Report

Ecologically Sustainable Development Statement

ALTERATIONS AND ADDITIONS TO MERIDEN SCHOOL, STRATHFIELD

Allen Jack & Cottier Architects

Report

CONFIDENTIAL

Revision: 1.1 – FINAL
Issued: 3 May 2019

Norman Disney & Young
A TETRA TECH COMPANY

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1 EXECUTIVE SUMMARY

Norman Disney & Young (NDY) has been engaged by Allen Jack & Cottier Architects to provide an Ecologically Sustainable Development (ESD) Statement for the proposed Meriden School alterations and additions located at Redmyre Road and Margaret Street, Strathfield.

The principal objective of this report is to outline how the project will address the following four Key Issues of the Planning Secretary's Environmental Assessment Requirements (SEARs) – SSD 9692, Key Issue: 8, ***Ecologically Sustainable Development***:

- ESD principles incorporated in the design and operation of the development;
- A framework for best practice sustainable building principles;
- Preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance; and,
- Climate Change Resilience Statement addressing how the design is responsive to the CSIRO projected impacts of climate change (e.g. hotter days, extended drought, extreme rainfall, wind conditions etc).

In addition to the above SEARs, this report demonstrates that the proposed design is in line with initiatives contained within the GANSW Design Guide for Schools and the GANSW Environmental Design in Schools Manual.

The proposed developments at the Meriden School – Centre for Music and Drama (CMD) and the Administration & Student Centre (ASC) – aim to go beyond minimum building requirements and provide a progressive sustainability outcome for the community. Through early design input from sustainability professionals, sustainability initiatives incorporated in the proposed development include:

- Passive design elements to reduce the energy demand of the building in operation and improve indoor environment quality and thermal comfort for students and staff, including a high-performance building envelope in the ASC and natural ventilation or mixed-mode ventilation in the CMD building;
- High performance glazing, efficient lighting and lighting zoning, solar PV, solar hot water, selection of appliances with high energy efficiency ratings, and solar skylights for reduced energy consumption, good daylighting and visual comfort;
- Preliminary consideration of the building designs and their resilience to climate change impacts;
- Acoustic design in both buildings to support their functions as training and teaching spaces and private staff areas, and best practice waste management principles for the demolition of the existing music centre to avoid waste to landfill; and,
- Enhanced greening (e.g. green walls and planters) to improve air quality and reduce the urban heat island effect, water efficient fixtures and fittings (high WELS ratings), and rainwater collected from the roof and stored for use on-site.

These ESD principles adopted for the project will contribute to the conservation of resources and future resilience, across the whole life cycle of the project; from construction, through to the operation phase. Refer to Table 1 for the project's specific sustainability SEARs and how they have been satisfied.

A number of sustainability frameworks are currently under investigation for use on the development, including the WELL Building Standard (WELL) and/or Green Star for the Centre for Music & Drama and Passive House (Passivhaus) for the Administration & Student Centre. For the purposes of this report, the proposed development has been benchmarked against a 5 Star Green Star Design & As Built v1.2 'in principle' rating as it is considered the most widely-adopted sustainability framework in Australia, covering the broadest range of sustainability initiatives. Green Star Design & As Built incorporates a mixture of initiatives in line with the

intent of WELL (healthy environment for occupants), Green Star Performance (efficient building in operation), Passive House (high performing façade & mechanical systems), as well as other sustainability frameworks.

2 PROJECT SUMMARY

2.1 Purpose

This Ecologically Sustainable Design (ESD) Statement has been prepared in accordance with SEARs requirements – SSD 9692 – to detail the sustainability features of the proposed development.

2.2 Development Description

The proposed development comprises Class 9b education facilities across 2 buildings; the Centre for Music & Drama (CMD) and Administration & Student Centre (ASC). The CMD building will comprise 3 storeys of mixed-mode ventilated space including classrooms, training facilities, performance areas and staff areas. The ASC will comprise 2 storeys of administration, IT, and lounge spaces. Three existing buildings will be demolished to make way for the proposed CMD and ASC buildings. Figure 1 shows the existing site layout while Figure 2 shows the proposed upgraded facilities.

Figure 1: Existing site layout

Figure 2: Proposed Centre for Music and Drama (L) and Administration & Student Centre (R)

2.3 Information Sources

The following information sources have been used in the preparation of this report:

- Planning Secretary's Environmental Assessment Requirements – SSD 9692;
  - Key issues, Part 8, "Ecologically Sustainable Development (ESD)";
- Section 4.12(8) of the Environmental Planning and Assessment Act;
- Schedule 2 of the Environmental Planning and Assessment Regulation 2000;
- GANSW Design Guide for Schools;
- GANSW Environmental Design in Schools Manual
- NSW and ACT Government Regional Climate Modelling (NARCliM) climate change projections;
- OEH (2015) Urban Green Cover in NSW Technical Guidelines;
- NCC Section J 2016;
- Green Star Design & As Built v1.2 Submission Guidelines;
- Architectural drawings prepared by Allen Jack & Cottier Architects; and,
- Discussions and workshops with the design team.

2.4 Revision History

Revision	Date	Reason for Issue
0.1	22/02/2019	Draft for Review and Comment
1.0	30/04/2019	Final
1.1	3/05/2019	Final – minor reference updates

3 SEARS COMPLIANCE SUMMARY

Sustainability principles are embedded in the proposed design for both the ASC and CMD at Meriden School. Outcomes of the sustainability principles across both developments will include energy and water efficiency, resilience to future climate impacts, high indoor environment quality, and comfort and wellbeing for staff and students using the spaces within.

Table 1 addresses how the project's specific sustainability initiatives satisfy the relevant SEARs for ESD, the GANSW Design Guide for Schools, and the GANSW Environmental Design in Schools requirements.

Table 1: Meriden School SEARs Compliance Summary

ESD Requirements	Proposed Compliance Strategy	Compliance
SEARs		
Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Regulation) will be incorporated in the design and ongoing operation phases of the development.	General ESD principles have been adopted for the project, with a focus on conservation of resources and future resilience. The proposed design includes sustainability initiatives relating to: ■ Management: preliminary consideration of the building designs and their resilience to climate change impacts, and separation of waste streams to facilitate reuse, recycling, compositing and overall waste reduction. ■ Indoor Environment Quality: enhanced greening (e.g. green walls, planters), energy-efficient lighting, high efficiency heating and cooling, acoustic design, and a combination of high performance building sealing (e.g. shading, glazing) and natural or mixed-mode ventilation for reduced energy consumption, thermal comfort, climate change resilience, and to facilitate the transient and pedestrianised aims of the space. ■ Energy: both buildings will comply with NCC 2016 Section J minimum requirements, solar PV and solar hot water on roof spaces to reduce the urban heat island effect, integrated shading, high efficiency glazing, high performance building sealing, and passive design strategies to reduce mechanical energy consumption. ■ Transport: Meriden School is highly connected to public transport – less than a 10 minute walk to Strathfield Station and well-connected to central public transport hubs. The CMD design also supports a highly-circulatory and transient environment with large openings to the outdoors and joining buildings, internal voids for connectivity, and a feature staircase. ■ Water: selection of water efficient sanitary fixtures and fittings (high WELS ratings), and rainwater collected from the roof and stored for use on-site.	✓

ESD Requirements	Proposed Compliance Strategy	Compliance
	■ Materials: a significant portion of construction waste generated from the demolition of three existing buildings (and other minor alterations to surrounding buildings including the Hope Turner building) will be reused or recycled, to limit the amount of waste going to landfill. Strategies to reduce natural resource consumption (e.g. exposed services or prefabricated components) will also be considered in developed design. ■ Land Use & Ecology: both buildings will be built on previously developed land and the proposed designs will include integrated shading and overhangs, landscaping, and the minimization of hardscaping where possible. ■ Emissions: landscaping and rainwater harvesting will be implemented to support Water Sensitive Urban Design and limit stormwater pollutants leaving the site; and high-efficiency lighting and appropriate lighting zoning will reduce light pollution. These initiatives relate to ESD benefits over the entire lifecycle of the project; from construction through to ongoing operation of both the CMD and ASC buildings.	
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.	For the purpose of this report, the design of both the CMD and the ASC buildings has been benchmarked against a 5 Star Green Star 'in principle' rating. Environmental impact categories covered by Green Star include; Management, Indoor Environment Quality, Energy, Water, Transport, Land Use & Ecology, Emissions and Materials. A formal rating is likely to be targeted for both the CMD and the ASC building, however discussions are currently taking place to determine the rating tool that will provide most benefit to the occupants and community. A 'best of all' approach may be adopted for the two proposed buildings, whereby a formal rating may not be targeted, however key credits from a number of rating tools may be implemented in design if it is found that this approach will provide the optimum project outcome. All buildings to be demolished will aim to adhere to best practice Green Star principles regarding avoiding waste to landfill. An indicative Green Star scorecard can be found in Appendix A of this report. Refer to Section 5 for a detailed breakdown of how the SEARs for ESD have been met, as well as BCA Section J requirements.	✓

ESD Requirements	Proposed Compliance Strategy	Compliance
Include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance.	The proposed design addresses building performance through numerous ESD initiatives, including: passive design, high performance building sealing (e.g. glazing), selection of energy efficient building systems, and reduced potable water consumption from selection of high efficiency fittings and fixtures (high WELS ratings). Refer to Section 5 for more information on the Meriden School's proposed building performance initiatives. Mitigation of climate change impacts will be addressed in the Climate Change Resilience Statement. In addition, the design includes ESD elements relating to energy and water efficiency, good management practices for building systems during the operational phase, and adaptable design elements. Ventilation simulation will also be undertaken for the CMD building, in support of the development's aims of natural or mixed-mode ventilation for the central core space. While Green Star Performance will not formally be targeted, the proposed development does support high-efficiency building performance and mitigation of climate change, thus satisfying this Key Issue of SEARs for ESD.	✓
Provide a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change, specifically: ▪ hotter days and more frequent heatwave events ▪ extended drought periods ▪ more extreme rainfall events ▪ gustier wind conditions ▪ how these will inform landscape design, material selection and ▪ social equity aspects (respite/shelter areas).	NDY has been engaged to undertake a Climate Change Resilience Statement to satisfy this requirement which has been reported separately to this ESD Statement (refer rp190225s0014_Climate Change Resilience Statement.pdf). In addition, elements of climate-responsive design are included in benchmarked initiatives from Green Star Design & As Built v1.2 (refer Section 5).	✓
GANSW Design Guide for Schools		
The GANSW Design Guide for Schools and the Environmental Design in Schools Manual address the environmental and passive	The project has adopted environmentally conscious design initiatives including air quality, ventilation, natural lighting, thermal comfort, and acoustic performance to benefit teacher wellbeing and student attentiveness, attendance, and overall performance. The ESD principles embedded in the proposed design satisfy the environmental and passive	✓

ESD Requirements	Proposed Compliance Strategy	Compliance
design elements in schools, including those related to: 1. Context, built form and landscape 2. Sustainable, efficient and durable 3. Accessible and inclusive 4. Health and safety 5. Amenity 6. Whole of life, flexible and adaptive 7. Aesthetics.	design elements in the GANSW Environmental Design in Schools Manual and the GANSW Design Guide for Schools. The project will incorporate passive design elements, systems with high energy and water efficiency, and technology to ensure that the development is both sustainable and durable. Likewise, the spaces will be inclusive and accessible through good indoor environment quality, lighting design, acoustic design and thermal comfort initiatives; this will, in turn, provide healthy environments with high levels of amenity for students and staff. Furthermore, renewable energy technologies, high performance building facades, and sustainable product selection on the project will ensure that the development reduces its impact on natural resources, whilst maintaining a flexible and adaptive design. Refer to Section 5 for a detailed breakdown of ESD initiatives in the proposed development.	

4 SUSTAINABILITY FRAMEWORKS AND LEGISLATION

Relevant sustainability frameworks and legislation applicable to the proposed development are detailed in the following sub-sections.

4.1 NCC 2016 – Section J

The National Construction Code (NCC) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives efficiently. The Meriden School development will achieve compliance with Section J either through DTS Provisions, or a JV3 Alternate Solution. Minimum performance requirements for the development as well as design opportunities that would allow these requirements to be exceeded are outlined in the following section.

4.1.1 Section J Minimum Requirements

Section J of the NCC 2016 sets regulations for energy efficiency for all types of buildings with respect to the building's environment, design and activity. The performance of the CMD and ASC building envelopes of the Meriden School Development will be designed in accordance with NCC Section J.

- All conditioned spaces are required to comply with NCC Section J;
- For non-conditioned spaces, general energy efficiency principles will be applied to minimise energy consumption where practical, using best practice principles.

The following sub-sections outline the general principles applied to the project that meet the requirements of Section J.

4.1.1.1 Section J1 Building fabric

Deemed to Satisfy provisions apply to all elements forming the envelope of all class types present in the Meriden School Development. Further investigation on the minimum total R-value for wall, ceilings/roofs and floors for climate zone 5 can be undertaken in the next stage of the development.

4.1.1.2 Section J2 Glazing

The glazing will be determined by the NCC Glazing Calculator and is a function against the percentage of the window area in relation to the wall area (i.e. wall to window ratio). All new glazing must have better thermal properties (U-value / SHGC) than the properties determined through the Glazing Calculator.

High efficiency glazing will be incorporated into the facade design. Glazing on facades with high solar radiation exposure will incorporate high performance glass to reduce solar heat gains through these facades. Glazing on facades with less solar exposure may be increased where practical to improve daylight access and heating during the winter months while still meeting energy performance requirements.

There will be the possibility to further optimise glazing performance in a holistic approach by demonstrating compliance with Section J by carrying out a JV3 Alternate Solution.

4.1.1.3 Section J3 Building Sealing

Deemed to Satisfy provisions apply to all elements forming the envelope of conditioned spaces.

Roof lights must be sealed, or capable of being sealed, when serving a conditioned space. Roof lights must be constructed with either of these items:

- Imperforated ceiling diffuser or the like installed at the ceiling or internal lining level;

- Weatherproof seal if it is a roof window; and,
- Shutter system readily operated either manually, mechanically or electronically by the occupant.

Doors, openable windows or the like which form part of the envelope of conditioned spaces must be fitted with a seal to restrict air infiltration. This seal may be a foam or rubber compressible strip, fibrous seal or the like.

Entrances to a building leading to a conditioned space must have an airlock or the like.

Roofs, walls, floors and any opening such as a window/door frame or the like which form part of the envelope or external fabric of a habitable room must be:

- Enclosed by internal lining systems that are close fitting at ceiling, wall and floor junction; or,
- Sealed by caulking, skirting, architraves, cornices or the like.

Exhaust fans must be fitted with a sealing device such as a self-closing damper or the like when serving a conditioned space or habitable room.

4.1.1.4 Section J5 Air-Conditioning and Ventilation

Section J5.2 specifies minimum energy efficiency ratio requirements for air conditioning equipment and only applies to spaces that are required to be conditioned.

The development will incorporate occupancy sensors and/or timer controls to control the HVAC systems and prevent space conditioning and energy consumption of unoccupied or infrequently used spaces.

It is noted that compliance with Section J5 of the BCA shall be demonstrated by the mechanical project engineer / contractor.

4.1.1.5 Section J6 Artificial Lighting & Power

Section J6 of the NCC provides the requirements for lighting power load within all Classes in the project spaces.

The aggregate design illumination power load must not exceed the sum of the allowances obtained by multiplying the area of each space by the maximum illumination power density (table J6.2b in section J6-NCC) and dividing by the illumination power density (table J6.2c in section J6-NCC) adjustment factor where applicable; or

The aggregate design illumination power load is the sum of the design illumination power loads in each of the spaces served.

The above requirements do not apply to the following:

- Emergency lighting;
- Signage and display lighting within cabinets and display cases;
- A heater where the heater also emits light;
- Lighting of a specialist process nature such as in an operating theatre, fume cupboard or clean workstation;
- Lighting of performances such as theatrical or sporting; and
- Lighting for the permanent display and preservation of works of art or objects in a museum or gallery other than for retail sale, purchase or auction.

Spaces not included in Section J such as stairs and toilets, must adopt LED flicker free lighting systems, with zoning, dimming controls and daylight sensors. Moreover, glare avoidance should be achieved.

The development will incorporate advanced lighting control strategies in the design with day-lighting and occupancy sensors to prevent energy consumption when sufficient natural light is available or spaces are unoccupied.

It is noted compliance with Section J6 shall be demonstrated by the electrical / lighting engineer / contractor.

4.1.1.6 Section 7 Heated Water Supply

The thermal efficiency for gas heated hot water systems must comply with minimum thermal efficiencies outlined in Specification J5.2d, Table 2b: 80% when under 750Kw thermal load, and 83% when above.

4.1.1.7 Section 8 Facilities for Energy Monitoring

The development must have the facility to individually monitor and record the energy consumption of:

- Air conditioning plant: heating plant, cooling plant, heat rejection and air handling units;
- Lighting;
- Power;
- Central hot water supply; and,
- Lifts, escalators, travellators where there is more than one in the building.

4.2 Passive House

Passive house (or Passivhaus) is a rigorous, voluntary standard for energy efficiency in a building, which reduces the building's ecological footprint. It results in ultra-low energy buildings that require little energy for space heating or cooling.

4.3 WELL Building Standard

WELL is the leading tool for advancing health and well-being in buildings globally and is administered by the International WELL Building Institute (IWBI) in the United States. WELL is a performance-based system for measuring, certifying, and monitoring features of the built environment that impact human health and well-being.

WELL is grounded in a body of scientific and medical research and literature that explores the connection between the buildings where we spend more than 90 percent of our time, and the impact on environmental health, behavioural factors, health outcomes and demographic risk factors. WELL Certified™ developments can help create a built environment that improves the nutrition, fitness, mood, sleep patterns and performance of its occupants.

Figure 3: WELL Concepts

4.4 Green Star

Green Star is a voluntary sustainability rating tool for buildings, tenancies and communities in Australia. It was launched in 2003 by the Green Building Council of Australia (GBCA), a not-for-profit organisation with the key objective of driving the transition of the Australian property industry towards the design and construction of a more sustainable built environment.

Although initially developed specifically for the design and construction of office buildings, the Green Star suite of rating tools has now expanded to cover all habitable buildings and communities across a design, as built and operational performance life cycle.

Figure 4: Green Star Rating Tool Suite

5 SUSTAINABILITY INITIATIVES

The proposed developments at the Meriden School – the CMD and the ASC – aim to go beyond minimum building requirements and provide a progressive sustainability outcome for the community.

The ESD principles adopted on the project will contribute to the conservation of resources and future resilience, across the whole life cycle of the project; from construction, through to the operation phase.

As discussed, to address the SEARs requirement for ESD, the design intent of the proposed alterations and additions to the Meriden School development has been benchmarked against the GBCA's Green Star Design and As Built rating tool.

While a formal rating is not currently targeted, the project intends to achieve the design intent of a 5 Star 'in principle' rating. The following sub-sections (5.1 to 5.9) outline the initiatives incorporated into the proposed development in line with the Green Star categories and credits. The project will benchmark against the current version of Green Star Design & As Built v1.2 (refer to Appendix A for the full 'in principle' pathway).

5.1 Management

5.1.1 General Principles

Good management - adopted from design phase, construction and through to building operation - may be used to support best practice sustainability outcomes. These practices and processes include:

- Guidance from sustainability professionals;
- Pre-commissioning, commissioning and tuning;
- Adaptation and resilience;
- Building information to facilitate operator and user understanding;
- Metering and monitoring;
- Responsible construction practices; and,
- Commitments to performance (e.g. building and operational waste).

5.1.2 Best Practice Initiatives

The following initiatives have been incorporated into the proposed design to ensure that the project minimises its environmental impact through construction and operational management, including but not limited to:

- Preliminary consideration of the proposed CMD and ASC to assess how the proposed designs are responsive to future climate impacts; and,
- Separation of waste streams (e.g. paper, cardboard, glass, plastics, toner cartridges, batteries, organics etc) to facilitate reuse, recycling, composting, and overall waste reduction.

5.1.3 Opportunities

In addition to the management initiatives outlined above, the following initiatives are currently being explored:

- Pre-commissioning, commissioning, and tuning of building systems to ensure systems are operating as intended;

- Engagement of an Independent Commissioning Agent to lead the commissioning and tuning process from design through to project completion;
- A Climate Adaptation Plan developed for both buildings to address specific climate risks of the designs and how they might be mitigated to reduce risk;
- Provision of building information to facilitate operator and user understanding of all building systems, and their specific operation and maintenance requirements and/or environmental targets (e.g. BMS monitoring);
- Environmental targets for the CMD and ASC and a system in place to measure results, for reduction of energy and water consumption;
- Metering and monitoring to capture data consumption trends in support of building environmental targets;
- Essential building services equipment such as electrical and mechanical infrastructure to be protected from the inundation of up to a 1 in 100 year flood level through the location of these services above required height levels;
- Waste management plans for demolition, construction and operation of the site. The plans should set targets to divert demolition and construction waste from landfill; and,
- Adopting Green Star 'management' credits across the development.

As design development progresses, the feasibility of implementing the above opportunities will be investigated further.

5.2 Indoor Environmental Quality

5.2.1 General Principles

Healthy, comfortable learning environments are vital for students and staff, particularly when they may require spaces that facilitate focus and engagement for a considerable amount of time. General principles of indoor environmental quality (IEQ) include:

- High indoor air quality (e.g. increased fresh air levels that is free from pollutants);
- Acoustic comfort with noise levels suitable to the activities within each space;
- Good lighting design and control that is suitable to the space and free from glare;
- High levels of daylight amenity and views for visual interest;
- Reduced internal air pollutant levels (e.g. product and material selection); and,
- Thermal comfort.

5.2.2 Best Practice Initiatives

The following initiatives have been incorporated into the proposed design, including but not limited to:

- Effective shading on the CMD and ASC to further support comfortable and low-energy indoor environment quality;
- Energy-efficient lighting (typically LED) will be provided throughout;
- High levels of daylight will be provided for building occupants (glazing and solar skylights);
- High efficiency heating and cooling will be provided to both buildings;

- CMD to include either a naturally ventilated or mixed-mode ventilated central core for reduced energy consumption, thermal comfort, climate change resilience, and to facilitate the transient and pedestrianised aims of the space; and,
- Acoustic design in both buildings to support their functions as training and teaching spaces and private staff areas.

5.2.3 Opportunities

In addition to the indoor environmental quality initiatives outlined above, the following initiatives are currently being explored:

- Breathable walls that improve local air quality for occupants, as well as provide an acoustic buffer to neighbouring residents;
- Responsible structural and finishing materials for reduced environmental impact and improved indoor environment quality;
- Common area lighting controlled by motion and/or daylight sensors to reduce the operation of artificial lighting when it is not required. Lighting power densities could also be reduced to below the NCC maximum values;
- Biophilic design (e.g. green walls, plants) to provide students and staff with a strong connection to nature, creating visible and functional green spaces; and,
- Adopting Green Star 'IEQ' credits across the development.

As design development progresses, the feasibility of implementing the above opportunities will be investigated further.

5.3 Energy

5.3.1 General Principles

Ineffective energy management can lead to unnecessary growth in greenhouse gas emissions and consumption of natural resources. An effective energy plan should aim to:

- Minimise energy consumption through good passive design;
- Maximise energy efficiency of systems; and,
- Consider green energy technologies.

5.3.2 Best Practice Initiatives

The following initiatives have been incorporated into the proposed design to enhance the energy efficiency of the proposed buildings. It is worth highlighting that many initiatives are currently being explored that go over and above the minimum requirements stated in the SEARs and Section J.

- NCC 2016 Section J minimum requirements (refer Section 4.1);
- Passive design principles; and,
- High performance building fabric.

5.3.2.1 Centre for Music & Drama: Passive Design Principles

In addition to the minimum energy efficiency performance requirements listed in Section J, the CMD building will consider passive design strategies where practical to reduce mechanical energy consumption, also

improving the indoor environmental quality and thermal comfort of occupants. The following strategies have been incorporated into the proposed design:

- Mixed mode ventilation (MMV) simulation (CFD) to help drive a comprehensive and successful passive design outcome;
- Ventilation for naturally ventilated/MMV spaces designed to benefit from prevailing winds whilst maintaining comfortable conditions;
- Adaptable building design that is climate responsive;
- Appliances with high energy ratings;
- Integrated shading devices which reduce solar heat gains to conditioned spaces;
- High performance building sealing for conditioned spaces (e.g. practice rooms, teaching spaces, staff areas); and,
- High efficiency glazing.

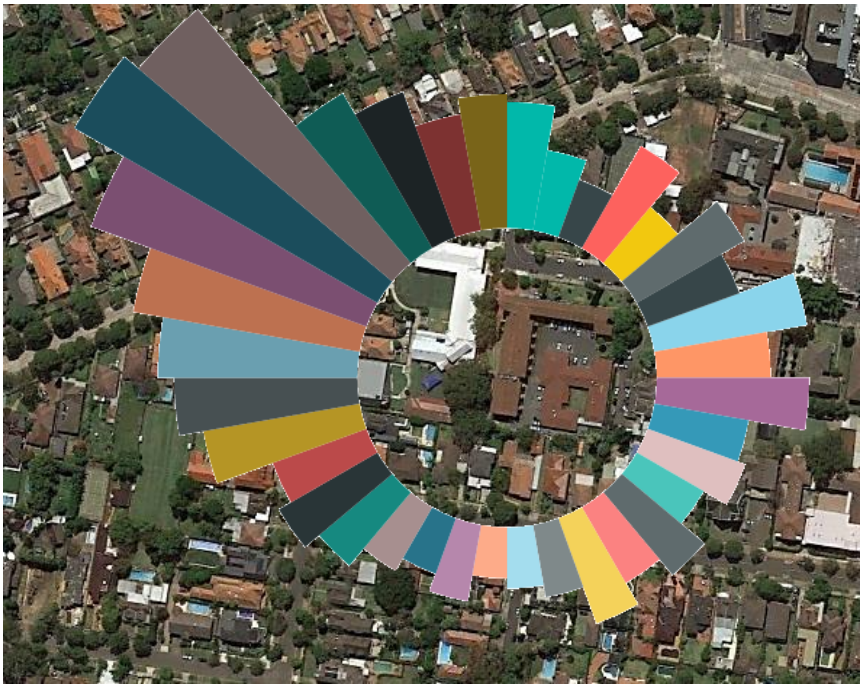

Figure 5: Prevailing winds for the CMD building.

The CMD building redevelopment spans a large area, and thus is susceptible to the urban heat island effect. To reduce these impacts, the following passive design principles have been incorporated into the proposed design:

- Solar PV incorporated on roof spaces, minimising solar radiation being absorbed and re-radiated to the building below; and,
- Landscaping incorporating native species to improve air quality and reduce the urban heat island effect, whilst minimising water required for irrigation.

5.3.2.2 Administration & Student Centre: High Performance Building

The ASC design will focus on a highly-sealed envelope to drive energy efficiency, while also improving occupant health and wellbeing within the space through a controlled internal environment. The following design strategies have been incorporated into the proposed design:

- High performance building fabric, including high performance glazing;
- Effective shading to further support comfortable and low-energy indoor environment quality;
- Solar hot water incorporated on roof spaces, to reduce grid-based energy demand and therefore Greenhouse Gas Emissions impacts; and minimising solar radiation being absorbed and re-radiated to the building below;
- Appliances with high energy ratings; and,
- Energy-efficient lighting (typically LED) will be provided throughout, and high efficiency heating and cooling.

5.3.3 Opportunities

In addition to the best practice initiatives above, further energy efficiency improvements for the Meriden School development could be achieved by implementing additional initiatives that are currently being explored, in particular:

- Minimising up-lighting from external light fittings unless for a specific purpose;
- Lighting controlled by motion and/or daylight sensors to reduce the operation of artificial lighting when it is not required;
- Lighting power densities reduced to below the NCC maximum values;
- Maximise the roof mounted solar photovoltaic (PV) system to the available roof space;
- Battery storage to support a pathway towards Net Zero emissions from electricity;
- Building integrated photovoltaics (BIPV), including for windows or ceiling tiles;
- Phase change ceiling tiles for high thermal mass, which contributes to reduced peak loads and reduced demand for building cooling;
- New and renovated roofs with Solar Absorptance values of <0.45;
- Utilisation of tempered spill air from adjacent spaces where possible to provide free cooling;
- Adoption of minimum targets energy efficiency of appliances (Air conditioners, TVs, fridges) to make energy efficiency one of the selection requirements. Major appliances to be within 1 star of the best available energy star rating label for the appliance type and size;
- Higher levels of thermal insulation than required under the National Construction Code (NCC);
- Energy efficient lift system, incorporating VVVF drives, occupancy sensing, LED lighting and reduced standby power consumption;
- Climate and Seasonal Adaptive comfort controls with an expanded temperature range based on outdoor temperature could be applied to spaces where there is not a requirement for precise temperature control; and,
- Adopting Green Star 'energy' credits across the development.

As design development progresses, the feasibility of implementing the above opportunities will be investigated further.

5.4 Transport

5.4.1 General Principles

Sustainable transport has a role in encouraging healthier active transport options while also decreasing greenhouse gas emissions from transport.

5.4.2 Best Practice Initiatives

The following initiatives have been incorporated into the proposed design to improve sustainable transport options:

- Meriden School is highly connected to public transport – less than a 10 minute walk to Strathfield train and bus station;
- The School is well-located, being in close-proximity to amenities (e.g. gyms, pools, retail centres, ATMs etc) at Strathfield Plaza and surrounds;
- To encourage active and public transport, no additional car parking for staff or students is provided to the development; and,
- The CMD building is the meeting point of several pedestrian corridors. As such, the design supports a highly-circulatory and transient environment with large openings to the outdoors and joining buildings, internal voids for connectivity, and a feature staircase.

5.4.3 Opportunities

Due to the fixed location of the school and immediate proximity to central public transport hubs, there are limited opportunities to increase the school's connectivity to public transport.

5.5 Water

5.5.1 General Principles

Ineffective management of water use can lead to unnecessary potable water consumption. An effective water management plan should aim to:

- Reduce consumption by focusing on efficiency of major uses (hydraulic fittings and fixtures, landscape irrigation, and HVAC);
- Incorporate appropriate building management systems to reduce leakage; and,
- Reduce consumption by encouraging a change in user behaviour.

5.5.2 Best Practice Initiatives

The following initiatives have been incorporated into the proposed design to enhance the water efficiency of the proposed development and reduce potable water consumption associated with the above major uses.

5.5.2.1 Fixtures & Fittings

Water sanitary fittings and fixtures are expected to account for a large portion of water use for the Meriden School development. By selecting water efficient sanitary fittings and fixtures, potable water demand can be significantly reduced. In line with Green Star water efficiency benchmarks, all fittings and fixtures installed by the project will aim to be within one star of the proposed WELS ratings in Table 2 below.

Table 2: WELS rated fittings and fixtures as per the Green Star (Design & As Built v1.2) Potable Water credit

Fittings and Fixtures	Standard Practice Benchmark	Proposed WELS Rating
Taps	4 Star (7.5 L/min)	6 Star (4.5 L/min)
WC	3 Star (4 L/Flush)	5 Star (3L/Flush)
Urinals	3 Star (2 L/min)	6 Star (1 L/min)
Showers	3 Star (9 L/min)	3 Star (<=6 L/min)

5.5.2.2 Rainwater Harvesting

After water demand has been reduced, water supply will be addressed through a water reuse system which will reduce potable water utilisation. Rainwater will be collected from the roof, stored, and used throughout the Meriden School development. The rainwater re-use strategy (e.g. potential for use in landscaping irrigation, toilet and urinal flushing) and sizing will be further developed during the detailed design phase.

Figure 6: Rainwater harvesting system for landscape irrigation

5.5.3 Opportunities

The following initiatives will be considered during the design development stage to significantly reduce potable water consumption:

- Motion sensor taps;
- Water meters installed to assist with monitoring and detection of leaks or excessive consumption;
- Adopt a minimum water efficiency target for dishwashers and washing machines;
- Develop a water management plan for post-occupancy monitoring and provide a platform to allow the facilities manager to identify leaks and water inefficiencies;
- Incorporate water wise landscaping principles, including using xeriscape (draught tolerant species) landscaping, and/or irrigation with non-potable water, sub-soil dripper irrigation and moisture sensors;
- Trigger hoses and recycled water connections for any wash-down areas; and,
- Adopting Green Star 'water' credits across the development.

As design development progresses, the feasibility of implementing the above opportunities will be investigated further.

5.6 Materials

5.6.1 General Principles

The construction sector is a significant contributor to greenhouse gas emissions and climate change. Building construction should aim to reduce the natural resources consumption and environmental impacts resulting from the manufacture and procurement of materials, and waste impacts from demolition and construction.

5.6.2 Best Practice Initiatives

To raise the level of sustainability for the project regarding material use, the following initiatives have been incorporated into the proposed design:

- A significant portion of construction waste generated from the demolition of the existing buildings (and other minor alterations to surrounding buildings including the Hope Turner building) will be reused or recycled, to limit the amount of waste going to landfill;
- Low-VOC and low- or no-formaldehyde products specified where possible to improve the indoor environment quality for users; and,
- Reduced materials strategies such as exposed services or prefabricated components to reduce material consumption.

5.6.3 Opportunities

The following initiatives should be considered during the design development stage to significantly reduce consumption of natural resources and the generation of waste:

- The Meriden School could consider targets to reduce:
    - The Portland Cement content of concrete;
    - The use of potable water used in concrete mix water; and,
    - The use of aggregate in concrete mixes, substituted with alternative materials.
- Where possible, products and materials procured for the development should come from a local source, contain a low embodied energy content, or be selected for their product transparency and sustainability (e.g. reused or recycled products, or those with third-party environmental certifications); and,
- Adopting Green Star 'materials' credits across the development.

As design development progresses, the feasibility of implementing the above opportunities will be investigated further.

5.7 Land Use & Ecology

5.7.1 General Principles

Building developments can lead to unnecessary growth in local temperatures (referred to as the 'urban heat island effect') and loss of ecology and biodiversity. An effective building design should aim to:

- Improve the ecological value of the site;
- Reuse land or improve previously contaminated land; and,
- Select building materials and include site elements that reduce heat absorption from the sun.

5.7.2 Best Practice Initiatives

The following initiatives have been incorporated into the proposed design to reduce negative impacts on the site's ecological value.

5.7.2.1 Urban Heat Island Effect

The project will look to utilise roofing materials that have a high Solar Reflectance Index (SRI) value to reduce the heat absorption from the sun and therefore reduce the impact on mechanical HVAC systems. In addition, increasing landscaped areas that incorporate native trees and flora will provide shade and visual interest as well as reduce the urban heat island effect.

The project will reduce surface heat absorption through the incorporation of some, or all, of the following:

- Natural shading provided by building overhangs or landscaping;
- Minimisation of hardscaping where possible and the utilisation of paving that has a high SRI; and,
- Incorporation of architectural shade features with a high SRI.

5.7.3 Opportunities

The following initiatives should be considered during the design development stage to significantly reduce impacts to land use and ecology:

- Utilisation of open grid pavement systems that can accommodate vegetation in open cells;
- Water features incorporated into the design for visual interest and increased comfort (internal or external) through the cooling effect of water;
- Biophilic design (e.g. green walls, plants) to provide students and staff with a strong connection to nature, creating visible and functional green spaces;
- Incorporate water wise landscaping principles, including using xeriscape (draught tolerant species) landscaping for improved ecology and biodiversity at the site; and,
- Adopting Green Star 'land use & ecology' credits across the development.

As design development progresses, the feasibility of implementing the above opportunities will be investigated further.

5.8 Emissions

5.8.1 General Principles

In any new development there is a risk that the project will generate negative impacts including:

- Light pollution;
- Pollutants in stormwater runoff;
- Environmental damage from refrigerant leaks; and,
- Harmful microbes in cooling systems.

5.8.2 Best Practice Initiatives

The following initiatives have been incorporated into the proposed design to reduce harmful emissions from the site, including but not limited to:

- Landscaping and rainwater harvesting to support Water Sensitive Urban Design and limit stormwater pollutants leaving the site; and,
- High-efficiency lighting and appropriate lighting zoning to reduce light pollution.

5.8.3 Opportunities

The following initiatives should be considered during the design development stage to significantly reduce impacts from pollutants:

- All refrigerants in fridges, HVAC or other sources of refrigerants to have an ozone depletion potential of zero, and a global warming potential of <10;
- External lighting to be designed such that the Upward Light output Ratio (ULOR) <5%;
- Use of awnings to block light pollution to neighbours and the night sky;
- Water detention or infiltration to native soils for management of stormwater peak flows;
- All heat-rejection systems to be waterless to eliminate risk of Legionella; and,
- Adopting Green Star 'emissions' credits across the development.

As design development progresses, the feasibility of implementing the above opportunities will be investigated further.

5.9 Innovations

The proposed development will focus on exceeding minimum building requirements, incorporating innovative technologies, and exceeding Green Star benchmarks. Specific strategies for Innovation will be explored further in the detailed design phase.

6 CONCLUSION

This report identifies the sustainability measures being pursued or investigated by the project team, demonstrating how the project-specific SEARs for Ecologically Sustainable Development have been addressed.

The proposed design for the Meriden School Development incorporates sustainability measures that have far reaching benefits from the perspective of energy, water and waste reduction; as well as providing good indoor environment quality, thermal comfort and visual comfort. These are expected to have a positive impact on the health and wellbeing of the students and staff occupying the building.

APPENDIX A: GREEN STAR DESIGN & AS BUILT V1.2 – 5 STAR 'IN PRINCIPLE' PATHWAY

Credit	Initiative	Pts
Management		**10**
01	**Accredited Professional:** engaged to provide support and advice on ESD matters.	1
02	**Commissioning and Tuning:** commissioning, handover and tuning initiatives to maximise potential of building services.	1
03	**Adaptation and Resilience:** building design adapted for climate change resilience.	2
04	**Building Information:** building information that facilitates operator and user understanding of building systems and their operation and maintenance.	1
05	**Commitment to Performance:** environmental building performance targets and monitoring strategies.	2
06	**Metering and Monitoring:** energy and water metering and monitoring systems.	1
07	**Responsible Construction Practices:** construction practices that manage environmental impacts, enhance staff health and wellbeing, and improve sustainability knowledge on site.	1
08	**Operational Waste:** waste management plans that facilitate the re-use, upcycling, or conversion of waste into energy.	1
Indoor Environment Quality		**10**
09	**Indoor Air Quality:** high indoor air quality provided for building occupants.	4
10	**Acoustic Comfort:** appropriate and comfortable acoustic conditions are provided for building occupants.	1
11	**Lighting Comfort:** well-lit spaces to minimise glare and maximise visual interest.	1
12	**Visual Comfort:** well-lit spaces for visual comfort.	2
13	**Indoor Pollutants:** reduced internal air pollutant levels for occupant health.	2
Energy		**12**
15	**Greenhouse Gas Emissions:** energy efficient buildings and the reduction of greenhouse gas emissions associated with the use of energy in building operations.	10
16	**Peak Electricity Demand Reduction:** reduction of peak demand load on the electricity network infrastructure.	2
Transport		**4**
17	**Sustainable Transport:** design and operational measures to reduce carbon emissions arising from occupant travel to and from Meriden School.	4

Water		**3**
18	**Potable Water:** building design minimises potable water consumption in operations.	3
Materials		**8**
19	**Life Cycle Impacts – Concrete:** Portland cement content in all concrete reduced by replacing it with supplementary cementitious materials.	2
20	**Responsible Building Materials:** building materials are responsible sourced or have a sustainable supply chain.	3
21	**Sustainable Products:** a proportion of materials used in the project meet transparency and sustainability requirements.	2
22	**Construction and Demolition Waste:** construction waste going to landfill is reduced by reusing or recycling building materials.	1
Land Use & Ecology		**3**
23	**Ecological Value:** ecological value of the site is improved.	1
24	**Sustainable Sites:** sites are developed that have limited ecological value or are previously developed land.	1
25	**Heat Island Effect:** the contribution of the site to the 'heat island effect' is reduced.	1
Emissions		**3**
26	**Stormwater:** peak storm water and pollutant outflows from the site are minimised.	2
27	**Light Pollution:** lighting design minimises light pollution to neighbouring bodies and the night sky.	1
Innovation		**6**
	Innovative Technology	1
	Improving on Green Star Benchmarks	2
	Innovation Challenges	3

NORMAN DISNEY & YOUNG

CONSULTING ENGINEERS

NDY Management Pty Limited trading as Norman Disney & Young
ABN 29 003 234 571
60 Miller Street
North Sydney NSW 2060
Telephone: +61 2 9928-6800
Facsimile: +61 2 9955-6900

OFFICES

Australia:	Sydney, Melbourne, Brisbane, Perth, Canberra, Adelaide, Gold Coast
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NDY QA SYSTEM

Revision No:	1.1
Revision Date:	3 May 2019
Reason Description:	FINAL
File Location:	\\ndy.group\syd\W\S322xx\S32209\001\G-\24_Reports
Filename:	rp190430s0005
Client Name:	Allen Jack & Cottier Architects
Client Contact:	Anthony DiCristo
Project Leader:	Luke Williams
Editor:	Claudia Burbidge

Authorisation By: Kim Featherston

Verification By: Luke Williams

NDY Offices

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