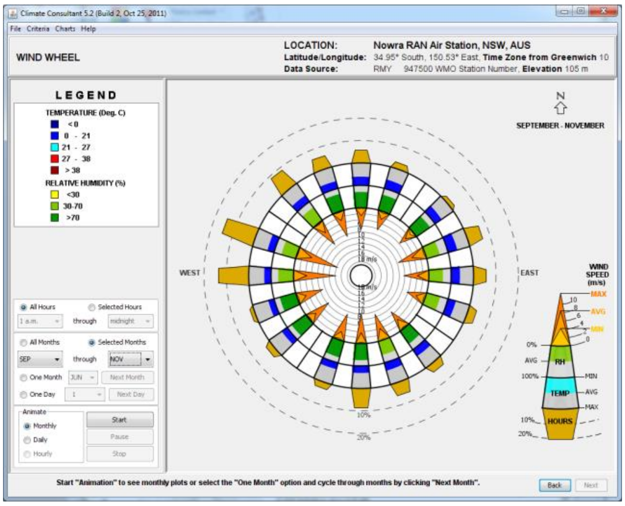
	
Winter (Jun, Jul Aug)	**Spring (Sep, Oct, Nov)**

Figure 4: Local Wind Pattern and Prevailing Wind Direction

During the winter months (June, July and August) the majority of the coldest winds are from the West and North West at an average speed of approximately 6-8 m/s. During these months, wind protection is required on the western façade of the building.

During summer (December, January and February), the favourable winds or cooler winds come from South, East and West at an average speed of approximately 4-5 m/s. Wind from the east is relatively warmer compared to the south and west. Where feasible, natural ventilation is utilised to provide passive cooling in summer.

During autumn (March, April and May), the majority of winds come from the West and South and some from North. During Spring (September, October and November), the majority of winds come from the West and South and some from North. During shoulder seasons it can be seen that the mild air temperature could be effectively used for natural ventilation.

2.2.3 Ground Temperature

Ground temperature is the dry bulb temperature measured at the given depth. The ground temperature is relatively stable due to thermal mass of the earth. Similarly, the ground water or the water bodies such as ponds and aquifer will have stable temperature throughout the year which will be used throughout the year using earth tube cooling system with some ventilation assistance depending on the building type and the climate.

Figure 5 below shows the ground temperature for Nowra at various depths. It can be seen that the ground temperature (average at 3m depths) is about 19°C to 12°C with an average temperature of 15.3°C throughout the year. The ground temperature for the site and the presence of large water bodies on site near the buildings presents an opportunity to use this site resource for passive cooling.

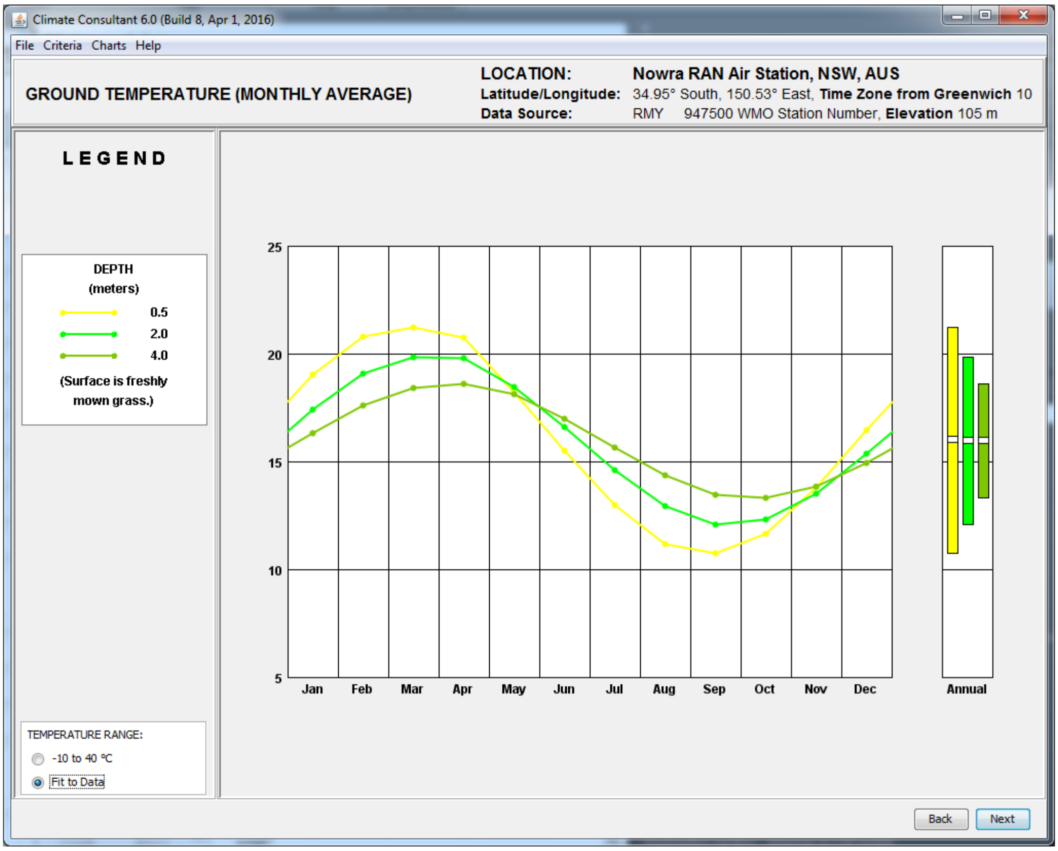


Figure 5: Ground Temperature at Various Depths

2.2.4 Passive Design Features

- The site layout and orientation will be developed with consideration of passive solar design principles to allow winter solar access but prevent summer solar heat gains. Passive solar design is illustrated in Figure 6.

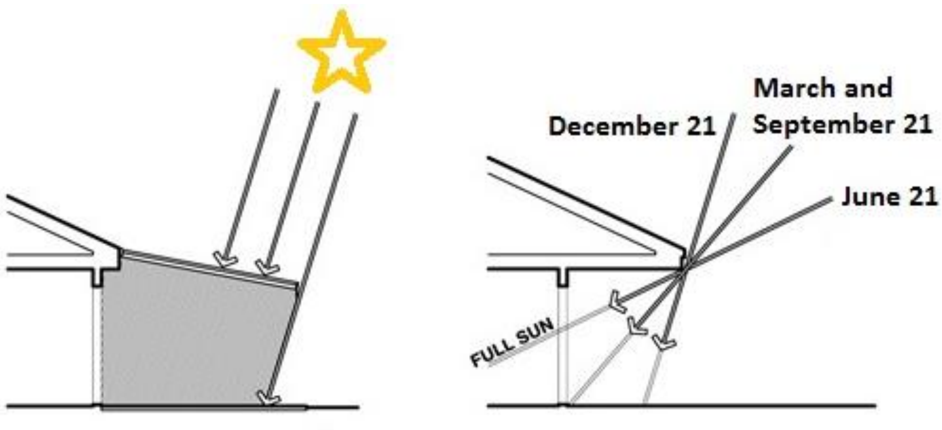


Figure 6: Passive Solar Design

- The thermal performance of the buildings glazing and envelope in their current form will be optimised and fabric and glazing requirements determined in accordance with BCA Section J1 and J2 Deemed to Satisfy Requirements. Refer to Thermal Environmental section J report.
- All buildings are suited to using natural ventilation with internal layouts generally providing cross flow paths through the building (refer to Figure 7). However, due to the climate conditions some mechanical cooling and heating would be required during summer and winter, therefore it is proposed to use a mixed mode solution.

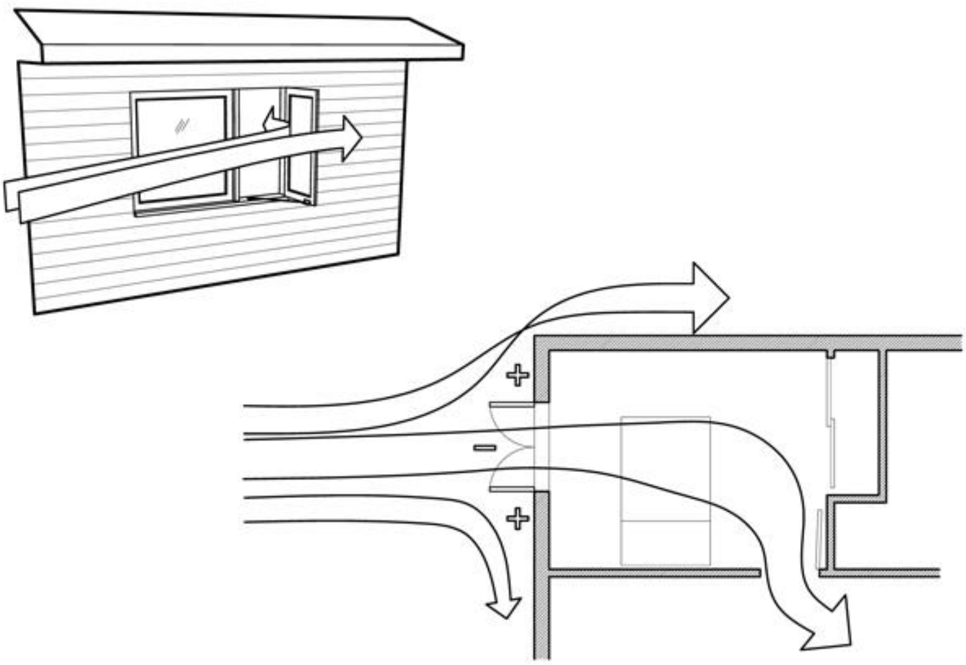


Figure 7: Natural Ventilation

- The orientation of the facilities and position of glazed elements in facades will enable internal spaces to receive adequate levels of daylight thereby reducing the need for artificial lighting and conserving energy. Daylight modelling and analysis will be undertaken during detailed design to optimize the buildings' daylight performance. The integration of day lighting with the artificial lighting will be coordinated with the lighting design engineer during the detailed design phase of the project. Conceptual illustration of daylight and ventilation is shown in Figure 8.

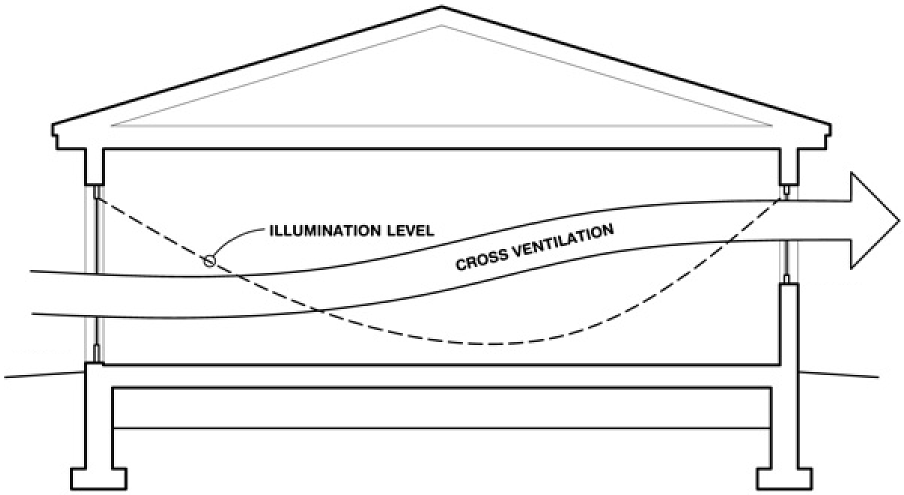
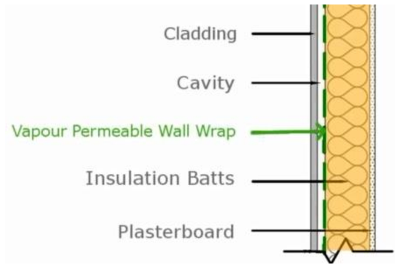
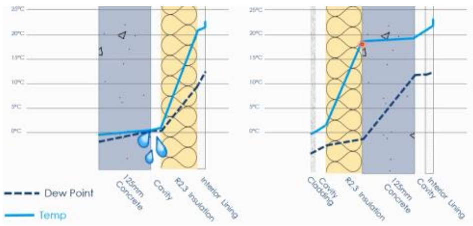
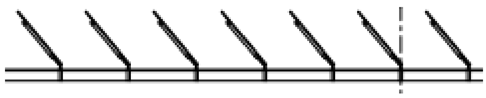
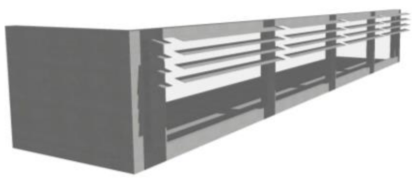


Figure 8: Daylighting and Cross Ventilation

Table 1 below summarises opportunities, constraints and design response to address SEARS and EFSG guidelines.

Table 1: Site Temperature - Summary of Site Opportunity, Constraint and Design Response.

Parameter	Opportunity	Constraints	Design Response
Temperature and Diurnal range	Economy cycle, night purging, thermal mass – supporting passive design	Maximum DBT around 26°C with periods of high moisture content suggesting some dehumidification	TBA – with Mechanical Engineer

	strategies	would be required.	
Relative Humidity	-	Most part of the year the relative humidity is high suggesting possible risk for condensation. The design should mitigate the condensation risk throughout the year.	Building sealing, construction detailing, use of moisture management and vapour permeable membranes. Generally, for temperate climate - vapour permeable wrap on outside of the insulation.  Or use external insulation for better moisture management  A full hygrothermal study would be required for detailed assessment and advice.
Temperature range > 20°C		Shading is required to prevent overheating. Good management of internal heat gains for comfort through shading. Shading will benefit overall most part of the year in reducing cooling energy consumption at the expense of little increase in heating.	Façade Shading – on east and west to minimise solar heat gains with vertical louvres as shown below. Vertical louvres on outside can be replaced with in between venetian shading of a double-glazed unit.  **(Plan View)** North/ East and West façade shading by fixed horizontal projections – concept shown below. 
Temperature range 20 to 10°C	About 60 to 65% of the temperature range suitable for economy cycle	-	

Temperature below 10°	-	Heating may be required, however a good envelope and glazing system design should be able to mitigate or minimise heating requirements.	Allow some solar access and low angle winter sun by incorporating dynamic shading strategy to cater for minimising summer solar gains and allow some winter to assist heating.

2.2.5 Solar Radiation

The site has good potential for harnessing solar energy. The availability of roof space provides an opportunity to investigate roof top photovoltaic system for this development. This opportunity plays a vital role in transitioning towards net zero emissions.

The direct average solar radiation for the site exceeds 600 W/m^2. The excess level of heat in summer will be mitigated through appropriate façade and shading device design. In winter, this heat load could be used to supplement the heating required where feasible and appropriate. The available solar radiation indicates good potential for onsite building integrated or roof top mounted photovoltaic option.

Onsite Solar PV generation Opportunity is summarised in Table 3.

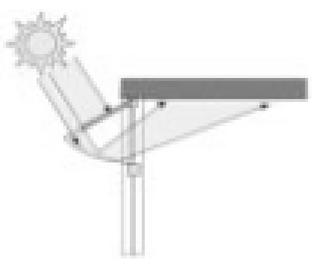
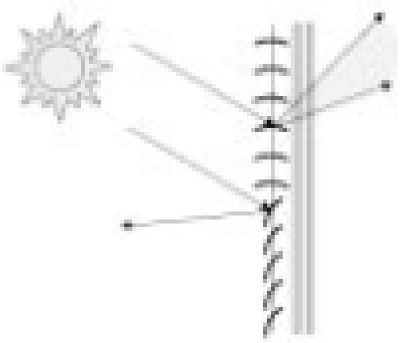
Table 2: Site Solar Energy - Opportunity, Constraint and Design Response.

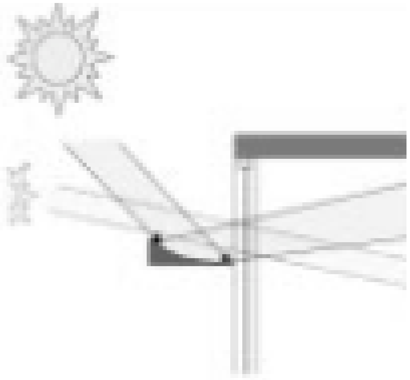
Parameter	Opportunity	Constraints	Design Response
Solar Radiation	On site Generation and pathway for net zero building.	Size and space limitations	Installation of PV on the roof space.

2.2.6 Illumination and Daylighting

Daylighting could be a strategy for the development. Some of these strategies for implementing daylighting are presented in Table 4 as this is opportunity for the development.

Table 3: Daylighting Concepts and Strategies

Name	Type of system	Location	Design Criteria
Light Guiding Shade		Vertical Windows above eye height	- Glare protection - External views - Increasing the depth of light penetration
Louvres and Blinds		Vertical Windows	- Glare protection - External views - Increasing the depth of light penetration

Name	Type of system	Location	Design Criteria
Light shelves for redirection of sunlight		Vertical Windows	- Glare protection - External views - Increasing the depth of light penetration

2.2.7 Energy Efficiency Features

The design of the building services within the development includes the following energy efficiency initiatives:

Building Envelope

- Optimised building orientation and site layout
- Optimised insulation and shading to be implemented for all buildings on site
- Minimised thermal bridging of assemblies and structures such as studs of the building envelope
- Optimised window to wall ratio for:
  - Daylight
  - Views
  - Energy efficiency
- Building sealing and construction detailing to ensure building envelope is sufficiently sealed to achieve permeability less than 5 $m^3/(h.m^2)$at 50 Pa.

Mechanical Services

- Efficient and suitably sized mechanical heating, ventilation and air conditioning systems;
- Economy cycle will be used when outside conditions are favorable (100% outside air) and mixed mode air conditioning should be implemented;
- Appropriate zoning and control for HVAC systems to condition spaces when required;
- Variable speed drives for fans, pumps and air handling plant;
- $C0_2$ sensors and demand / occupancy control ventilation in central facilities, gallery and gym and pool
- Motion-activated thermostats and reed switches linked back to air conditioning to prevent guests leaving system operating unless occupied.
- Building management systems and metering to optimise and monitor operational performance;
- Lighting control connected to daylight sensors to provide daylight dimming to use natural light where possible;
- Use of ceiling fans (Figure 9). Ceiling fans or indoor air motion can make the environment feel at least 2.5 to 2.8°C cooler thus less air conditioning is needed. This needs to be further investigated with the mechanical services design.

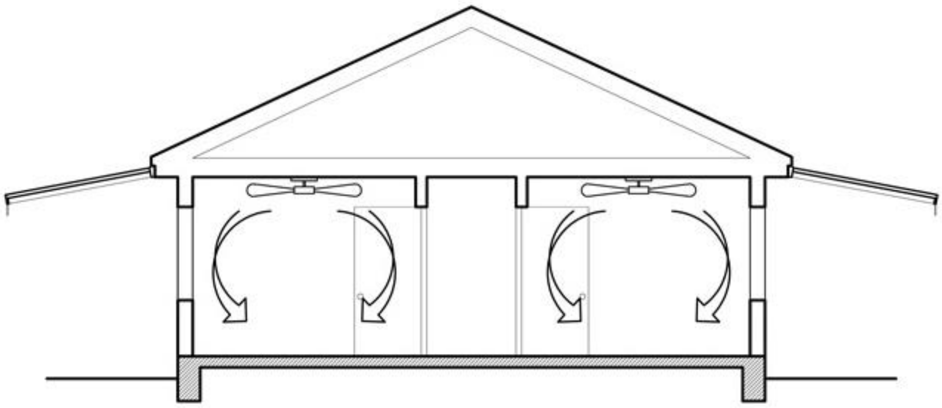


Figure 9: Use of Veiling Fans

- Lower the indoor comfort temperature at night to reduce heating energy consumption (lower thermostat heating setback and also increasing the cooling set point by 0.5°C in Summer.)

Electrical - Lighting

- Selection of energy efficient light fittings, such as LED, with time clock control and motion detection switching; and;
- External lighting controlled by daylight sensor and/or timer to ensure that lights are turned on when required.

Hot Water Services

- Potential for Solar gas boosted for domestic hot water in all buildings;
- For the hydrotherapy pool, consider using either a heat pump heating system or solar with electric boost.

2.3 INTEGRATED WATER CYCLE MANAGEMENT PLAN

The development is remote from urban water supplies and therefore water management is a key aspect of the sustainability strategy for the site.

A sustainable water strategy for the site is critical to both reducing demand for water as well as minimising the volume of waste water generated on site that requires treatment.

In a similar manner to energy, the water strategy for the development seeks to first minimise water consumption through design and selection of efficient fixtures, fittings and through the use of low water species where practical to reduce need or limit the need for irrigation.

For further details on site wide water strategy or water sensitive urban design and water cycle management please refer to the water engineer's report.

2.3.1 Water Efficiency

The following measures have been implemented to reduce demand for water use and reduce the volume of waste water effluent generated at the development:

- The use of sanitary fixtures and appliances with the following WELS rating:
  - Taps – 5 Star
  - Urinals – 5 star
  - Toilet – 5 Star (with dual flush)
  - Showers – 4 Star
  - Washing Machines – 5 Star
  - Dishwashers – 6 Star

- Landscaping - planting type using local and indigenous species

- An extensive rainwater harvesting system to be implemented. All buildings to be provided with a rainwater tank. Rainwater will be used to supply part of the development's potable water.

2.4 INDOOR ENVIRONMENT (IE)

Indoor environment initiatives target thermal comfort, provision adequate ventilation and fresh air supply as well as acoustic and visual amenity.

- Thermal comfort conditions will be achieved (PMV - +/-0.5) through the passive solar design strategies, building fabric, natural ventilation, and HVAC system;
- Provide appropriate and comfortable acoustic conditions for occupants
- Artificial lights are flicker free and designed to achieve suitable lighting levels for the use of the space;
- The design of the envelope and extent of glazing does allow for daylight penetration whist minimising heat transfer and glare;
- Internal building services are suitably attenuated to provide adequate internal noise levels.
- Outside air rates should aim to exceed by at least 50% of the minimum code (AS1668) requirements providing additional quantities of fresh air to occupants;
- The design will reduce indoor pollutants, such as volatile organic compounds (VOC) and formaldehyde through appropriate material selection;
- Designated smoking areas away from building entrances, outdoor dining areas and building air intakes will be nominated;

2.5 WASTE

The following strategies are proposed to reduce construction and operational waste:

- Construction and demolition waste including safe removal and disposal of hazardous wastes will be dealt with in accordance with statutory requirements and Green star requirements;
- At least 90% of construction and demolition waste will be diverted from landfill;
- Provide facilities for collection and separation of distinct operational waste streams that meet best practice access requirements for collection by the relevant waste contractor.
- It is proposed that the following waste streams are separated as per Green Star requirements:
    - general waste;
    - paper and cardboard;
    - glass;
    - plastic;
    - food waste; and
    - electronic waste (printers, computes, cartridges etc)
- Kitchen waste and dry leaves are to be collected and converted into compost.

2.6 MATERIAL LIFE CYCLE IMPACTS

The selection of materials used in the building is critical for minimising environmental impact through:

- Consideration of life cycle environmental impacts (e.g. embodied energy, GHG and water, other emissions to air)
- The use of innovative sustainable materials (for example: cross laminated timber) as opposed to traditional construction, such as pre-fabricated structures on piers as opposed to raft and slab type

construction reduces ground and ecological disruption and impact on the soil and natural environment.

- Pre-fabricated structures will be quick to assemble on site and cost effective onsite construction and are manufactured using processes that result in less material waste.
- Minimising or eliminating the use of materials with ozone depletion potential, global warming potential and materials containing volatile organic compounds;
- Capital costs, ongoing maintenance costs and total life-cycle-cost;
- The operability and maintainability of the facility;
- The reliability, availability and flexibility of the facility and its useful life;
- Climate change adaptation and risk management.

The following strategies will be implemented and also satisfy the Green Star requirements for selection of sustainable building materials.

- The construction of the development includes the use of environmentally sustainable construction materials to minimise the construction and operational impacts of the development.
- All timber used for the development to be sourced from Forest Stewardship Council (FSC) certification scheme or reused source.
- Timber products used should contain no formaldehyde and be procured from a forest certification scheme OR from a reused source;
- Any concrete used on site will include a proportion of waste product binding agents such as fly ash to reduce the amount of Portland cement, recycled water and recycled aggregate.
- Any steel structure or reinforcement will be sourced from environmentally accredited suppliers and will include a high-recycled content. Improved steel strength grades are also considered to minimize the volume of steel required.
- Cables, pipes, flooring and blinds should contain no PVC or meet the requirements of Green Building Council PVC guide;
- Glazing, cladding, internal finishes and furniture are to be environmentally certified or procured from suppliers with stewardship programs;
- Maintenance forms a significant component of a building's life cycle cost. Durability and longevity of all construction materials, finishes, furniture and equipment is considered to deliver a future-proofed asset with minimised life cycle costs.

2.7 CLIMATE CHANGE AND ADAPTATION

Climate change projections published by NSW Office of Environment and Heritage for the Shoalhaven / Illawarra region indicates:

- By 2030 maximum temperatures are projected to rise by 0.7°C and continue to rise by 1.9°C by 2070.
- Rainfall is projected to decrease in the south western region during spring and winter. Rainfall is projected to increase across the region during autumn
- Severe Fire Weather is projected to increase slightly across the Illawarra during spring and summer by 2070
- By 2030 the Illawarra is projected to experience an average of 2 more days per year above 35 ºC and continue to rise to 5 more days per year by 2070
- By 2030 the Illawarra is projected to experience an average of 4 fewer nights below 2 ºC per year and continue to decrease by 11 nights per year by 2070

CSIRO research projected Australia's climate will experience:

- Hot days will become more frequent and hotter (very high confidence)
- Sea levels will rise (very high confidence)
- Oceans will become more acidic (very high confidence)
- Snow depths will decline (very high confidence)
- Extreme rainfall events will become more intense (high confidence).
- In southern mainland Australia, winter and spring rainfall is projected to decrease (high confidence), but increases are projected for Tasmania in winter (medium confidence).
- In eastern Australia, there is high confidence that in the near future (2030) natural variability will predominate over trends caused by greenhouse gas emissions. This means that while the trend is skewing the natural variability towards winter decreases, it will be relatively minor compared to the natural seasonal and annual changes, so continuing to manage for large natural variability will still be appropriate. For late in the century (2090), there is medium confidence in a winter rainfall decrease.
- In northern Australia and northern inland areas, there is high confidence that in the near future (2030), natural variability will predominate over trends due to greenhouse gas emissions. There is low confidence in the direction of future rainfall change by late in the century (2090), but substantial changes to wet-season and annual rainfall cannot be ruled out.
- The time in drought is projected to increase over southern Australia (high confidence).
- There is high confidence in increasing potential evapotranspiration (atmospheric moisture demand).
- There is high confidence in decreasing soil moisture from mid-century in the southern regions (particularly in winter and spring) driven by the projected decrease in rainfall and higher evaporative demand. There is medium confidence in decreasing soil moisture elsewhere in Australia where evaporative demand is projected to increase but the direction of rainfall change in uncertain.
- Southern and eastern Australia are projected to experience harsher fire weather (high confidence).
- Tropical cyclones may occur less often, but become more intense (medium confidence).

Climate change projections should be considered as part of the project's detailed design phase to ensure risks are assessed and addressed through features to increase resilience. An assessment of climate change scenarios and impacts on the project should be undertaken using at least two timescales relevant to the project lifespan. CSIRO or NSW Government projects can be used.

The assessment will consider direct and indirect environmental, social and economic effects and impacts of changes in temperature, precipitation, relative humidity, wind speed, and sea level, and changes in the occurrence of heatwaves, drought, flood, storms, cyclones and bushfires.

2.7.1 Implementation of the Climate Change Plan

The Project team and the Client must ensure that:

- At least two risk items identified in the risk assessment component of the Climate Change Adaptation plan are addressed by specific design response
- All risk items identified as high or extreme are addressed by specific design response.

3 ESD REQUIREMENTS AND DRIVERS

The relevant regulations, including State planning requirements, and other drivers which collectively influence the ESD response for the proposed development are summarised as follows:

3.1 NCC – SECTION J

The National Construction Code (NCC) Building Code of Australia (BCA) sets the mandatory minimum energy performance requirements for buildings in Section J. The objective is to reduce building greenhouse gas emissions by efficiently using operational energy. Section J is focussed on establishing minimum acceptable practice in the building industry.

The project is adopting the NCC 2019 which includes the revised and more stringent Part J Energy Efficiency provisions. The building must meet the requirements as set out in the NCC BCA Section J building fabric, glazing, building sealing, HVAC and light and power provisions using either the Deemed to Satisfy or Performance provisions.

3.2 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The SEARS (SSD 8845345) require that the Environmental Impact Statement (EIS) shall:

- detail how ESD principles (as defined in clause 7(4) Schedule 2 of the EP&A Regulation 2000) will be incorporated in the design, construction and ongoing operation of the development
- proposed measures to minimise consumption of resources, water (including water sensitive urban design) and energy
- 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.
- how environmental design will be achieved in accordance with the GANSW Environmental Design in Schools Manual
- an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level
- a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change.
- an Integrated Water Management Plan detailing any proposed alternative water supplies, proposed end uses of potable and non-potable water, and water sensitive urban design.

3.3 EP&A REGULATION 2000 – ESD PRINCIPLES

Schedule 2 of the EP&A Regulation, clause (1) subclause (f) requires that an EIS:

- must include the reasons justifying the carrying out of the development in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).

The principles of ecologically sustainable development in sub clause (4) are as follows:

- the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:
  - careful evaluation to avoid, wherever practicable, serious, or irreversible damage to the environment, and
  - an assessment of the risk-weighted consequences of various options.
  - inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

- conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.
- improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:
    - polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, and
    - the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

3.4 SHOALHAVEN CITY COUNCIL

The DCP-2014 contains a number of specific provisions relating to Budawang School. DCP includes the controls to support Environmental Sustainability objectives. Refer to the specific sections of the DCP relating to the development.

3.5 SUSTAINABILITY RATING TOOLS (GREEN STAR)

The project is currently seeking a formal certification under a sustainability rating – 4 star Green Star rating using the Design and As Built Tool v1.3. In addition to the rating tool, the project will seek to implement best practice ESD features. These features would otherwise support the several outcomes intended by categories and credits such as Green Star.

3.6 MARKET DRIVERS AND TRENDS

3.6.1 Decarbonisation of the Built Environment

Australia has committed to becoming net zero by 2050, like many other countries who are signatories to the Paris Climate Agreement. Built environment contributes to resource depletion and carbon emissions and have a significant role to play in reducing the transition to net zero economies. There are a number of growing policy platforms to encourage buildings to become net zero. Newly constructed buildings should consider adopting strategies to support the transition to achieving net zero emissions. Zero carbon ready buildings are energy efficient and set up so they are ready to achieve zero carbon usage when combined with renewable or decarbonised on or off site energy systems. This requires projects to:

- Maximise building energy efficiency
- Inclusion of onsite renewable energy systems where practical (or future provision for installation of renewable energy systems)
- Avoidance of fossil fuel based building services such as gas fire boilers and heating hot water plant.

3.6.2 Electric Vehicles

Electric vehicles (EV) have rapidly developed from concept to market emergence, with prices forecast to continue declining every year. While currently only forming a small proportion of annual vehicle sales, this is anticipated to increase sharply in coming years as cost of production declines, along with the improvements in availability and range capacity of EVs, and developments in public charging infrastructure. Considerations should be made for the future provision of electric vehicle charging infrastructure in the future development.

4 DESIGN RESPONSE

The design will address the project requirements through the following initiatives:

- Addressing the ESD Principles of the EP&A Regulation 2000
- Developing a project specific framework outlining mechanisms for guiding the development through leading national and international best practice sustainable building principles throughout the remainder of the project design and delivery stages to improve environmental performance (Section 4.2)
- Proposed preliminary sustainability initiatives for incorporation into the design or measures requiring further consideration at the detailed design stage (Section 4.3).

4.1 ESD PRINCIPLES OF EP&A REGULATION

The EP&A Regulation ESD Principles will be met as follows:

EP&A Regulation Requirement	Methodology/Approach
Precautionary Principle	The development will be designed to avoid, where practicable, damage to the environment. An ESD framework (Section 4.2) will guide the design of the development through adoption of strategies that will reduce energy and water consumption, limit carbon emissions, encourage use of responsible materials, reduce waste and limit other forms of emissions from the site including light pollution.
Intergenerational equity	The development will seek to benefit present and future generations through increased health and environmental benefits associated with reductions in pollution, enhanced health through improved active transport facilities and creating a space that can be utilised and accessed by all ages, cultures and abilities. The development will also seek to integrate the best practice IEQ features to reduce internal air pollutant levels and enhance the internal building environment to the benefit of occupant health.
Conservation of biological diversity and ecological integrity	The development will actively seek to enhance environmental conditions on the site through restorative sustainability strategies that enhance the ecological and biological value of the site through introduction of landscaping including vertical landscaped elements. In addition to this, the stormwater management plan prepared by SCP nominates the return of water by means of absorption trenches around the facility.
Improved valuation, pricing and incentive mechanisms	The development is targeting high levels of sustainability performance which will impose additional upfront costs to the development but will ultimately result in increased asset value through improved financial and environmental life cycle performance and features to support resilience to future climate change.

4.2 ESD FRAMEWORK - SEARS

The ESD framework for the development detailed in Table below is intended to define the guiding principles to inform the future detailed design and construction of the development and enable the development to incorporate best practice sustainable principles that respond to site conditions, regulatory requirements, policies and emerging market trends and drivers.

Theme	Objective
Leadership & Governance	Demonstrate leadership by embedding sustainability objectives into decision-making processes and committing to setting targets and having a measuring and monitoring system to track the environmental performance of the building.
Energy & Carbon Minimisation	Minimisation of carbon emissions and energy consumption through adoption of hierarchal energy design strategies using passive design, energy efficiency and sourcing of energy from low or zero carbon sources.
Water	Reduce potable water usage and maximise opportunities for rainwater / stormwater capture and reuse for non-potable purposes.
IEQ	Buildings and external areas support physical and mental wellbeing and

<table>
<tr><td></td><td>enhance overall spectator experience.</td></tr>
<tr><td>Materials</td><td>Minimize construction and material waste generated throughout the project lifecycle by considering embodied lifecycle impacts of material selections for the project. Contractors, sub-contractors and suppliers are to adopt sustainability as a key initiative in their work and procurement processes</td></tr>
<tr><td>Operational waste</td><td>Reduce waste generation and encourage reuse or recycling to avoid waste going to landfill</td></tr>
<tr><td>Land Use, Ecology & Biodiversity</td><td>Natural ecosystems and local landscape habitat to be preserved. Ecological value to be enhanced through landscaped elements</td></tr>
<tr><td>Emissions and Discharges</td><td>Reduce sources of pollution and emissions to limit degree of environmental harm caused.</td></tr>
<tr><td>Climate Change Resilience</td><td>The site will be investigated and designed for resilience to the effects of climate change. Climate change risks and impacts to be assessed, with design strategies and plans in place to address them.

Following strategies are proposed for the Budawang School in response to the CSIRO projected impacts of some climate change events:

Hot days will become more frequent and hotter
• Solar passive design /shading features – such as minimising heat gains through shading and glazing selection
• Quality of thermal construction, air leakage and building sealing to prevent hot air infiltration through the façade.
• Maintain indoor comfort conditions by the appropriate use of active and / or passive cooling.
• Landscaping, water bodies and shading provided by trees
• Use of heat reflective paints on roof or hard surfaces to reduce heat island effect:
  o For roof pitched <15° - a three-year SRI of minimum 64 or initial SRI of minimum 82
  o For roof pitched >15° - a three-year SRI of minimum 34 or initial SRI of minimum 39

Extended drought periods
• Site wide water efficiency and water sensitive urban design
• Selection of high WELS rating appliances
• Use of drip irrigation and low water use species
• Rainwater capture and reuse on site

More extreme rainfall events
• Consideration for increased drainage capacity to reduce the risk of flooding of roofs and hard surfaces
• Assessment of stormwater peak discharge for the site post development and risk of flooding

Gustier wind conditions
• Site orientation and layout for wind protection
• Assessment of façade wind loading and its impact.</td></tr>
</table>

4.3 ESD STRATEGIES AND DESIGN FEATURES

The table below provides a summary of the ESD strategies that are:

- Recommended for future incorporation into the project during detailed design; and
- Additional opportunities requiring further investigation in the project's detailed design stages.

Theme	Consideration for SSDA Design	Recommended for Future Investigation
Leadership & Governance	• Set building specific environmental targets (energy, water and waste) and measure and report results • Certification of 4 Star rating under the Green Star Design and As Built V1.3 • Final decisions taken during detailed design stages on major building systems such as envelope and plant equipment to be guided based on life-cycle costing and life cycle impacts • Construction contractor to implement site-specific responsible construction practices including ISO14001 - Environmental Management Plan and staff Wellness program as required by Green Star • Implementation of a comprehensive commissioning plan in accordance with best practice standards	-
Energy and Carbon Minimisation	• Refer to BASIS of Design	Refer to Basis of Design (Ref Memorandum S-M2021020900)
Water	• Rainwater harvesting • Water efficeint appliances and fittings • WSUD • Select drought tolerant native species for vegetation and landscape	-
IEQ	• Building layout and orientation • supports use of natural ventilation to maintain indoor air quality and thermal comfort • Use of low formaldehyde and low VOC products • Deisgn of the façade that support views, daylighting	Selection of ultra low-voc products.
Materials	• As per Green Strar requirements	-
Operational Waste	• As per Green Star requiremts	-
Land Use, Ecology & Biodiversity	• As per Green Star requiremts	-
Emissions and Discharges	• Water sensitive urban design • Meet or exceed Green Star requirements	Project to investigate stormwater reuse for irrigation and additional levels of treatment.
Climate Resilience	• Project to complete a formal climate change risk assessment and incorporate mitigation measures into design.	-

4.4 GANSW DESIGN RESPONSE

Key ESD design considerations of the GANSW design guide for schools are dealt with in this report in various sections. A summary of GANSW sustainable design outcomes is summarised below. Only ESD themes are captured and summarised in the table. Respective design teams are to document the relevant theme applicable under their discipline.

Theme	GA NSW Design Considerations	Relevant Section(s) / External Reference
Sustainable, Efficient and Durable	Be Responsive to local climate including sun, wind and aspect	Section 2.2; and Sub-sections (2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6)
	Select materials and approaches to detailing	Section 2.6 (in addition to this there is a

	that are robust and durable	separate Green Star requirement)
	Integrate landscape, planting and Water Sensitive Urban Design (WSUD) principles to enhance amenity and building performance	Section – 2.3 Refer to Civil or Water Engineer's report.
	Include deep soil zones for ground water recharge and planting.	Section 2.3 Landscape, Hydraulic and Civil (water engineer) to coordinate.
	Minimise reliance on mechanical systems	Section 2.2.7
	Include initiatives to reduce waste, embodied energy and emissions through passive design principles and the use of advanced energy production systems where possible	• Waste – Section 2.5 • Embodied Energy – 2.6 • Passive Design – Section 2.2
	Maximise opportunities for safe walking, cycling and public transport access to and from the school.	Refer to the Basis of design (Ref Memorandum S-M2021020900) Architect and Traffic engineer to coordinate.

5 CONCLUSION

Thermal Environmental / INTELLE have reviewed the applicable sustainability requirements including statutory obligations as defined by the Building Code of Australia Section J, EP&A Regulation and SEARS. A project specific ESD framework has been developed (refer to section 4.2) to address the statutory obligations and ensure the future stages incorporate best practice ESD features. A number of sustainable design considerations have also been proposed and are summarised in Section 4.3

On the basis of this review, and assumption that that the sustainability framework will be followed for future stages of the development, the proposed development is capable of including best practice initiatives and complying with the applicable statutory obligations.