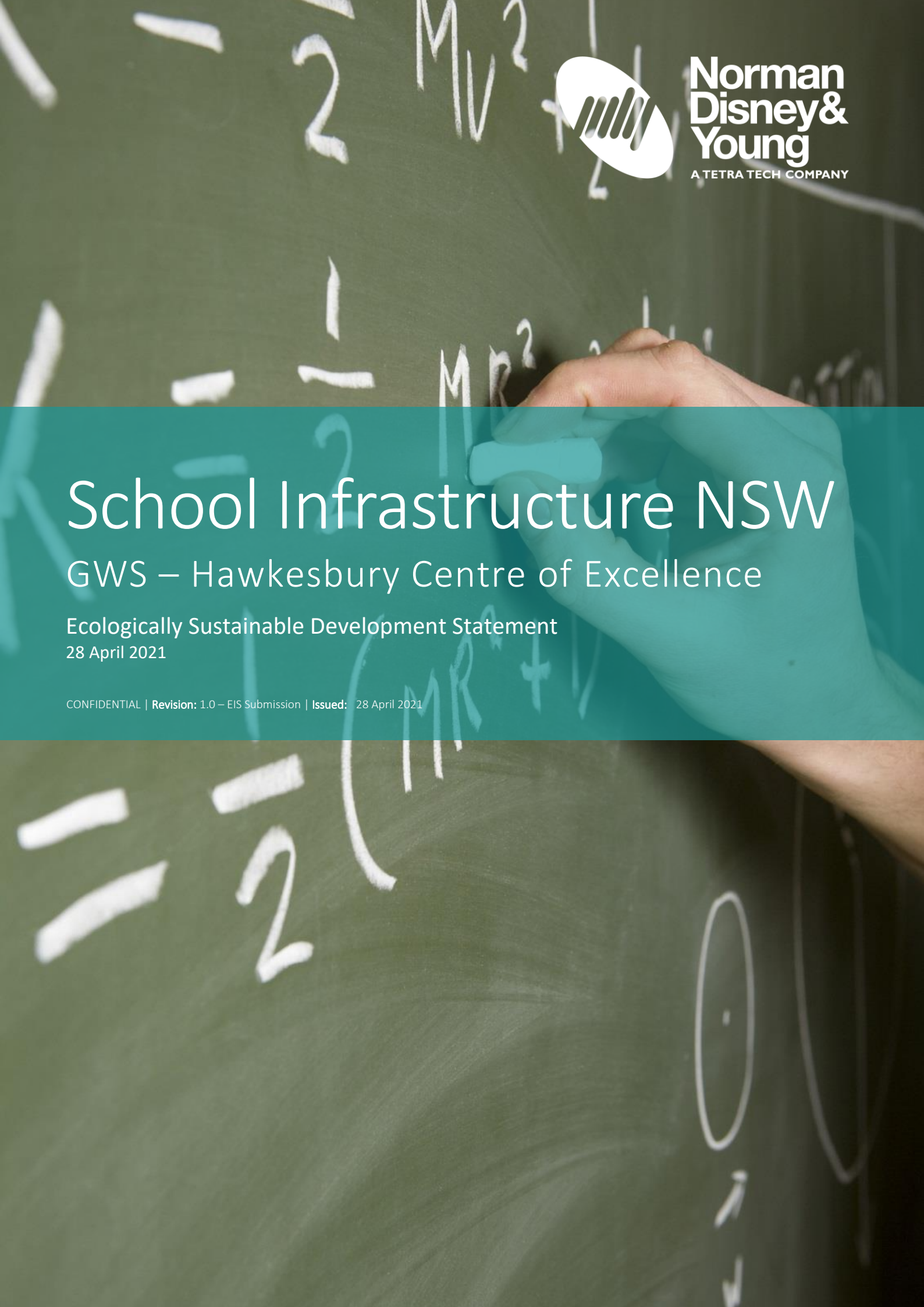

School Infrastructure NSW

GWS – Hawkesbury Centre of Excellence

Ecologically Sustainable Development Statement

28 April 2021

CONFIDENTIAL | **Revision:** 1.0 – EIS Submission | **Issued:** 28 April 2021

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1 EXECUTIVE SUMMARY

Norman Disney & Young a Tetra Tech company (NDY) has been engaged by Colliers (on behalf of School Infrastructure NSW, 'SINSW') to provide an Ecologically Sustainable Development (ESD) Statement for the proposed new Hawkesbury Centre of Excellence in Agricultural Education (HCoE) facility in Richmond, NSW.

The principal objective of this report is to address the minimum requirements set out in the following:

- *Secretary's Environmental Assessment Requirements* (SEARs) – SSD-15001460, Key Issues Part 5, "Ecologically Sustainable Development (ESD)"
- SINSW *Education Facilities Standard and Guidelines* (EFSG) – Design Guides
- Government Architect NSW (GANSW) *Design Guide for Schools* and *Environmental Design in Schools Manual*
- NSW Government Resource Efficiency Policy (GREP) 2019

The proposed HCoE development aims to go beyond minimum building requirements and provide a progressive sustainability outcome for the community. Through early design input from sustainability professionals, key initiatives incorporated in the proposed development include:

- Passive design elements to reduce the energy demand of the buildings in operation and improve indoor environment quality and thermal comfort for students and staff
- High performance façade and glazing, energy efficient lighting and air conditioning and solar PV system to reduce greenhouse gas emissions
- Preliminary consideration of the building design's resilience and adaptation to climate change impacts
- High indoor air quality, acoustic design principles, visual amenity and thermal comfort to support the site functions as training and teaching spaces and private staff areas
- Best practice waste management principles in operation, and construction and demolition waste diversion from landfill
- Water efficient fixtures and fittings (high WELS ratings), and rainwater collection from the roof and stored for use on-site (landscaping irrigation, toilet flushing) to reduce potable water consumption

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 operational phase.

The proposed development has been benchmarked using the Green Star Design & As-Built v1.3 tool, in line with a 4 Star outcome, although it is not currently formally registered. A formal 4 Star Green Star rating is deemed to represent an Australian Best Practice development.

Green Star 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), NABERS (efficient building in operation), Passive House (high performing façade & mechanical systems), as well as other sustainability frameworks.

2 PROJECT SUMMARY

2.1 Purpose of This Report

This Ecologically Sustainable Development (ESD) Statement has been prepared in accordance with *Secretary's Environmental Assessment Requirements* (SEARs) – SSD-15001460 – to detail the sustainability features of the proposed development.

2.2 Project Description

Hawkesbury Centre of Excellence in Agricultural Education (HCoE) is a proposed new agricultural college in Richmond, NSW. The site comprises eight new buildings:

- Block A – Administration
- Block B, C & D – Learning
- Block E – Dining / Conference Hall
- Block F – Accommodation
- Block G & H – Farming

The site is located at Vines Drive, Richmond and is under the jurisdiction of Hawkesbury City Council. The school is located within climate zone 6 – mild temperate conditions, which is associated with:

- High diurnal ranges inland and four distinct seasons
- Summer and winter that can exceed human comfort range, while spring and autumn are ideal for human comfort
- Mild to cool winters with low humidity
- Hot to very hot summers, with moderate humidity

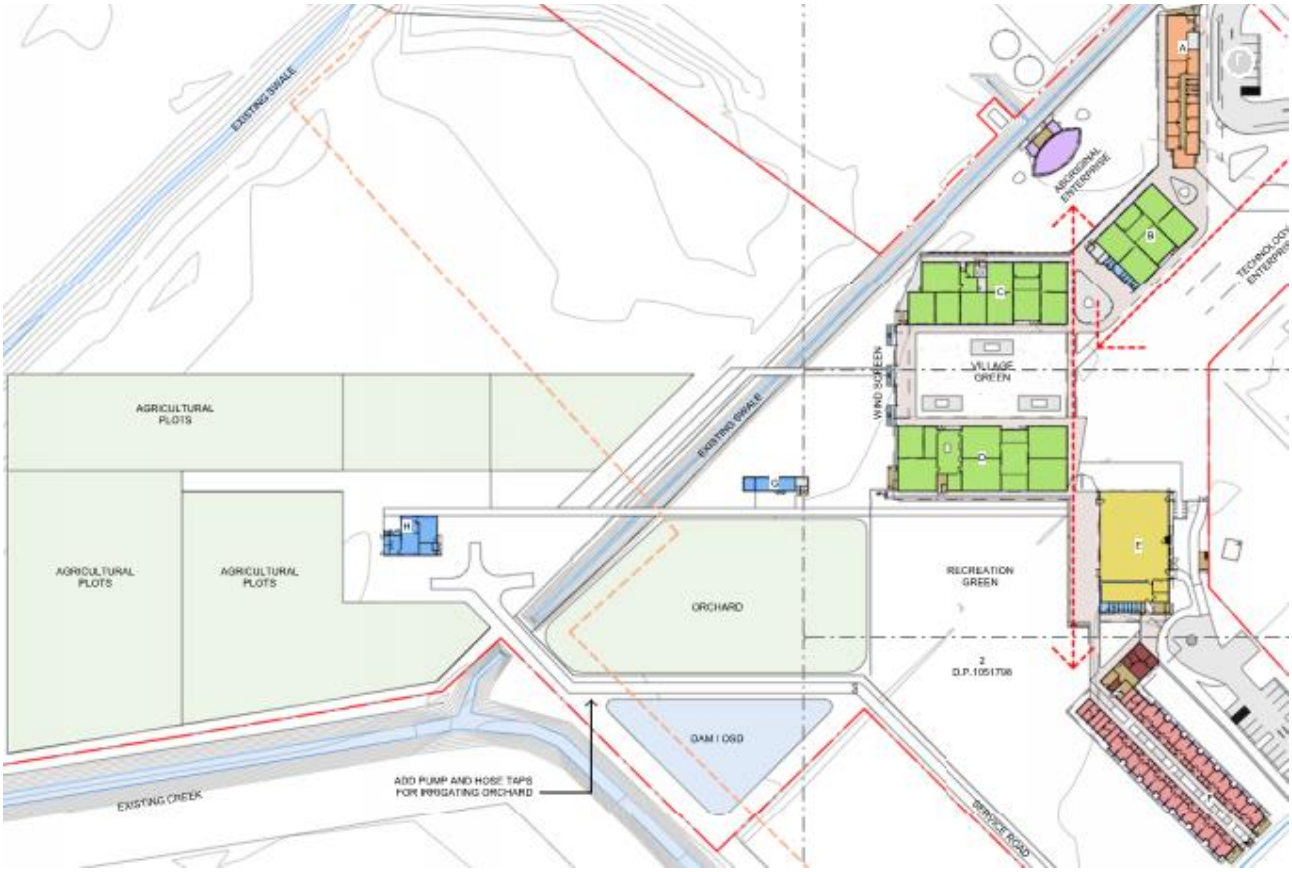


Figure 1 Proposed Site Plan

2.3 Information Sources

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

- Section 4.12(8) of the Environmental Planning and Assessment Act 1979
- Schedule 2 of the Environmental Planning and Assessment Regulation 2000
- Planning Secretary's Environmental Assessment Requirements – SSD-15001460
  - Key Issues, Part 5, "Ecologically Sustainable Development (ESD)"
- NSW Department of Education – School Infrastructure documents:
  - Education Facilities Standard and Guidelines (EFSG) – Design Guide
  - GANSW Design Guide for Schools
  - GANSW Environmental Design in Schools Manual
  - DfMA Guidelines
- NSW Government Resource Efficiency Policy (GREP) 2019
- NSW and ACT Government Regional Climate Modelling (NARCliM) climate change projections
- NCC Section J 2019
- Green Star Design & As Built v1.3 Submission Guidelines
- Architectural drawings prepared by NBRS Architecture
- Discussions and workshops with the design team.

2.4 Revision History

Table 1 Revision History

Revision	Date	Reason for Issue
0.1	09/04/2021	Draft for Review
1.0	28/04/2021	EIS Submission

3 SEARS COMPLIANCE SUMMARY

Sustainability principles are embedded in the proposed HCoE design. Outcomes of the sustainability principles will include energy and water efficiency, resilience to future climate impacts, high indoor environment quality, materials selection, and comfort and wellbeing for staff and students occupying the facilities.

Table 2 addresses how the project's specific sustainability initiatives satisfy the relevant SEARs for ESD, the GANSW Environmental Design in Schools requirements, and the EFSG requirements. Refer to Section 5 for a detailed breakdown of ESD initiatives in the proposed development.

Table 2: Compliance summary

ESD Requirement	Proposed Compliance Strategy	Compliance
SEARS 1. Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Regulation) would be incorporated in the design and ongoing operation phases of the development.	*The Precautionary Principle* The design has been reviewed against holistic sustainability principles to ensure a high ecologically sustainable design (ESD) outcome is achieved. Sustainability measures have been incorporated, spanning across the project's design, construction and operations, based around the core principles of: ▸ Efficient use of resources (energy, water and materials) ▸ Enhancing indoor environment quality and occupant comfort ▸ Minimising ecological impacts. A climate change risk assessment has been completed to assess the anticipated impacts of climate change and implement design strategies to mitigate these impacts. *Inter-Generational Equity* Student and staff health will be considered through the incorporation of Indoor Environmental Quality design features such as daylight and glare analysis for natural lighting, best-practice lighting, indoor air quality, thermal comfort assessment, acoustic design, and responsible material selection to reduce internal pollutants and resource depletion for future generations. *Conservation of Biological Diversity & Ecology* The proposed design will consider design strategies to minimise the urban heat island effect and improve ecological value of the site. Access to views will be considered to increase student engagement with the natural environment. *Improved Valuation, Pricing and Incentive Mechanisms* Total cost of operation will be reduced through sustainable considerations to reduce energy, water and waste requirements, taking into consideration whole-of-life costing. The project will ensure sustainable principles are extended to include value for money, fit for purpose, long term reliability/resilience and flexibility. Designing with the long-term operation of the building in mind will create further buy in and cooperation from the operating stakeholders. Strategies to reduce operational waste will be considered such as the development of an operational waste management plan and separation of waste streams.	✓ ✓ ✓ ✓
SEARS 2. Detail proposed measures to minimise consumption of resources, water (including water sensitive urban design) and energy.	Refer to the *Energy*, *Water* and *Emissions* sections in Item 3 below.	✓

ESD Requirement	Proposed Compliance Strategy	Compliance
SEARS 3. Detail how the future development would be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on a materiality assessment and include waste reduction design measures, future proofing, use of sustainable and low-carbon materials, energy and water efficient design (including water sensitive urban design) and technology and use of renewable energy.	The development has been designed in line with the following sustainability frameworks: ▸ Benchmarked against a 4 Star Green Star 'in principle' rating, corresponding to an Australian *Best Practice* Development ▸ EFSG strategy aligned with the current Schedule v8. 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 design and its resilience to climate change impacts, commissioning and tuning, metering and monitoring to capture consumption trends, building information to facilitate operator understanding, and separation of waste streams (e.g. to facilitate reuse, recycling, composting and overall reduction of waste to landfill). ▸ Indoor Environment Quality: passive design analysis in early design phase, preliminary daylight and glare analysis for natural lighting, energy-efficient best-practice lighting, thermal comfort assessment, acoustic design, and responsible material selection to reduce indoor pollutants. ▸ Energy: the building will comply with NCC 2019 Section J minimum requirements, passive design features including high performing building fabric and integrated shading to reduce mechanical energy consumption, high efficiency air conditioning and LED lighting, climate projections analysed to support an adaptable and climate responsive design, solar PV on roof spaces to reduce grid energy consumption, high performance building sealing, and minimum energy efficiency targets for appliances. ▸ Transport: to encourage active and public transport, bicycle parking for staff and students as well as change facilities for staff are provided to the development. ▸ Water: selection of water efficient sanitary fixtures, fittings (high WELS ratings), and appliances, water meters installed for monitoring, waterwise landscaping principles, and rainwater collection from the roof and stored for use on-site. ▸ Materials: a significant portion of construction waste generated from the demolition works 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. Low-carbon products and materials to be specified. ▸ Land Use & Ecology: proposed design will include light-coloured roof, integrated shading and overhangs, landscaping, and the minimization of hardscaping where possible to minimise the urban heat island effect and improve ecological value of the site. ▸ 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 light 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 the HCoE site. Refer to Appendix 8.1 for an indicative Green Star Design & As-Built v1.3 scorecard prepared for the project.	✓ ✓ ✓ ✓ ✓ ✓ ✓

ESD Requirement	Proposed Compliance Strategy	Compliance
SEARS 4. Detail how environmental design will be achieved in accordance with the GANSW Environmental Design in Schools Manual (GANSW, 2018).	Refer to Item 8 below.	✓
SEARS 5. Provide an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.	The HCoE development has been benchmarked against a 4 Star Green Star 'in principle' rating. Refer to Appendix 8.1 for an indicative Green Star Design & As-Built v1.3 scorecard.	✓
SEARS 6. Provide a statement regarding how the design of the development is responsive to the NARCliM projected impacts of climate change.	NDY has been engaged to assess the projected impacts of climate change on the proposed development, based on predicted climate change models. This engagement included a Climate Adaptation Workshop and risk assessment undertaken as per AS 5334-2013 and Green Star Design & As Built v1.3 requirements. Expected impacts from climate change were identified with reference made to both CSIRO projections for the East Coast (South) sub-cluster and the NSW Government's NSW and ACT Regional Climate Modelling (NARCliM) projections. Refer to Section 6 and Appendix 8.3 for details.	✓
SEARS 7. Provide 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.	By others.	By others.
GANSW Design Guide for Schools and GANSW Environmental Design in Schools Manual 8. The GANSW Design Guide for Schools and the Environmental Design in Schools Manual address the environmental and passive design elements in schools, including those related to: ▸ Context, built form and landscape ▸ Sustainable, efficient and durable ▸ Accessible and inclusive ▸ Health and safety ▸ Amenity ▸ Whole of life, flexible and adaptive Aesthetics.	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 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 are designed with inclusivity and accessibility in mind 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 support the development's aims to reduce impact on natural resources, whilst maintaining a flexible and adaptive design.	✓

ESD Requirement	Proposed Compliance Strategy	Compliance
Schools Infrastructure NSW: Educational Facilities Standard Guidelines (EFSG) and City of Sydney's Sustainable Design Technical Guidelines (SDTG) 9. The ESD consultant will be responsible for delivering their scope of services in accordance with EFSG and SDTG sustainability requirements.	NDY as ESD consultants have been actively engaged on the project from schematic design. The ESD principles embedded in the proposed design generally satisfy the sustainable design elements in the EFSG. Refer to Appendix 8.2 for the full EFSG ESD schedule outlining all EFSG requirements and additional commentary.	Refer to Appendix 8.2

4 SUSTAINABILITY FRAMEWORKS & LEGISLATION

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

4.1 NCC 2019 – 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. Section J of the NCC Volume 1 2019 sets out the minimum energy efficiency requirements for all commercial buildings in Australia.

There are 6 Deemed-to-Satisfy subsections, focusing on different aspects of energy efficiency as follows:

- J1 - Building Fabric (i.e. the ability of the roof, walls and floor to resist heat transfer)
- J3- Building Sealing (i.e. how well parts of a building are sealed to ensure comfortable indoor environments are efficiently maintained)
- J5 - Air Conditioning and Ventilation Systems (i.e. the efficiency and energy saving features of heating, ventilation and air-conditioning systems)
- J6 - Artificial Lighting and Power (i.e. power allowances for lighting and electric power saving features)
- J7 - Hot Water Supply and Swimming Pool and Spa Pool Plant (i.e. the efficiency and energy saving features of hot water supply)
- J8 – Facilities for Energy Monitoring (i.e. access to certain energy efficiency equipment for maintenance purposes)

The HCoE development will achieve compliance with NCC 2019 Section J either through DTS Provisions, or a JV3 Performance Solution.

4.2 Educational Facility Standards and Guidelines (EFSG)

The Educational Facilities Standards and Guidelines (EFSG) are intended to assist those responsible for the management, planning, design, construction and maintenance of new and refurbished school facilities. The EFSG is a suite of information compiled into Design Guides to aid in the planning, design and use of NSW Department of Education school facilities. The guides aim to provide functional and durable facilities within a systematic whole of life, value for money framework that takes into account enhancement of learning and teaching, planning and development, sustainability and facilities management.

4.3 SINSW Design for Manufacture & Assembly (DfMA) Guidelines

Design for Manufacture and Assembly (DfMA) is a design approach that focuses on ease of manufacture and efficiency of assembly. DfMA principles can lead to reduced manufacturing time, reduced material wastage and lower construction costs.

The SINSW DfMA guidelines have been developed to describe the drivers, principles, system and performance criteria of the DfMA system in an aim to enable the application of DfMA principles to schools projects across NSW.

4.4 NSW Government Resource Efficiency Policy (GREP)

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

4.5 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.

4.6 Government Architect NSW Environmental Design Guide for Schools

The Government Architect NSW (GANSW) released an Environmental Design in Schools Manual which illustrates a set of design principles as guidelines to follow for new development and expansion of schools. The design principles from the GANSW Design Guide for Schools include:

- Context, Built Form and Landscape
- Sustainable, Efficient and Durable
- Accessible and Inclusive
- Health & Safety
- Amenity
- Whole of Life, Flexible and Adaptive
- Aesthetics

4.7 SEARs & Environmental Planning and Assessment Regulation 2000

Environmental Planning and Assessment Regulation 2000 is a planning tool that captures NSW legislation relating to planning. Schedule 2 of the act calls for an Environmental Impact statement to be provided with to planning authorities that addresses project specific Secretary's Environmental Assessment Requirements (SEARs).

Refer to Section 3 of this report for details.

5 SUSTAINABILITY INITIATIVES

The proposed HCoE development aims 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 operational phase.

To address the SEARs requirement for ESD, the design intent of the proposed HCoE development has been benchmarked against the GBCA's Green Star Design and As Built v1.3 rating tool.

The following sub-sections (5.1 to 5.9) outline the initiatives incorporated into the proposed development in line with the EFSG and Green Star categories and credits. Refer to Appendix 8.1 and 8.2 for the detailed schedules outlining specific sustainability initiatives proposed for the project, including:

- Green Star Design & As-Built v1.3 'In Principle' Pathway
- EFSG ESD Schedule
- Schedule Highlighting Crossover Between SINSW Requirements & Green Star D&AB v1.3

Under each sub-category, the initiatives already incorporated into the design, and additional opportunities identified for further investigation have been outlined. These will be refined through further investigation in design development.

The Green Star pathway, and associated relevant design details, will be incorporated into project contract documentation. The head contractor will ultimately be responsible for ensuring this design potential is realised, and if any credits become unsuitable throughout the course of the project, the head contractor will be required to adopt additional initiatives such that equivalence with a 4 Star Green Star design standard is maintained.

5.1 Management

5.1.1 General Principles

Good management - adopted from design phase, construction and through to building operation - should 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
- Commitments to performance (e.g. reducing 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 development to assess how the proposed design is responsive to future climate impacts by undertaking a climate change risk assessment
- A Climate Adaptation Plan developed for the building to address specific climate risks of the design and how they might be mitigated to reduce risk
- Adopting Green Star 'management' credits across the development where feasible.

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.
- SINSW Commissioning and Temporary Schools Program reviews process to assist in advising, monitoring, and verifying the commissioning and tuning of the nominated building systems throughout the design, tender, construction, commissioning and tuning phases
- 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 development and a system in place to measure results, for reduction of energy and water consumption
- Development of an operational waste management plan (OWMP) and incorporation of OWMP principles into the design, including separation of waste streams (e.g. paper, cardboard, glass, plastics, toner cartridges, batteries, organics etc.) to facilitate reuse, recycling, composting, and overall waste reduction
- Waste management plans for demolition, construction and operation of the site. The plans should set targets to divert demolition and construction waste from landfill.

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)
- Thermal comfort
- Responsible materials selections to reduce indoor pollutants

5.2.2 Best Practice Initiatives

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

- Passive design principles have been incorporated in the design, including high-performance building envelope, effective shading, and natural ventilation openings to support comfortable and low-energy indoor environment quality
- Preliminary Daylight Analysis to assess the level of natural lighting received in internal spaces, to further support high levels of daylight for building occupants as design progresses
- Energy-efficient best-practice lighting (typically LED) will be provided to improve lighting comfort
- High efficiency heating and cooling to improve thermal comfort
- Acoustic design to support the building's function as training, teaching and multi-purpose spaces for students, staff and community use.
- Adopting Green Star 'IEQ' credits across the development where feasible.

5.2.3 Opportunities

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

- 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
- Responsible materials for reduced environmental impact and improved indoor environment quality

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
- 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 building. It is worth highlighting that many initiatives are currently being explored that go over and above the minimum requirements stated in the SEARs, EFSG and Section J.

- Exceeding NCC 2019 Section J minimum deemed-to-satisfy (DtS) requirements. The EFSG Section DG02.03 requires the development to target a 10% reduction in energy consumption, in comparison to a minimum NCC 2019 DtS compliant building, excluding any contribution from renewable energy (e.g. rooftop solar PV). Final improvement will be demonstrated via energy modelling in detailed design, however specific provisions currently include:
  - Exceeding the minimum building envelope R-values of Section J1.3, J1.5 & J1.6 where feasible
  - Improving on the glazing performance requirements of Section J1.5
  - Improving on the maximum illumination power densities of Section J6.2
- Effective shading devices which reduce solar heat gains to conditioned spaces
- High performance building sealing for conditioned spaces
- High performance building fabric, including high performance glazing
- Energy-efficient lighting (typically LED) will be provided throughout, and high efficiency heating and cooling
- Roof mounted solar photovoltaic (PV) system in accordance with EFSG requirements
- Adopting Green Star ‘energy’ credits across the development where feasible.

5.3.3 Opportunities

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

- Adoption of minimum targets energy efficiency of appliances (air conditioners, TVs, fridges, computers) to make energy efficiency one of the selection requirements. Major appliances to be within one star of the highest available at the time of purchase
- Adaptable building design that is climate responsive
- Lighting controlled by motion and/or daylight sensors to reduce the operation of artificial lighting when it is not required.

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:

- Traffic engineer has been engaged to carry out a transport assessment in line with the SINSW requirements
- To encourage active and public transport, bicycle parking for staff and students as well as change facilities for staff are provided to the development.

The site's transport plan will be carried out in accordance with the SINSW transport assessment process, which is guided by the following 8 principles:

- Students achieve daily physical activity requirements through active travel to school
- Prioritise multi-modal transport planning and infrastructure provision to school
- Consult with transport stakeholders early and regularly
- Install supporting infrastructure to the school and on-site
- Minimise traffic disruption to the school and community during construction
- Implement and commit to a visible, funded, feasible Travel Plan
- Monitor and evaluate the School Transport Plan process to revise and improve the process to achieve outcomes
- Increase consistency and quality of deliverables

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
- Reduce consumption by encouraging a change in user behavior.

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:

- Selection of water efficient sanitary fittings and fixtures, refer to Section 5.5.2.1
- Rainwater harvesting and water reuse system (toilets, landscaping), refer to Section 5.5.2.2
- No water-based heat rejection systems for air conditioning (cooling towers)
- Adopting Green Star 'water' credits across the development where feasible.

5.5.2.1 FIXTURES & FITTINGS

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

Table 3: WELS rated fittings and fixtures as per the Green Star (Design & As Built v1.3) Potable Water credit

Fittings and Fixtures	Standard Practice Benchmark	Proposed WELS Rating
Taps	4 Star	5 Star
Showers	3 Star	3 Star
WC	3 Star	4 Star
Urinals	3 Star	5 Star
Dishwashers	3.5 Star	5 Star

5.5.2.2 RAINWATER HARVESTING

A rainwater reuse system will reduce potable water consumption from the mains water supply. Recycled water tank is included in the design in accordance with the EFSG requirements. 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.

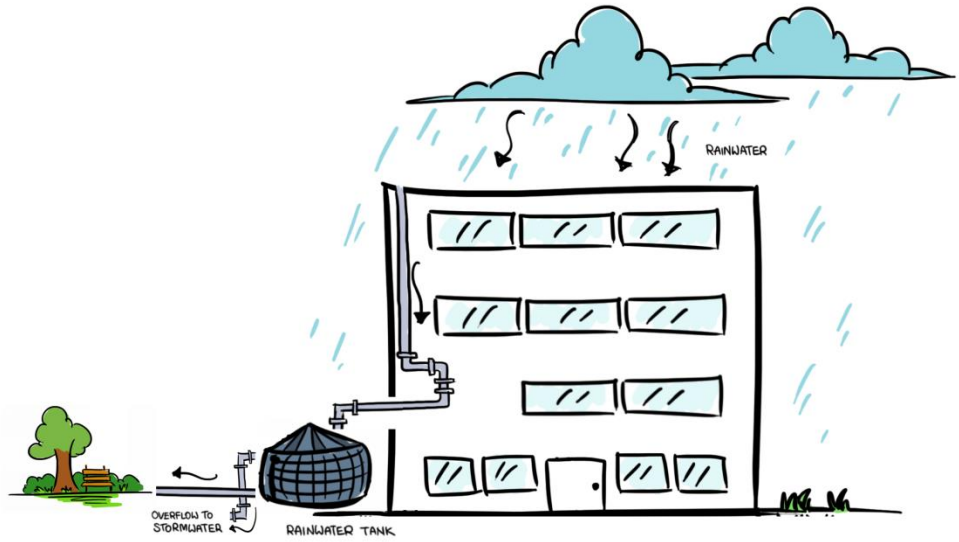


Figure 2: Rainwater harvesting system for landscape irrigation

5.5.3 Opportunities

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

- Motion sensor taps.
- Develop a water management plan for post-occupancy monitoring and provide a platform to allow the facilities manager to identify leaks and water inefficiencies
- Water wise landscaping principles incorporated, including using xeriscape (drought tolerant species) landscaping, and/or irrigation with non-potable water, sub-soil dripper irrigation and moisture sensors
- Water meters installed to assist with monitoring and detection of leaks or excessive consumption
- Trigger hoses and recycled water connections for any wash-down areas.

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. Materials selections can also impact health and wellbeing by reducing the source of indoor pollutants.

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 demolition 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
- Adopting Green Star 'materials' credits across the development where feasible.

5.6.3 Opportunities

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

- 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)
- Reduced materials strategies such as exposed services or prefabricated components to reduce material consumption.
- Select resistant materials to reduce wear and tear requiring replacement
- Selection of materials that are easily cleaned with low-toxicity cleaning products

5.7 Land Use & Ecology

5.7.1 General Principles

Building developments can lead to loss of ecology and biodiversity. The proposed development will limit its impact on the ecology and biodiversity by reusing land.

5.7.2 Best Practice Initiatives

To raise the level of sustainability for the project regarding ecology and biodiversity, the following initiatives have been incorporated into the proposed design:

- Selection of locally indigenous native planting where feasible
- Adopting Green Star 'land use & ecology' credits across the development where feasible

5.7.3 Opportunities

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

- Incorporate water wise landscaping principles, including using xeriscape (draught tolerant species) landscaping for improved ecology and biodiversity at the site
- The proposed design will consider design strategies to minimise the urban heat island effect and improve ecological value of the site
- Biophilic design (e.g. green walls, plants) to provide students and staff with a strong connection to nature, creating visible and functional green spaces.

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
- 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
- Appropriate lighting design to reduce light pollution
- All heat-rejection systems to be waterless to eliminate risk of Legionella (no cooling towers)
- Adopting Green Star 'emissions' credits across the development where feasible.

5.8.3 Opportunities

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

- Water detention or infiltration to native soils for management of stormwater peak flows.
- External lighting to be designed such that the Upward Light output Ratio (ULOR) <5%.
- Use of awnings to block light pollution to neighbors and the night sky.
- Stormwater treatments to reduce pollutants in water leaving the site
- On-site detention (OSD) tank or rainwater tank to reduce peak discharge to the sewer

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.

5.10 GANSW Design Guide for Schools and GANSW Design in Schools Manual

The GANSW Design Guide for Schools and Design in Schools Manual are documents prepared by the office of the Government Architect NSW and set out guidelines for ensuring high quality, well designed schools throughout NSW. The guide and manual act as a best practice manual to support the delivery of good school design, by highlighting the importance design plays in creating high quality education environments; Outlining good design principles, design considerations and key steps for effective design processes and key activities for good design outcomes.

The following highlights the key design principles as nominated in the GANSW guide and manual: Context, built Form and Landscape; Sustainable Efficient and Durable; Accessible and Inclusive; Health and Safety; Amenity; Whole of life, flexible and adaptive; Aesthetics.

The following summarises how these will be addressed by the project:

- 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

- Best practice lighting design and control that is suitable to the space and free from glare
- Reduced internal air pollutant levels (e.g. product and material selection)
- High quality levels of thermal comfort
- Consideration of the building design's resilience and adaptation to climate change impacts
- Passive design principles including consideration for building orientation and façade design to reduce energy consumption
- Maximise energy efficiency of systems

Refer to Section 3 of this report for details.

6 CLIMATE CHANGE RESILIENCE STATEMENT

The projected impacts of climate change on the proposed development have been assessed, based on predicted climate change models. A Climate Adaptation Workshop was held with all project stakeholders to:

- Identify and describe risks posed by climate change to the development and rate the consequences and likelihood of each.
- Identify and evaluate potential adaptation actions and/or design strategies to mitigate those risks which are deemed unacceptable

To facilitate this process, pre-workshop notes were provided to all stakeholders attending the workshop which consisted of the following parts:

- Climate change projections
- Consequence scale for the risk assessment
- Likelihood scale for the risk assessment.

A climate change risk assessment undertaken as per AS 5334-2013 and Green Star Design & As Built v1.3 requirements. Expected impacts from climate change were identified with reference made to both CSIRO projections for the East Coast (South) sub-cluster and the NSW Government's NSW and ACT Regional Climate Modelling (NARCliM) projections. The results showed the following:

- Extreme temperatures are projected to increase with very high confidence, and substantial increases in temperatures reached on hot days, as well as the frequency of hot days.
- Average temperatures will continue to increase in all seasons (very high confidence).
- Generally, less rainfall is expected in winter (medium confidence), but the intensity of extreme rainfall events is projected to increase (high confidence).
- There is high confidence that climate change will result in a harsher fire-weather climate in the future.
- Time spent in drought projected to increase (medium confidence) over the course of the century.

The design's responsivity to the above impacts was then assessed. The climate change risk analysis identified no 'High' or 'Extreme' risks due to climate change impacts after design elements were considered for this project. All risks, including existing controls, were identified as being either 'Low' or 'Medium'.

Several of these residual risks were selected and mitigation strategies were implemented into the building design to reduce these risks to increase building resilience to future climate change. Several operational risk mitigation strategies were also recommended.

Refer to Appendix 8.3 for the Climate Change Adaptation Workshop: Pre-Workshop Notes and Climate Change and Adaptation Report.

7 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, GANSW Environmental Design in Schools, and the Educational Facilities Standard Guidelines requirements have been addressed.

The proposed design for the HCoE 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.

8 APPENDICES

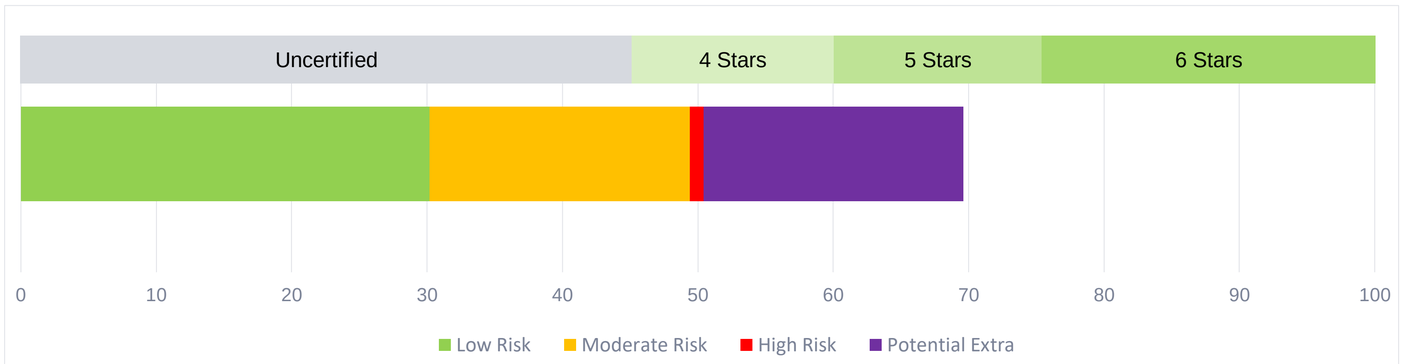
8.1 Green Star Design & As-Built v1.3 'In Principle' Pathway

Refer over.

Design & As Built v1.3 Scorecard

Project:	**Hawkesbury CoE**
Targeted Rating:	**4 Star - Best Practice**
Date:	**28.04.2021** **Rev5.0**

Core Points Available	Low Risk	Moderate Risk	High Risk	Potential Extra	Total Score Targeted
99	30.2	19.2	1.0	19.2	50.4



NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	Low Risk	Moderate Risk	High Risk	Potential Extra	Responsible Party	Comments
	Management				**14**						
	Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.0	Accredited Professional	1	1				NDY Sustainability	NDY engaged as GSAP. Submission requires meeting minutes showing involvement throughout.
	Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	-	Complies				Client / NDY Sustainability	Set and document operational environmental performance targets for the project (generally energy and water or waste consumption) in early design phase. Services design team to create an Owners Project Requirements (OPR) document that describes basic functions, operations, metering, and maintenance of the Nominated Building Systems, or adapt the services return brief to document. Generally aligned with EFSG requirements.
			2.1	Services and Maintainability Review	1	1				Services / Contractor / Client	Review of the design prior to construction for maintainability, commissionability, safety, and fitness-for-purpose by construction and operation-side stakeholders, with responses by relevant design team members. As per GBCA technical question R-14417, compliance can be achieved via the EFSG, provided that there is a process in place to verify that the project has been delivered as per the EFSG and that any issues identified have been rectified and any actions have been incorporated in the design intent report. It is recommended this is managed in internal SINSW commissioning team.
			2.2	Building Commissioning	1					Services / Contractor / ICA	
			2.3	Building Systems Tuning	1	1				Services / Contractor / Client	Minimum 12 month building tuning from occupancy with quarterly measurement and adjustments including warranty reviews. Building Tuning team to be created to undertake the process, including the Facilities Manager, Owners Representative, Commissioning Manager, Head Contractor and Services design team as required. To be managed by internal SI NSW Commissioning team.
			2.4	Independent Commissioning Agent	1		1			Client	SI NSW Commissioning team to be involved during design stages to assist with credit 2.1 and 2.3. This approach has been approved by the GBCA.
	Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2				NDY Sustainability	A climate change impact assessment to be undertaken by NDY, including facilitation of a workshop with the client and design team to review climate change adaptation and resilience measures which may be incorporated into the project. Generally aligned with EFSG requirements.
	Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Information	1	1				Contractor / Services / NDY Sustainability	Best Practice O&M Manuals to be developed by the Contractor (as defined under Green Star credit 4), and all services to provide input into the Building User Guide. Building Log Book to be developed by the Contractor in line with CIBSE TM31, covering all Nominated Building Systems, with systems description input by the design team. Building Log Book to be provided to the Building Owner prior to Practical Completion.
	Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	1	1				Client / NDY Sustainability	Building Owner to make a written internal commitment (policy, guideline, or environmental management plan) to at least 2 environmental performance targets (GHG emissions, Potable Water consumption, Operational Waste, Indoor Environment Quality). Commitment must include quarterly reporting to relevant stakeholders and must state the targets in units (e.g. kWh/m2, kg/CO2/m2, kL/m2). Energy and water are expected to be easiest to track and report on, although waste could also be considered. Generally aligned with EFSG and GREP requirements, though some additional prescriptive environmental reporting requirements are specified by the GREP. Note GREP requires reporting of energy, water AND waste (i.e. not just two of them)
			5.2	End of Life Waste Performance	1	1				Client / NDY Sustainability	Building Owner to make a written internal commitment (policy, guideline, or environmental management plan) to extend the life of the interior fitout or finishes to at least 10 yrs, barring minor wear and tear or minor repairs.
	Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	-					Services	
			6.1	Monitoring Systems	1					Services	
	Responsible Building Practices	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies				Contractor	Head contractor must develop and implement project specific best practice EMP meeting requirements of the NSW EMS Guidelines.
			7.1	Formalised Environmental Management System	1	1				Contractor	Contractor to hold and maintain a formalised Environmental Management System (EMS) independently certified to AS/NZS ISO 14001, BS 7750, or EMAS. Certification party must be an International Accreditation Forum member. Contractor to provide certification as part of tender submission. Auditing reports, including non-conformities and actions taken must be provided.
			7.2	High Quality Staff Support	1		1			Contractor	At least 3 issues (mental and physical) addressed through programs and policies. Sustainability training to site workers. Note that Needs-Analysis must be carried out by principal contractor
	Operational Waste	Performance Pathway	8A	Performance Pathway - Specialist Plan	1		1			Waste Consultant / Architect	Engage a qualified waste auditor to undertake a waste audit of the site to determine waste and recycling streams and generation rates, developing an Operational Waste Management Plan (OWMP) which is then implemented by the design team. Generally aligned with EFSG and GREP requirements, though some additional prescriptive requirements are specified by the EFSG . It is understood that OWMP will be developed in later stages of the project. Recommendations from this report will then need to be included in the building design.
			8B	Prescriptive Pathway - Facilities	-					Architect / NDY Sustainability	
	Total				**14**	**9**	**3**	**0**	**0**		
	Indoor Environment Quality				**17**						
☐	**Indoor Air Quality**	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1	1				Mechanical	Requires co-ordination from mechanical services and contractor regarding position of air intakes, design for ease of maintenance and cleaning (including FCUs) and ductwork to be cleaned prior to occupation. Entry of outdoor air pollutants is mitigated (as per ASHRAE Standard 62.1:2013) through minimum separation distances between pollution sources and outdoor air intakes. Generally aligned with EFSG requirements.
☐			9.2	Provision of Outdoor Air	2				1	Mechanical	Outdoor air provided at a rate of 50% (1pt) or 100% (2pts) greater than AS 1668.2:2012 minimum requirements for mechanical ventilation, or demand control ventilation strategy with CO2 sensors to maintain CO2 concentrations below 800ppm. This will generally be achieved by demand control ventilation - increased outside air rates are not feasible due to increased air conditioning load and energy consumption.
☐			9.3	Exhaust or Elimination of Pollutants	1		1			Mechanical	Relates to removing the source of pollutants (e.g. kitchen exhaust, printers) or exhausting pollutants directly to the outside. Provision for exhaust in printing/photocopying rooms. Each print room must achieve a minimum flow rate in accordance with AS1668.2-2012. Generally aligned with EFSG requirements.
☐	**Acoustic Comfort**	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1	1				Acoustic Consultant	Noise levels are designed to be suitable and relevant to the activity type. Ambient noise levels in primary and secondary spaces to be no more than 5dB(A) above the lower figure in Table 1 of AS/NZS 2107:2016. Generally aligned with EFSG requirements.
☐			10.2	Reverberation	1	1				Acoustic Consultant	Project to reduce the persistence of sound to a level suitable to the activity type within each space. Reverberation times in primary and secondary spaces to be below maximum stated in 'Recommended Reverberation Time' in Table 1 of AS/NZS 2107:2016. Generally aligned with EFSG requirements.
☐			10.3	Acoustic Separation	1				1	Acoustic Consultant	Project would need to addresses noise transmission between enclosed spaces, with requirements differing according to the space. Different requirements for Block F residential areas. Glazed operable walls have reduced requirements as per the approved TQ. Generally aligned with EFSG requirements. This requirement is satisfied in all areas except for the Block F residential areas. Block F acoustic separation is in accordance with NCC Part F5, however would require uplift to achieve Green Star requirements which is not currently proposed.
☐	**Lighting Comfort**	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort	-	Complies				Electrical / Architect	Primary and secondary spaces will have lighting that is flicker free and accurately address the perception of colour in the space. High frequency ballasts, electronic drivers with 12-bit or greater resolution (LED) and CRI of at least 80 for all luminaires.
☐			11.1	General Illuminance and Glare Reduction	1	1				Electrical / Architect	Glare from artificial lighting is eliminated and minimum lighting levels provided as per best practice general illuminance guidelines (AS1680.1/2). Fitting all bare light sources with baffles, louvers, translucent diffusers or other means that obscures the direct light source from all viewing angles will be achievable.
			11.2	Surface Illuminance	1					Electrical / Architect	
☐			11.3	Localised Lighting Control	1					Electrical / Architect	
☐	**Visual Comfort**	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	-		Complies			Architect	Blinds with a VLT <10% must provide glare reduction to 95% of the area of viewing facade and skylights.
☐			12.1	Daylight	2				1	Architect	40% of the nominated area must satisfy specified daylight requirement. Using daylight factor pathway will require daylight modelling to be undertaken to verify compliance. Daylight modelling undertaken to date indicates that this credit is not currently achieved.
☐			12.2	Views	1		1			Architect	60% of the nominated area has clear line of sight to a high quality internal or external view. Based on current design, 76% of nominated area achieves compliance. May need to be updated as the design develops.

	Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, Adhesives, Sealants and Carpets	1	1				Architect / Contractor	At least 95% of all internally applied paints, adhesives, sealants and carpets must meet stipulated 'Total VOC limits'. EFSG nominates that **ALL** items must meet the Green Star specified limits (i.e. not just 95%)
			13.2	Engineered Wood Products	1	1				Architect / Contractor	At least 95% (by area) of all engineered wood products must meet stipulated formaldehyde emission limits. EFSG nominates that **ALL** items must meet the Green Star specified limits (i.e. not just 95%)
	Thermal Comfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	1			1		Services / Sustainability / Architect / Façade Consultant	Based on schematic phase modelling, all buildings except for Block E have been demonstrated to achieve high levels of thermal comfort via PMV levels between -1 and +1. Block E is naturally ventilated (with radiant heaters) and therefore compliance can be demonstrated via methodology described in ASHRAE 55-2013. Updated modelling is required to demonstrate compliance which is currently underway.
			14.2	Advanced Thermal Comfort	1					Services / Sustainability / Architect / Façade Consultant	
	Total				**17**	**6**	**2**	**1**	**3**		

Energy					**22**					
	Greenhouse Gas Emissions	E. Modelled Performance Pathway	15A.0	Conditional Requirement: Prescriptive Pathway	-					NDY Sustainability	
			15A.1	Building Envelope	-					Architect	
			15A.2	Wall-Glazing Construction and Retail Display Glazing	-					Architect	
			15A.3	Lighting	-					Architect / Electrical	
			15A.4	Ventilation and Air-conditioning	-					Mechanical	
			15A.5	Domestic Hot Water Systems	-					Hydraulics	
			15A.6	Transition Plan	1					Client	
			15A.7	Fuel Switching	1					Client	
			15A.8	On-Site Storage	1					Client	
			15A.9	Vertical Transportation	1					Vertical Transportation	
			15A.10	Off-Site Renewables	5					Client	
			15B.0	Conditional Requirement: NatHERS Pathway	-					NDY Sustainability	
			15B.1	NatHERS Pathway	-					NDY Sustainability / Services / Architect	
			15C.0	Conditional Requirement: BASIX Pathway	-					NDY Sustainability	
			15C.1	BASIX Pathway	-					NDY Sustainability / Services / Architect	
			15D.0	Conditional Requirement: NABERS Pathway	-					NDY Sustainability	
			15D.1	NABERS Energy Commitment Agreement Pathway	-					Client	
			15E.0	Conditional Requirement: Reference Building Pathway	-	Complies				NDY Sustainability / Services / Architect	Requires a 10% improvement in operational greenhouse gas emissions compared to a Section J compliant building.
			15E.1	Comparison to a Reference Building Pathway	20	4	2.4			NDY Sustainability / Services / Architect / Client	Points award based on additional reduction in greenhouse gas emissions below the benchmark building. Based on preliminary modelling, 6.4 points are achieved. It is noted that Purchasing Power Agreements for GreenPower can provide additional points for this credit. GREP requires 6% Green Power purchase, already included in 777 and 776 contracts. Any contribution from GreenPower has not been included in this calculation. Modelling undertaken to date is based on assumptions and simplifications in the absence of suitable design detail in the schematic phase documents, and will need to be further refined during detailed design.
	Peak Electricity Demand Reduction	Performance Pathway	16A	Prescriptive Pathway - On-site Energy Generation	-					Electrical / Architect / NDY Sustainability	
			16B	Performance Pathway - Reference Building	2	0.9				Electrical / Architect / NDY Sustainability	Based on preliminary modelling, 0.9 points are achieved.
	Total				**21**	**4.9**	**2.4**	**0**	**0**		

Transport					**10**					
☐ ☑	**Sustainable Transport**	Performance Pathway	17A.1	Performance Pathway	10				10	Traffic Consultant	Strategies include provision of good End of Trip facilities (e.g. secure bike parking, showers and lockers for staff), provision of electric vehicle infrastructure and reduction of car parking provision below the maximum allowable. Project location unlikely to yield any points for public transport access. Note EFSG requires 1 bike space for every 20 students. Ten points can be awarded for this credit using the SINSW Schools Transport Assessment Template process ss per GBCA approved TQ R-14426. Traffic consultant has advised that the Transport Assessment Template cannot be followed exactly due to contradictions with project SEARs.
			17B.1	Access by Public Transport	0					NDY Sustainability	
			17B.2	Reduced Car Parking Provision	0					Architect	
			17B.3	Low Emission Vehicle Infrastructure	0					Architect / Electrical	
			17B.4	Active Transport Facilities	0					Architect	
			17B.5	Walkable Neighbourhoods	0					NDY Sustainability	
	Total				**10**	**0**	**0**	**0**	**10**		

Water					**11**					
	Potable Water	Prescriptive Pathway	18A.1	Potable Water - Performance Pathway	0					NDY Sustainability / Hydraulics / Civil / Landscape / Fire / Mechanical	
			18B.1	Sanitary Fixture Efficiency	1	1				Architect / Hydraulics	Low-flow fixtures and fittings throughout (bathroom and kitchen). Generally aligned with EFSG requirements, however EFSG requirements are more onerous for showers and washing machines.
			18B.2	Rainwater Reuse	1	1				Hydraulics	Requires rainwater harvesting to the size of 10L per square metre of GFA. To be reused for landscape irrigation and/or toilet flushing. Generally aligned with EFSG requirement. Proposed 100KL rainwater tank satisfies this requirement.
			18B.3	Heat Rejection	2					Mechanical	Evaporative cooler is proposed for Block E, therefore credit is not satisfied.
			18B.4	Landscape Irrigation	1		1			Landscape Consultant / Hydraulics	Requires xeriscaping and/or landscape irrigation from rainwater harvesting. Generally aligned with EFSG requirement
			18B.5	Fire System Test Water	0					Fire / Hydraulics	Fire system to not expel water during testing. Where a sprinkler system is not provided/required, this credit is deemed Not Applicable
	Total				**5**	**2**	**1**	**0**	**0**		

Materials					**14**					
	Life Cycle Impacts	Prescriptive Pathway - Life Cycle Impacts	19A.1	Comparative Life Cycle Assessment	6					LCA Consultant	
			19A.2	Additional Life Cycle Impact Reporting	4					LCA Consultant	
			19B.1	Concrete	1					Structural / Contractor	
			19B.2	Steel	1					Structural / Contractor	
			19B.3	Building Reuse	4					Architect / Contractor	
			19B.4	Structural Timber	3					Structural / Contractor	
☐	**Responsible Building Materials**	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Structural and Reinforcing Steel	1	1				Structural / Contractor	95% of all steel is sourced from a responsible steel maker and either 60% of fabricated structural steelwork is supplied by a steel fabricator accredited to ASI, or 60% of all reinforcing bar and mesh is produced using energy-reducing processes in its manufacture.
☐			20.2	Timber Products	1	1				Architect / Contractor	95% of all timber used in building and construction must either be certified by a forest certification scheme that meets GBCA's criteria, or from a reused source. Generally aligned with EFSG requirements, though some additional prescriptive requirements are specified by the EFSG
☐			20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1	1				Architect / Services / Contractor	90% of all permanent formwork, pipes, flooring, blinds and cables either do not contain PVC or meet the GBCAs best practice guidelines for PVC
☐	**Sustainable Products**	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustainability	3	1	1			Architect / Contractor	Generally achieved by selecting materials with reused content or third party certifications. 1 point = 3% compliant products, 2 points = 6% compliant products, 3 points = 9% compliant products (by cost against total project materials cost). FF&E, Steel, Third Party Certified Timber etc. To be assessed and best value items targeted in discussion with design team and QS in DD.
	Construction and Demolition Waste	Percentage Benchmark	22A	Fixed Benchmark	-					Contractor	
			22B	Percentage Benchmark	1		1			Contractor	90% of construction and demolition waste diverted from landfill - achieved by engaging a reliable, suitably qualified waste contractor who will undertake verification summaries.
	Total				**12**	**4**	**2**	**0**	**0**		

Land Use & Ecology					**6**					
	Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	-	Complies				Client / Ecologist	Requires client to confirm no critically endangered, endangered or vulnerable species or ecological communities were present on each site. Appears to be a cleared site, so may depend on time of purchase. As per approved TQ, this can be demonstrated through an acknowledgement of length of time the school has operated, where purchase documents are difficult to find.
			23.1	Ecological Value	3		1		2	Landscape Architect / Ecologist	Ecology of the site must be enhanced compared to pre design/construction state. Aided by planting of native vegetation on landscaped areas. Will depend heavily on definition of project boundary, to be confirmed by independent SINSW ESD representative or GBCA if project is registered. Final points to be assessed during detailed design.
	Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement	-	Complies				NDY Sustainability	
			24.1	Reuse of Land	1					NDY Sustainability	
			24.2	Contamination and Hazardous Materials	1					Demolition Contractor	
☐	**Heat Island Effect**	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.0	Heat Island Effect Reduction	1		1			Landscape Architect / Contractor	Landscaping and roofing materials to be kept light in colour, external hardscaping to be minimised. Potentially glare related restrictions.
	Total				**6**	**0**	**2**	**0**	**2**		

Emissions					**5**					

Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Stormwater Peak Discharge	1	1				Civil	To be incorporated through WSUD and appropriate rainwater storage and treatment. Civil consultant to advise. Potential to use innovative solutions for irrigation.
		26.2	Stormwater Pollution Targets	1	1				Civil	Civil / hydraulic consultant to advise on stormwater treatment impacts, including treatment of carpark runoff.
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies	-	Complies				Architect / Electrical	Outdoor lighting will comply with AS4282:1997 control of the obtrusive effects of outdoor lighting.
		27.1	Light Pollution to Night Sky	1	1				Client / Electrical	Control of external light sources - upward light output ratio < 5%
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28.0	Legionella Impacts from Cooling Systems	1		1			Mechanical	Although an evaporative cooler is proposed for Block E, this is not a traditional HVAC heat rejection system insofar as there are no cooling towers. Evaporative coolers do not pose a legionella risk as the systems do not produce aerosols. Therefore, intent of credit is believed to be satisfied, however shall be confirmed by independent SINSW ESD representative (or GBCA if project is registered).
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.0	Refrigerants Impacts	1					Mechanical	
Total				**5**	**3**	**1**	**0**	**0**		

Innovation				**10**					
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world.	30A	Innovative Technology or Process		1	0.7			One point available if onsite renewables (e.g. solar PV) contributes at least 15% to the overall annual energy consumption (30% for two points). Based on preliminary modelling, 1.7 points are achieved.
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	30B	Market Transformation - Soft Landings						Contractor	
		30B	Market Transformation - Design for Manufacture & Assembly			1			Architect	As per GBCA approved technical question R-14427, an innovation point can be awarded for incorporating Design for Manufacture & Assembly principles in the project. DfMA initiatives will be required to be implemented in the design and documented accordingly.
Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks - Stormwater			1			Civil	Requires improvements on stormwater pollution targets as identified in Credit 26.2.
			Improving on Green Star Benchmarks - Ultra Low VOCs			1			Architect	Over 50% of paints (by volume) have a maximum TVOC content of 5g/L
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge - High Performance Site Offices					1	Contractor	Requires the Contractor to ensure the demountable site shed meets a minimum level of compliance based on a High Performance Site Office Checklist (energy efficiency, waste, indoor environment quality, etc.).
			Innovation Challenge - Financial Transparency						Client / Contractor / Architect	Requires confidential reporting to the GBCA on costs of implementing Green Star. Not applicable if project is not formally registered with the GBCA
			Innovation Challenge - Reconciliation Action Plan (RAP)			1			Client/Architect	Requires development and implementation of a Reconciliation Action Plan (RAP). As per the GBCA approved FAQ F-00101, compliance with this credit can be achieved by using an organisation RAP. The project must summarise the initiatives included in the specific project to support the RAP outcomes - such as the proposed Indigenous Enterprise.
			Innovation Challenge - Integrating Healthy Environments	10				1		This credit aims to support high-performance, cost-effective and health-promoting project outcomes through an early analysis of the interrelationships among systems.. As per GBCA approved technical question R-14476, credit can be claimed by providing the Healthy Canteen Policy research report in lieu of a community analysis report, and providing evidence that this policy has been/will be implemented on the project. Additionally, rather than providing a monitoring plan, Schools Infrastructure may focus on implementing the program in stages across all schools within NSW.
			Innovation Challenge - Community Benefit					1	Client	This credit aims to encourage investment by projects in infrastructure for use by the broader community, such as the incorporation of spaces that are publicly accessible. As per GBCA approved technical question R-14478, credit can be claimed using the Schools Infrastructure policy 'Community Use of School Facilities' and the 'Share Our Spaces' program guide in lieu of a Needs Analysis Report. Evidence must be provided to demonstrate that these policies have been implemented in the design.
			Innovation Challenge - Universal Design			1			Architect / Accessibility Consultant	This credit aims to encourage projects to provide safe, equitable and dignified access for persons with disabilities. In accordance with the GBCA approved technical question R-14538, this credit can be claimed using the Education Facilities Sustainable Guidelines (EFSG) in lieu of a needs analysis report. An accessibility plan (or similar) must be developed for the project, and evidence must be provided to demonstrate how these policies have been implemented in the design.
Global Sustainability	Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star rating tools.	30E	Global Sustainability					1	Client	Potential to use credits from other tools, e.g. Green Cleaning requirements under WELL. May be desirable in the wake of COVID-19.
Total				**10**	**1**	**5.7**	**0**	**4**		

TOTALS	AVAILABLE	Low Risk	Moderate Risk	High Risk	Potential Extra
CORE POINTS	99	28.9	13.4	1.0	15.0
CATEGORY PERCENTAGE SCORE		29.2	13.5	1.0	15.2
INNOVATION POINTS	10	1.0	5.7	0.0	4.0
TOTAL SCORE TARGETED		30.2	19.2	1.0	19.2

8.2 SINSW ESD Schedules

8.2.1 EFSG ESD Schedule

Refer over.

PROJECT:	Hawkesbury Centre of Excellence

Theme	Indicator	Sustainability initiatives / requirements from the EFSG This is an extract only from the relevant EFSG. For full requirements refer to https://efsg.det.nsw.edu.au/welcome	EFSG	Crossover with Green Star	Standard evidence to demonstrate compliance	Has this been implemented in the project? Y or N	Contractor's ESD consultant comments	Actual evidence proposed This evidence needs to show that the requirement from column C has been met	Responsibility: (identify party responsible to provide evidence)
Energy & carbon	EC1: Energy efficiency	**Improvement over NCC** All new facilities must be designed and built so that energy consumption is predicted to be at least 10% lower than if build to minimum compliance with National Construction Code requirements. The energy consumption reduction must be achieved without including renewable energy generation in the calculation.	DG02.03	DAB c15E.0 GHG Emissions Reduction - Conditional Requirement	1. Energy modelling report / Predictive energy modelling and thermal comfort assessment. Report needs to show at least 10% improvement of building over minimum NCC requirements; and 2. As-built evidence that model is an accurate representation of the building, e.g. drawings; and 3. Specifications / calculations supporting modelling inputs, e.g. window energy rating scheme certificates, calculated R-values of walls, roofs, etc. 4. As an alternative to 2 and 3 above, a Statement by energy modeller confirming that the moel accurately represents the building.	N	Based on the schematic phase energy modelling, the development is predicted consume approximately **8.9%** less energy than NCC compliant reference buildings, excluding any contribution from renewable energy generation. It is understood that the incentive of this requirement is to achieve energy conservation by the means of improved building system and façade. As such, only air-conditioning energy has been accounted. It is noted that if the proposed solar PV is included in this calculation, the development is calculated to consume approximately **24.7%** less energy than the NCC compliant reference building.	NDY 'Preliminary Green Star Modelling Assessment' Report	ESD Consultant
Energy & carbon	EC1: Energy efficiency	**Energy conservation** Design and construct all school buildings within the parameters specified in the: - NSW Public Works Energy Manual for Buildings - Building Code of Australia (BCA) Section J for Energy Efficiency The NSW Public Energy Manual for Buildings provides an energy-saving strategy by identifying aspects of the building and services where reductions in operating and maintenance costs can be made through proper selection of: - Building fabric - Insulation materials - Shading and ventilation - Services and control It also requires the formulation of an energy impact statement.	DG65.02	DAB c15 GHG Emissions Reduction	1) Section J report 2) Energy impact statement	Y		NDY Reports: - Preliminary Green Star Modelling Assessment - Building Fabric Advice	ESD Consultant
Energy & carbon	EC1: Energy efficiency	**Daylighting** - Designers must seek to maximise natural daylight in all learning and administration spaces to reduce energy usage through windows and skylights - Including daylight sensors in rooms to reduce light output or turn off light when sufficient daylight is provided within the space - When the space is large and perimeter lighting is adjacent to windows, perimeter lighting is on a separate zone to make maximum use of daylight	DG2.3.1 DG12	DAB c15 GHG Emissions Reduction	1. Daylight modelling report demonstrating how natural daylight has been maximised in all habitable spaces; and 2. As built drawings demonstrating that the model accurately represents the building (i.e. window size and location; skylights installed, etc.); and 3. Specifications supporting inputs used in modelling (e.g. skylights and glass specs)	N	Area of windows is not less than 10% of the floor area of the room. The EFSG requirements applicable to the projects (i.e. current at the date of project commencement) are subjective qualitative requirements only and can be considered achievable, noting that majority of windows are provided with effective shading which reduces daylight but also reduces air conditioning energy consumption. However, the updated 'aspirational' EFSG requirements (11/03/21 updates) are not achieved. Refer to NDY advice CAN No: G-009 for details	NDY CAN No: G-009	ESD Consultant
Energy & carbon	EC1: Energy efficiency	**Shading devices** On exposed facades subject to direct sunlight, external window shading has been considered as part of the building design	DG2.3.1	DAB c15 GHG Emissions Reduction	1. As built drawings	Y	Screening has been applied to: Block A - West Elevation Block B - South East / North West Elevation Block C - North Elevation Block D - North Elevation Blocks A,B,C,D & E have large roof overhangs Block F has 500 roof eaves and Vertical blades to the North/East Elevations, South/West Elevations	As built architectural drawings	Architect
Energy & carbon	EC1: Energy efficiency	**Lighting energy conservation** Lighting system must have timed or sensor feedback functionality for energy conservation	DG2.3.2	DAB c15 GHG Emissions Reduction	1. As built mechanical drawings / statement from head contractor	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Energy & carbon	EC1: Energy efficiency	**Energy efficient lighting** - LED lighting must be installed - The design of the lighting systems and the selection of fittings is to be undertaken based on a Whole of Life approach - System must support sustainable design principles including reducing energy consumption - Use light sources lamps and control gear with a long life	DG2.3.1 SG63.01	DAB c15 GHG Emissions Reduction	1. As built electrical drawings	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Energy & carbon	EC1: Energy efficiency	**Maximum illumination power densities** Section J part 6 of the National Construction Code provides tables that define the maximum illumination power density that is acceptable in various locations. This, and all other elements of Section J part 6 should be applied appropriately.	DG63.05.01	DAB c15 GHG Emissions Reduction	1) Lighting drawings 2) Lighting specifications / schedules 3) Lighting modelling report showing compliant power densities	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Energy & carbon	EC1: Energy efficiency	**Lighting control** The required communication protocol for the luminaires is DALI. The following systems for the control of luminaires fitted with DALI control gear are considered acceptable: - Diginet Rapix suite of products. - Clipsal C-bus suite of products - Philips Dynalite suite of products - KNX based systems Systems must be designed to be as simple as possible. This simplicity must extend from the topography to ease of use. It is a specific requirement that programming of any control system must be relatively simple and not limited to costly specialist consultants. Allowances should be made in system design specifications for user group training of control systems and for the programming of the system as part of the commissioning and hand over process. All equipment and manuals necessary to operate and maintain the system must be provided to the school and Asset Management	DG63.06.01	DAB c15 GHG Emissions Reduction DAB c4 Building Information	1) Commissioning report 2) Confirmation from AMU that all relevant manuals have been handed over	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Energy & carbon	EC1: Energy efficiency	**Constant light output / Daylighting** -Constant Light Output (CLO) systems consisting of dimming luminaires and light level sensors are highly recommended as they are effective in maintaining the required illuminance values. CLO systems ensure that the lit environment remains compliant at the lowest possible Watts per square metre for the reasonable operating life of the luminaires. Maintained illuminance values required for design compliance will result in areas being over-lit for a large proportion of their operating life without a CLO system. - Sensors can be fitted to each luminaire or by utilising sensors that control groups of luminaires. - Once in operation a CLO system delivers compliant light levels over the life of a system by reducing the light through dimming and ramping the levels up over the lifespan of the luminaire. These systems should be seamless and invisible in operation to users of the locations. - Daylight Harvesting can be delivered as a component of a CLO system and requires no additional hardware above and beyond that required for a CLO to operate. - Daylight harvesting is recommended in areas where there is a rapid transition from natural day light to a dark environment, such as when entering a multi deck or underground car park from a street in full daylight, or in a classroom where daylight from windows is within the field of view.	DG63.06.02 DG63.06.03	DAB c15 GHG Emissions Reduction	1) Lighting drawings 2) Lighting modelling report showing compliant power densities	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Energy & carbon	EC1: Energy efficiency	**Switching strategy** - Local switching should be provided where it is identified that the users can benefit from manual operation of the lighting and other lighting automation technology is considered cost prohibitive. The switching should be clearly marked and robust. - Achieve energy efficient switching in Schools by: The use of multiple switching groups Automatic control of these groups to operate as follows: Controlled luminaires are to automatically turn-off nominally 3 minutes after the bell sounds. Turn-off is to be in two steps other than in small rooms, one step after 3 minutes and the second group 2 minutes later (5 min). If the lighting is required for the next period, occupants of that room can prevent the lights turning off by pressing the ON switch/es after the bell sounds. The luminaires in each room can be turned off at any time by pressing the OFF switch/es. The off signal is to be capable of transmission at the end of normal school hours or at other selected times without the bells sounding, with the lighting turning off in two steps (other than in small rooms).	DG63.07 DG65.03.01	DAB c15 GHG Emissions Reduction	1) Electrical & lighting drawings showing switching groups and automatic controls	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Energy & carbon	EC1: Energy efficiency	**Energy efficient HVAC system** HVAC system must have timed or sensor feedback functionality for energy conservation Systems shall be designed to minimise energy consumption. System design / equipment selection is to be based on whole of life cost analysis. Specifically air conditioning equipment should: - support sustainable design principles including reducing energy consumption; and - be easily accessible and serviceable – easy to maintain with minimal impact on school operations / activities when maintenance is being performed. All new school buildings are to be designed to meet or exceed the requirements of building regulations for conditioned spaces	DG2.3.2 DG55 DG16.09	DAB c15 GHG Emissions Reduction	1. As built mechanical drawings / statement from head contractor; 2. Whole of life cost analysis demonstrating systems were selected based on WOL performance.	Y	Mech system controlled based on temperature sensor input.	As built mechanical drawings	Mechanical Contractor
Energy & carbon	EC1: Energy efficiency	**Energy efficient appliances & equipment** Electrical equipment must be at least 0.5 stars above the market average star rating or comply with high efficiency standards specified in the GREP	DG2.3.3	DAB c15 GHG Emissions Reduction	1. Schedule of appliances and equipment with their star ratings or performance standards, signed by head contractor or architect. All appliances and equipment required in the GREP must be listed, incl air conditioning equipment, electric motors, transformers, etc.	Y	Appliance and Equipment selection to comply with star ratings. Air conditioning star rating system applies to residential single-split systems and therefore is not applicable to VRF systems.	As built architectural drawings	Architect

Energy & carbon	EC1: Energy efficiency	**Heat loss/gain** Building/HVAC design must consider: - Climate/ micro-climate: This data must come from the current AIRAH handbook and where a specific area is not referenced in the handbook, the Bureau of Meteorology statistics must be utilised. - Orientation: exposure to sun(solar) and wind - Natural Ventilation and cross ventilation - Insulation, thermal capacity and time lag of building fabric. - Energy and Resources Cost: Initial and on-going, of heating and cooling. Reduced energy consumption provides future cost savings and a reduced carbon footprint. - Activities / Equipment that may produce excess heat. Energy modelling software must be used to determine heating and cooling loads as part of the Whole of Life analysis that must be undertaken. (i.e. Camel or Carrier).	DG04.01	DAB c15 GHG Emissions Reduction	1. Thermal modelling report 2. As built evidence demonstrating that model is an accurate representation of the building 3. Specifications/ calculations supporting modelling inputs	Y	Camel used for detailed heatload calculations in next project phase (NDY is not engaged for this yet).	Mechanical design report	Mechanical Contractor
Energy & carbon	EC1: Energy efficiency	Passive design The need for active cooling and heating shall be minimised by employing passive / sustainable design principles. Windows: The size and proportions of windows need to be carefully considered in the design to provide maximum efficiency and a balance between the ESD factors such as; maximising daylight in rooms but avoiding unnecessary solar heat gain and thermal loss etc. Roofing: The colour selected will have an impact on the thermal performance. Light colours will reflect more of the sun's heat and darker colours absorb more of the sun's heat, which will be transferred into the roof structure. Unless prevented by glare issues to surrounding development, light colours must be selected to reduce the thermal load from solar heating and contribute to heat island effect mitigation. Orientation (as close to True North as possible). With appropriate shading, this will provide a balanced approach to reducing summer heat ingress and encouraging solar warmth during winter. Appropriate glazing/ shading strategy (related to orientation and local environment), Depending on the climate, windows would be minimised on southern, eastern & western elevations with external shading on western and eastern facades). Use of thermal mass (to stabilise internal temperatures). Insulation: maximise insulation	DG55 DG06.02 DG27.12	DAB c15 GHG Emissions Reduction	1. Thermal modelling report 2. As built evidence demonstrating measures implemented to reduce need for active cooling / heating 3. Passive design report by Architect listing all passive design initiatives implemented	Y	Ventilation area not less than 5% of the floor area. Cross ventilation will be difficult to achieve give the double stack arrangement of the GLS. Where cross ventilation can be achieved (hall) it will be utilised. Roof colour will be a light finish External wall finishes will be warm finishes, greys and timbers	NCC Section J Report Energy modelling report As built architectural drawings	ESD Consultant Architect
Energy & carbon	EC1: Energy efficiency	**Ventilation strategy** A ventilation strategy must be developed to ensure that sufficient ventilation is provided to all spaces to meet the requirements of the BCA/NCC and associated standards. Specifically ventilation equipment must be designed from a whole-of-life perspective and: - Enable healthy learning environments with indoor air quality (IAQ) that supports learning and teaching (i.e. IAQ that is fit for purpose for schools) - Support sustainable design principles including reducing energy consumption - Be accessible and serviceable - easy to maintain with minimal impact on school use when maintenance is being performed	DG57.01	DAB c15 GHG Emissions Reduction	1) Cooling system strategy including WOL analysis 2) Concept plans 3) Construction drawings 4) Trade-based specification 5) As built drawings	Y	Mechanical and natural ventilation option for each space.	As built mechanical drawings	Mechanical Contractor
Energy & carbon	EC1: Energy efficiency	**Natural ventilation** - Is required to all classrooms for comfort in summer and to maintain a healthy indoor environment. - Where cross ventilation may be restricted (i.e. where rooms are located on each side of a corridor, at least one whole wall of operable windows plus ceiling fans are required, to provide air movement. - Some windows need to be operable in driving rain and so must be protected with appropriately designed weather hoods, eaves overhang or other method of protection.	DG05.01	DAB c15 GHG Emissions Reduction	As built drawings demonstrating windows have been installed as required.	Y	Ventilation area not less than 5% of the floor area.	As built architectural drawings	Architect
Energy & carbon	EC1: Energy efficiency	**Mechanically assisted cross-ventilation** In two storey blocks where cross flow ventilation is not possible to the lower floor, mechanically assisted cross ventilation is to be provided to the lower floor learning spaces nominated in the EFSG. The ventilation system is to be sized to provide at least 7 air changes per hour. The system is to be thermostatically controlled to activate when room temperature exceeds 28 deg C and is to run continuously until the room temperature drops below 27 deg C. Additionally the system is not to be activated unless the outdoor temperature is lower than the indoor temperature and is to be immediately de-activated as soon as the outdoor temperature exceeds indoor air temperature. Provide programmable seven-day time clock and 0-2 hrs adjustable after-hour timer to control each mechanically assisted exhaust ventilation system.	DG57.18	DAB c15 GHG Emissions Reduction	As built mechanical drawings and specifications Extracts from commissioning report	N	Due to the arrangement of the classrooms natural cross ventilation within the classrooms is not possible. Single sided ventilation with ceiling fans is proposed. Cross ventilation when the doors are open onto the common space is possible. Mechanically assisted cross ventilation will not be provided. The control bands where this would operate overlap with the air conditioning control bands defined in the DG55 Cooling Policy, and as such the systems become redundant.		
Energy & carbon	EC1: Energy efficiency	**Ceiling void ventilation** Provide ventilation so as to remove hot air build-up in large enclosed roof spaces. Roof mounted turbo ventilators are an approved method. - The size and number of ventilators to be included will depend upon the volume and use of the individual rooms and the local climatic conditions to provide suitable air changes and room cross ventilation. - Provide a minimum of two roof ventilators to each Secondary General Learning Space or a Primary Home Base unless otherwise directed, or other number recommended by the manufacturer for the size of the space (whichever is the greater). - Ventilator throat diameter to be no less than 400mm.	DG05.02 DG37	DAB c15 GHG Emissions Reduction	As built mechanical drawings demonstrating ventilation has been installed as required.	N	Not included in current design		
Energy & carbon	EC1: Energy efficiency	**Roof ventilator control** Provide controls for the operation of the motorised dampers on the roof ventilators. Generally one switch is required for each space within the school where roof ventilators are installed	DG65.16	DAB c15 GHG Emissions Reduction	Mechanical / electrical drawings showing controls	N	Not included in current design		
Energy & carbon	EC1: Energy efficiency	**Wind powered roof ventilators** School buildings can use wind powered roof ventilators with dampers to provide effective summer ventilation. Design to suit local ambient climatic conditions to ensure correct sizes, locations and numbers are provided for each particular application. Co-ordinate the locations of ventilators with the ceiling fans to achieve effective air movement. Fan assisted ventilators should also be considered on days of low wind Provide a wall mounted switch to open /close the damper.	DG57.14	DAB c15 GHG Emissions Reduction	As built mechanical drawings showing location of roof ventilators if installed	N	Roof ventilators will be provided for the canteen/hall only, not in teaching spaces.		
Energy & carbon	EC1: Energy efficiency	**Ventilation in sanitary spaces** - Greater air circulation than that required by building regulations is required, with sufficient natural ventilation or mechanical ventilation, to disperse odours and /or humidity. - Cross ventilation is to be used where possible. - Provide mechanical ventilation to all Disabled Toilets. - Operate the system by time control equipment (time switches or run-on timers as appropriate).	DG05.04 DG57.16	DAB c15 GHG Emissions Reduction	As built mechanical drawings demonstrating ventilation has been installed as required.	Y	WC's and Bathrooms with have both natural ventilation and air extraction. Cross ventilation is not possible without mechanical assistance	As built architectural & mechanical drawings	Architect Mechanical contractor
Energy & carbon	EC1: Energy efficiency	**Ventilation in storage spaces** - Permanent air ventilation openings are to be provided (without compromising security), to prevent concentration of odours.	DG05.05	DAB c15 GHG Emissions Reduction	As built mechanical drawings demonstrating ventilation has been installed as required.	Y		As built architectural drawings	Architect
Energy & carbon	EC1: Energy efficiency	**Ventilation in permanent learning spaces and libraries** Where feasible / practical: - Ceiling fans shall be installed where ceiling height is equal to or greater than 2,700mm. - Wall fans shall be installed where ceiling heights are less than 2,700mm	DG55	DAB c15 GHG Emissions Reduction	As built drawings demonstrating ceiling/wall fans have been installed as required.	Y	Natural ventilation and ceiling fans will be provided in GLS	As built architectural drawings	Architect
Energy & carbon	EC1: Energy efficiency	Indoor environment controls - Both the thermal comfort and indoor air quality shall be controlled automatically within specified parameters. - Controls shall be simple and intuitive to use. - A prominent green light shall highlight to occupants when conditions are suited to opening windows and doors to utilise natural ventilation. - A prominent blue light shall highlight to occupants when the air conditioning is operating. - The lights shall be clearly labelled with traffic light labels as follows: + Green light – "External conditions are suited to opening windows and doors" + Blue light – "Air conditioning is operating. Windows and doors should be closed" - Temperature and CO2 sensors are to be installed within the space and be readily accessible for maintenance. - Sensors must be located so as to accurately record the actual room temperature and indoor air quality (CO2). - Controls shall be designed to minimise energy consumption – e.g.: by minimising over cooling and heating and automatically switching off when the space is unoccupied. - Controls shall be designed so that the system/s will shut down automatically if a room is unoccupied for greater than 10 minutes (except in specific cases such as designated computer rooms). - Controls shall be properly labelled and suitably located in the space (preferably near the light switch) and incorporate: + a key operated auto / manual / off switch; and + a push on / push off adjustable hour run timer. The run timer shall be adjustable from 1 to 4 hours and initially be set at 2 hours	DG55	DAB c15 GHG Emissions Reduction	1) As built evidence demonstrating controls have been installed as required. 2) Commissioning report / statement by head contractor confirming controls have been set as required	Y		As built mechanical drawings	Mechanical Contractor
Energy & carbon	EC1: Energy efficiency	**Access for maintenance** All systems and equipment that is installed within a school is to be provided with suitable access to ensure that this equipment is safely and efficiently maintainable. In order to ensure that maintenance is available, on the completion of all buildings, drawings are to be provided showing the completed (As Built) building including all equipment and equipment access arrangements. **Communication services** DoE requires a 4 hour on-site training session for up to four persons on the use of the SCS. Training is to be accompanied by appropriate documentation and a video that demonstrates operation of the system and its components, including patching, cable management for voice, video and data of the SCS installed on site. Include explanation of detailed drawings left on site. The video / CD ROM may be generated from the on-site training for future use by DoE school staff. The Project Manager will, in consultation with the School Principal, nominate the timing of this session together with the number of attendees. Manuals are to be handed to the school during the training session. Include in copies of all cabling test reports and the (minimum) 20-year warranty certificate the manual. As built documentation and manufacturers warranty and test results are required **Building user's guide** Produce a Building User's Guide to enable the client to understand the building systems and operate systems to maximise efficiency. This must: - Clearly and concisely describe the operation of building and its services - Detail a reasonable maintenance program - Advise the user of the most suitable replacements for consumables	DG16.10 DG64.10 DG65.02	DAB c4 Building Information	1) As built drawings including all equipment access arrangements for maintenance 2) Training records 3) Operation manuals 4) Manufacturers warranties and cabling test reports 5) Building user's guide	Y		Services specification As build documentation O&M Manuals Building Users Guide	Services Consultants Principal Contractor ESD Consultant

Energy & carbon	EC2: Scope 1 & 2 emissions	**Renewable energy** A grid connected solar PV system must be installed in line with DG66 requirements Where feasible, PV systems shall be installed to offset as much of the electricity consumed by the school as is practicable	DG2.3.4 DG55	DAB c15 GHG Emissions Reduction; DAB c16 Peak Electricity Demand Reduction	1) As installed drawings of PV system 2) Energy modelling report showing renewable energy generation	Y		As built electrical drawings	Electrical Contractor
Energy & carbon	EC2: Scope 1 & 2 emissions	**Battery Energy Storage System** A battery energy storage system shall only be designed in consultation with SINSW Sustainability sustainability.enquiries@det.nsw.edu.au	DG66.8.3	DAB c15 GHG Emissions Reduction; DAB c16 Peak Electricity Demand Reduction	1) As installed drawings of battery storage system	N	Not included in current design		
Energy & carbon	EC2: Scope 1 & 2 emissions	**Heaters** Electric heating must be preferred over gas heating. Where gas heating is considered, it must be approved by SINSW Sustainability Heating equipment must be designed from a whole-of life perspective and: - Support sustainable design principles including reducing energy consumption and carbon emissions - Be accessible and serviceable - easy to maintain with minimal impact on school use when maintenance is being performed	DG56	DAB c15 GHG Emissions Reduction	1) If reverse cycle air conditioning is installed, confirmation that gas heaters are not installed, OR 2) Evidence that the gas heaters installed are energy efficient	Y	Heating via VRF air conditioning units. Electric radiant heaters provided to hall only.	As built mechanical drawings	Mechanical Contractor
Energy & carbon	EC2: Scope 1 & 2 emissions	**Water heaters** - Hot water and tempered water generation for schools must be carefully considered to ensure that a Whole of Life assessment is undertaken to minimise life cycle costs and carbon emissions - Environmentally friendly options such as solar heating (if vandal resistant) and heat pumps are preferred energy sources to minimise energy consumption.	DG53.09	DAB c15 GHG Emissions Reduction	1. WOL cost assessment for hot water systems 2. Hydraulic drawings/schematics showing installed DHW systems	Y	Feasibility of heat pumps will be explored during the detail design and final hot water plant will be determined during design development by life cycle cost analysis and carbon emissions.	As built hydraulics drawings	Hydraulic Contractor
Energy & carbon	EC3: Scope 3 emissions	Transport plan	N/A	DAB c17 Sustainable Transport		Y		Traffic Assessment Report	Traffic Consultant
Energy & carbon	EC3: Scope 3 emissions	**Bicycle storage** Provide 1 space for every 20 students to AS2890.3 standard	SG552 4.36	DAB c17 Sustainable Transport		Y		As built architectural drawings	Architect
Water	W1: Water use efficiency	**Potable water conservation** WATER CONSERVATION STRATEGIES must be implemented on school sites, including: Manual Flush Urinal Systems: New and replacement urinals must use manual in lieu of automatic flushing mechanisms. A microwave-activated urinal flushing system may be used as an alternative. Water Conserving Taps: Use metal flow control valves and /or push down taps with pre set flow limits. All new water-using appliances must be at least 0.5 stars above the average Water Efficiency Labelling and Standards (WELS) star rating by product type, except toilets and urinals, which must be purchased at the average WELS star rating. Refer to DG53.02 for specific rating requirements. Harvest Rainwater: Where practical, harvest roof water and connect to a pumped rainwater supply system to authorities' requirements for landscaped areas and toilet flushing	DG53	DAB c18 Potable Water	1. Schedule of fixtures and fittings showing type of urinals and taps installed are as required	Y	High efficiency fitting & fixtures will be specified. No urinals will be provided on the site	As built architectural drawings	Architect
Water	W1: Water use efficiency	**Fixture efficiency** All products must be rated to AS 6400 to the following minimum WELS ratings: - Tapware to 5 star flow rating requirements - Showers to have 3 star flow rating requirements - Water Closet Pans to 4 star flow rating requirements - Flow restrictors can be used to minimise water usage and wastage for staff amenities - Taps with timed flow can be used to minimise water usage and wastage in student amenities. In any case, all new water-using appliances must be at least 0.5 stars above the average WELS star rating by product type, except toilets and urinals, which must be purchased at the average WELS star rating. Where WELS rating is not available, use the alternative WaterMark rating scheme.	DG53.02 DG2.4.1	DAB c18B.1 Potable Water - Sanitary Fixture Efficiency	1. Schedules of materials, fixtures, fittings and equipment with WELS/WaterMark ratings, demonstrating compliance and identifying those with flow restrictors and timed flow.	Y	High efficiency fitting & fixtures will be specified. No urinals will be provided on the site	As built architectural drawings	Architect
Water	W1: Water use efficiency	**Hydraulic services** Hydraulic services should: - Support sustainable design principles including reducing water consumption and waste production. - Appropriately treat any trade waste to ensure minimal environmental impact - Be accessible and serviceable - easy to maintain with minimal impact on school use when maintenance is being performed - Use products with a long life span – many hydraulic services are concealed so durability is essential	DG51.01	DAB c18 Potable Water	1) Hydraulic report showing sustainability initiatives implemented to reduce potable water consumption 2) As built drawings showing trade waste arrestors	Y	Water efficient fixtures to be specified by the architects as per EFSG. Tradewaste treatment to be as per local authority requirements. Hydraulic services shall be accessible as per EFSG requirements and general good design practice. Hydraulic services materials will be specified as per EFSG requirements and general good practices.	As built hydraulics drawings	Hydraulic Contractor
Water	W1: Water use efficiency	**Water sub-metering** In addition to the main water meter for the site provide sub meters for the following: - Mixed irrigation systems - Laboratory buildings - Amenities blocks - Canteens - Any other major water use on the site	DG53.04		1) As built hydraulic drawings	Y		As built hydraulics drawings	Hydraulic Contractor
Water	W2 – Proportion of potable vs non-potable water	**Rainwater collection** It is DoE policy to include roof water harvesting and tank storage in new schools and to encourage it where practical in existing schools, to reduce the demand on drinking water supplies. Tank water can connect to drip irrigation systems for adjacent landscape/gardens with the major preference being for gravity fed supply to minimise ongoing maintenance.	DG53.14 DG2.4.2 DG53.01	DAB c18B.2 Rainwater Reuse	1) As built hydraulic drawings showing tank connection to end uses and capacity	Y		As built hydraulic drawings	Hydraulic Contractor
Water	W2 – Proportion of potable vs non-potable water	**Fire system water reuse** Where schools are required to install a sprinkler system for fire safety, it is recommended to install a closed loop system must be installed to capture and reuse fire systems testing and maintenance water, or by using an alternative non-potable water source.	DG2.4.2	DAB c18B.5 Fire System Test Water	Fire engineering report	N/A	N/A - No sprinkler system required		
Water	W2 – Proportion of potable vs non-potable water	**Ground water** Where ground water is available for use for irrigation purposes in drought affected locations, enquiries must be undertaken with the Department of Planning, Industry and Environment to determine the suitability of a ground water system.	DG53.03	DAB c18 Potable Water	1. Relevant due diligence report / investigation	N/A	N/A - Ground water is not available		
Water	W3 – Responsible water discharge	**Stormwater management** Must aim to minimise the transportation of toxicants to waterways and other offsite environments, and maintain the existing hydrological regimes. Due diligence for flooding must be done early to inform building and landscaping design	DG2.4.3	DAB c26 Stormwater	Stormwater modelling report showing stormwater pollution and flows. Civil / Hydraulic drawings showing management measures. Water sensitive urban design report (if WSUD was use4)	Y	Water Sensitive Urban Design measures will adopted	Civil drawings Integrated water management report	Civil Consultant
Water	W3 – Responsible water discharge	**Trade waste** Arrestors for acid, grease, plaster and clay of adequate capacity must be installed to treat wastewater from science laboratories, kitchens, art rooms and canteens as required in DG52.	DG52	Not covered in Green Star	1) As built drawings showing trade waste arrestors or 2) Letter by Hydraulic Engineer confirming arrestor have been installed as required	Y	Tradewaste treatment will be provided as per local authority requirements.	As built hydraulic drawings	Hydraulic Contractor
Waste & materials	WM1: Materials selection and use	**Life cycle assessment (environmental)** Environmental impacts of products and materials has been assessed and inform material selection	DG01.03	DAB c19A - Life cycle assessment	Life cycle assessment report	N	Full LCA and/or life cycle costing report is not part of current scope		
Waste & materials	WM1: Materials selection and use	**Whole of life costing (WOL)** Total cost of ownership (TCO) assessment / Analysis of direct and indirect costs and benefits / Life cycle costing analysis When calculating the whole of life cost for the different materials / building elements or systems, the following must be considered: - the total initial capital cost of the system/s – including design, project management, builder and building services works in connections etc. - resources (energy and where applicable water) consumption. - Maintenance. - the replacement of component parts. - disposal costs - ecological sustainable options - durability - vandalism - safety The whole of life cost shall be calculated over the estimated life of the asset/s.	DG01 All design guides for selection of materials and building systems	GSC c20 - Return on Investment	Life cycle costing report for relevant system	N	Full LCA and/or life cycle costing report is not part of current scope		
Waste & materials	WM1: Materials selection and use	**Sustainable materials** Construction materials must be selected based on the following: - Adequately and economically perform their intended functions, and also have lower adverse environmental impacts throughout their life cycle (refer to DG 3) - Contain reduced or no hazardous substances (e.g. low VOC) to ensure effective indoor environmental quality. Reduce the demand for rare or non-renewable resources. - Have low embodied energy and water. - Are made from or contain recycled materials or can be reused or recycled at the end of their useful life.	DG02.05	DAB c21 Sustainable Products	Environmental Product Declarations of products / materials used; Product certificates (like GECA, FSC, et3) Suppliers' declarations confirming recycled contents in products Bill of quantities	Y	While this will be considered, where the LCA is not being targeted it will not be documented as thoroughly	Environmental Product Declarations of products / materials used; Product certificates (like GECA, FSC, et3) Suppliers' declarations confirming recycled contents in products Bill of quantities	Principal Contractor
Waste & materials	WM1: Materials selection and use	**Sustainable timber** - No rainforest timbers, or timbers from high conservation forests, are to be used unless plantation grown. Use only recycled timber, engineered and glued timber composite products, or timber from plantations or from sustainably managed regrowth forests that is FSC, AFS or PEFC certified - All timber used is to be termite (white ant) resistant or treated to be termite resistant to the appropriate hazard level.	DG2.5.1 DG21.05.01	DAB c20.2 Responsible Building Materials - Timber	1. Evidence of chain of custody 2. Bill of quantities	Y		Evidence of chain of custody Bill of quantities	Principal Contractor
Waste & materials	WM1: Materials selection and use	**Built for disassembly** Consider the use of building materials which are able to be disassembled for re-use, in conjunction with considerations for the addition and removal of accommodation over time.	DG02.07			Y	Materials selected have been used for DfMA (kit of parts) are modular and repetitive and can be disassembled		

Waste & materials	WM1: Materials selection and use	**Concrete** - Use materials complying with AS based on the Whole of Life approach to materials selection. - Do not use breccia or dolerite in concrete mixes. - Fly ash is a manufacturing bi-product that can be used as a cement replacement but should limited to a maximum of 20% by weight of cement content.	DG21.02	DAB c19B.1	Structural specifications and drawings Structural Engineer's report showing %cement replacement	Y		Structural drawings	Structural consultant
Waste & materials	WM2 – Resource efficient school operations	**Operational waste** A waste storage area must be included in all new school sites. The provision of space must include source separation including bin stations and appropriate signage of waste and receptacles for multiple waste streams, including: - Organics - Comingled containers - Paper & cardboard - Container deposit scheme - Soft plastic - General waste Designers must refer to AS 4123.7 Mobile waste containers - Colours, markings, and designation requirements for further guidance on bin colour, waste stream and waste type. Safe methods for vehicle access and the transfer of waste must also be considered. For new and refurbished schools, an operational waste management plan (OWMP) must be developed to establish operational waste targets, identify opportunities for reuse and recycling in the operation of the facilities and make adequate provision for the facilities to accommodate for the OWMP. The OWMP must address all requirements from DG 2.7.2	DG02.07	DAB c8 Operational Waste	Operational waste management plan Operational waste reports showing diversion rates	Y	Operational waste management plan (OWMP) will be developed for the school and recommendations implemented int eh design	Operational waste management plan As built architectural drawings	Waste consultant Architect
Waste & materials	WM2 – Resource efficient school operations	**Building flexibility** Position structural members considering the future flexibility of the structure. Avoid ad hoc placing of columns internally, giving preference to uniformity in layout. Design all internal walls as non-load bearing to enable future flexibility.	DG21.1.16	Not covered in Green Star	As built drawings or statement by relevant professional	Y	Generally the buildings are volumetric DfMA and the column layout determined by the DfMA contractor.	Structural drawings	Structural consultant
Waste & materials	WM3 – Responsible management of waste	**Construction waste** Consider opportunities for re-use and recycling of materials in the construction phase	DG02.07	DAB c22 Construction and Demolition Waste	Construction waste reports showing percentage of waste re-used and recycled (diverted from landfill)	Y		Construction waste reports showing percentage of waste re-used and recycled (diverted from landfill)	Principal Contractor
Waste & materials	WM3 – Responsible management of waste	**Operational waste** A waste storage area must be included in all new school sites, with the provision of space for the separation of waste and receptacles for multiple waste streams, including: - general rubbish, - co-mingled recycling, - paper and cardboard, - secure waste, and - green waste. Safe methods for vehicle access and the transfer of waste must also be considered.	DG02.07	DAB c8 Operational Waste	As-built drawings showing location of waste storage area	Y	Operational waste management plan (OWMP) will be developed for the school and recommendations implemented int eh design	Operational waste management plan As built architectural drawings	Waste consultant Architect
Place	P1 – Green infrastructure	**Environmental conservation education** The design of the facilities provide unique and valuable environmental conservation learning opportunities and effective environmental modelling to the wider community.	DG02.06		Statement / Report by qualified ecologist	TBC	To be confirmed		
Place	P1 – Green infrastructure	**Productive landscape** Consider including opportunities for development of community garden within the site and relationships with community groups for this to occur.	DG02.06	GSC c14.2 Local Food Production	Site plan demonstrating location and size of community garden	Y	Aboriginal enterprise, orchards and agricultural plots will be cultivating and propagating natural food sources for consumption	As built landscape architectural drawings	Landscape Contractor
Place	P1 – Green infrastructure	**Drinking water catchment protection** For developments within drinking water catchment areas, a water cycle management study is to be included with the Development Application for Education Facility developments involving: - Agriculture facilities - Biosolids and effluent re-use schemes - Sewerage systems or works (including package sewerage treatment plants) - Stormwater or works involving the disposal of untreated runoff	DG51.07	GSC c24 Integrated Water Cycle	1. Water cycle management study 2. Evidence that recommendations in the study have been followed / implemented	N/A	Project is not located in an affected government area		
Place	P2 – Community & heritage connections	**Site investigations for place making / community connections** The following detailed reports/ surveys/ information should be considered in developing the business case: - Local environment/ character - Climate and microclimate - Heritage significance / impact - Appraisal of physical and visual factors affecting site development - Available transport/ road infrastructure servicing the site - Geo-technical and Soil reports will be required for each site to investigate the suitability of the topsoil and anticipated sub-grade materials for horticultural purposes. - Testing for toxic residues must be undertaken in all areas identified as being a possible risk - i.e. filled or dumped ground.	DG03.02	GSC c12 Culture, Heritage and Identity DAB 24.2 Contamination and Hazardous Materials	1) Relevant reports/surveys developed (these ideally include recommendations for further development stages) 2) Evidence demonstrating recommendations / best practice solutions have been implemented/addressed.	Y	As part of the site investigations, the following reports have been developed (among others): - Biodiversity Development Assessment Report - Arboricultural Impact Assessment Report - Aboriginal Cultural Heritage Assessment Report - Transport and Accessibility Impact Assessment - Historical Archaeological Assessment - Bush Fire Threat Assessment - Stormwater Management Report - Site Contamination Investigation & Remediation Action Plan - Flood Emergency Management Report - Social impact report - Soil & Water Report - Geotech Report	Relevant Reports	Relevant Consultants
Place	P2 – Community & heritage connections	**Sense of place** The following design principles to every landscape zone of the school. - A healthy and safe landscape - A sense of place - A sustainable landscape - A low maintenance landscape	DG90.04	Not covered in Green Star	1) Landscape design report 2) Landscape drawings	Y	Aboriginal enterprise, orchards and agricultural plots will be cultivating and propagating natural food sources for consumption	As built landscape architectural drawings	Landscape Contractor
Place	P2 – Community & heritage connections	**Community use of facilities** Some school facilities are used out of hours for activities such as weekend church groups, sport events and public meetings. Liaise with the Project Director to gain an understanding of any shared use, or community use arrangements that are being considered for the site. New schools should be designed so that direct access to the open play space, fields , hall and gym can be achieved without the public gaining access to the buildings.	DG16.08	DAB c30B Community Benefits	1. Confirmation by the Architect that direct access has been provided to open space and any other facilities that could be shared with the community. 2) A list of community engagement activities undertaken to develop a community benefits strategy. 3) Plans clearly outlining how the outcomes from the community benefits strategy have been implemented in the project 4) Joint-use or lease agreements where already in place	TBC	To be confirmed		
Place	P2 – Community & heritage connections	Reconciliation action plan	N/A	DAB c30D Reconciliation Action Plan	1) DoE's Reconciliation Action Plan 2) Evidence of the project's relationship with the RAP, e.g. actions implemented in line with RAP, etc.	Y	Aboriginal enterprise included in design	DoE's Reconciliation Action Plan As built landscape architectural drawings	Landscape Contractor
Place	P3 – Welcoming learning spaces	**Daylighting** Maximise natural daylight in all habitable spaces to improve indoor amenity and create a pleasant environment.	DG2.3.1	DAB c12 Visual Comfort	1. Daylight modelling report demonstrating how natural daylight has been maximised in all habitable spaces; and 2. As built drawings demonstrating that the model accurately represents the building (i.e. window size and location; skylights installed, etc.); and 3. Specifications supporting inputs used in modelling (e.g. skylights and glass specs)	N	Area of windows is not less than 10% of the floor area of the room. The EFSG requirements applicable to the projects (i.e. current at the date of project commencement) are subjective qualitative requirements only and can be considered achievable, noting that majority of windows are provided with effective shading which reduces daylight but also reduces air conditioning energy consumption. However, the updated 'aspirational' EFSG requirements (11/03/21 updates) are not achieved. Refer to NDY advice CAN No: G-009 for details	NDY CAN No: G-009	ESD Consultant
Place	P3 – Welcoming learning spaces	**Daylight glare control** Discomforting glare and brightness contrasts must be avoided. Designers must seek to: - Exclude direct sunlight from all learning spaces, libraries, administrative offices and staff studies for the period of 9.00am to 3.30pm including Eastern Daylight Saving Time between 21st September to 21st March (equinoxes). - Exclude direct sunlight from desk level in all learning spaces between 9am and 3:30pm. Sun exclusion and glare control can be achieved by the use of elements such as; Sun shades, eave extensions, vertical blades and the like. Glare must only be controlled by blinds as a last resort. Designers must prepare sun diagrams in the design phase as a minimum requirement.	DG12 DG07.01	DAB c12.0 Glare Reduction	1. Daylight glare modelling report / sun diagrams showing direct sunlight has been excluded as required. 2. Drawings supporting inputs of model, showing location of blinds and any other glare control device	Y	Glare is minimised by the use of elements such as sun shades, eave extensions, tinted glazing, screens, vertical blades and the like. Blinds to be provided to windows in the nominated area in accordance with Green Star credit 12	As build architectural drawings	Architect
Place	P3 – Welcoming learning spaces	**Lighting comfort** - Consider the furniture layouts to determine the orientation of luminaires. Especially when positioning luminaires in Materials Technology spaces to ensure adequate illumination on machines and work surfaces; - avoid potential stroboscopic effects and avoid shadows from ductwork - Mount luminaires as high as possible, but generally no higher than 4000mm AFFL (excluding Gymnasiums and Halls), to improve luminance uniformity and reduce direct glare in the direction of normal view - The standard lamp colour temperature is 4,000°K, except in certain toilet areas where the Design Guide requires the use of blue colours - Compliance with the uniformity requirements of the applicable standard should be demonstrated by the presentation of the output from lighting design software. - Unified Glare Rating (UGR) must be calculated using design software and compliant with the maximum recommended in AS/NZS 1680.1:2006	DG63.03 DG63.03.05	DAB c11 Lighting Comfort	1) Lighting drawings 2) Architectural drawings 3) Lighting specifications / schedules 4) Product data sheets 5) Isolux plot drawings 6) Lighting modelling report showing compliant uniformity and UGRs	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Place	P3 – Welcoming learning spaces	**Lighting modelling** Lighting designs should be carried out utilising industry standard lighting design software such as AGI32, Dialux or Relux. Modelling must provide output that clearly demonstrates that the proposed design is compliant with the standards including but not limited to the following parameters: - Maintained illuminance values (average, maximum and minimum) on horizontal surfaces such as floors or working planes as required, broken down to identify the parameters defined in AS/NZS1680.4 or AS/NZS1158 as applicable - Maintained illuminance values (average, maximum and minimum) on vertical surfaces such as walls, shelves or racks as required, broken down to identify the parameters defined in AS/NZS1680.4 or AS/NZS1158 as applicable - Unified Glare Rating (UGR) as defined by AS/NZS1680, - Uniformity as defined by the applicable standard for indoor or outdoor illumination, - Lighting power density in System Watts/m2	DG63.03.02	DAB c11.1 General Illuminance and Glare Reduction	Lighting modelling report confirming compliance with required standards and parameters	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor

Place	P3 – Welcoming learning spaces	**External access lighting** External Access Lighting shall be provided to illuminate building entrances, footpaths, sheltered walkways, roadways and car park. External Access Lighting must: - Be minimal and designed to prevent glare to pedestrians, nearby residents and to motorists. Evidence of compliance with AS4282, AS/NZS 1158 and other applicable Australian Standards must be provided by the designer. - Be located so as to link various sources of illumination such as street lighting (for carpark and roadways) and internal security lighting (for footpaths, walkways and entrances). - Illuminate building entry doors. - Highlight 'accident-prone' areas such as changes in level, stairs and ramps. - Provide vertical illumination.	DG63.08.01	DAB c27.0 Light Pollution to Neighbouring Bodies	1) As built drawings indicating the location of all external luminaires 2) Letter by lighting designer describing glare prevention measures	Y	Will be carried out during detailed design	As built electrical drawings	Electrical Contractor
Place	P3 – Welcoming learning spaces	**Thermal comfort** The inclusion of active cooling within school facilities is directed by the Department's Air Cooling policy: 2.1 Schools with a long term average mean maximum January temperature of 33 oC and above: Generally, air conditioning is to be provided to all school buildings. 2.2 Schools with a long term average mean maximum January temperature of below 33oC: Air conditioning is to be installed in all permanent learning spaces and libraries forming part of each projects scope. - Thermal modelling is undertaken to demonstrate that learning spaces and libraries have been designed to achieve a predicted mean vote (PMV) of +/- 0.5 for 95% of occupied hours	DG06.03 DG55.01 DG55.02	DAB c14 Thermal Comfort	1) Mechanical drawings showing HVAC systems installed, or 2) Confirmation from sub-contractors that services have been installed and commissioned as required; and 3) Modelling report showing required PMV is achieved. Modelling report to be done in line with methodology described in Draft thermal comfort and indoor air quality interim performance brief for DG55	Y	Based on schematic phase modelling, all buildings except for Block E have been demonstrated to achieve a high degree of thermal comfort. However, Block E includes the large Dining Hall/Recreation area that is provided with radiant heating only (no cooling) and does not satisfy specific requirements.	NDY Reports: - Preliminary Green Star Modelling Assessment	ESD Consultant
Place	P3 – Welcoming learning spaces	**Background noise levels** - HVAC systems shall be designed in accordance with the recommended internal noise levels noted in table 1 of DG55.02. The noise levels are the result from the cumulative contribution of traffic noise (via the façade) PLUS the building air-conditioning /ventilation systems. The noise measurement and documentation must be provided by a qualified acoustic consultant and in accordance with AS/NZS 2107. Noise measurement must account for all internal and external noise including noise arising from building services equipment, noise emission from outdoor sources such as traffic, and (where known) noise from industrial process. Occupancy noise is excluded. Compliance shall be demonstrated through measurement, and the measurements shall be conducted in at least 10% of the spaces in the nominated area. The selection of representative spaces must be justified and must consider how the spaces are considered to be the most conservative with respect to both internal, and external noise sources. The range of measurement locations shall be representative of all spaces available within the nominated area. All relevant building systems must be in operation at the time of measurement. Projects less than 500m2 Gross Floor Area (GFA) must account for measurements conducted in at least 95% of spaces within the nominated area. - Enclosed circulation areas should be acoustically absorptive	DG55.02 DG08.06	DAB c10.1 Internal Noise Levels	1. Road, rail, aircraft, industrial and rain noise assessment as per DG11.02 2. Report by qualified acoustics consultant demonstrating noise measurements are compliant.	Y		Acoustic Report	Acoustic Engineer
Place	P3 – Welcoming learning spaces	**Room-to-room noise control** The following elements have prescriptive acoustic performance or construction requirements: - Operable walls (between general learning areas, all schools): Rw 45 - Entry doors to occupied teaching, music, drama and sports spaces: Solid core, minimum 35 mm thick with acoustic weather (where external) seals on all rebated closing faces. Gap at floor to be minimized. - Internal glazed sections in walls and vision panels in or adjacent to internal doors: minimum 10.38 mm laminated glass. In some situations acoustic windows may be needed for satisfactory noise separation. - Construction separating wastewater pipework from occupied spaces: Rw 40 - Where adjacent to an occupied space (and not serving that space), hydraulic supply pipework and wastewater pipework shall be separated from the adjacent occupied space. Construction between the adjacent spaces in this instance shall be a 'staggered stud' arrangement or otherwise discontinuous.	DG11.05	DAB c10.3 Acoustic Separation	1. Detailed drawings including the acoustic design specification of operable walls, entry doors, internal glazed sections, etc. OR 2. Statement by a qualified acoustics consultant confirming compliance	Y	Note that this requirement does not apply to the Block F residential areas. Block F acoustic separation is in accordance with NCC Part F5.	Acoustic Report	Acoustic Engineer
Place	P3 – Welcoming learning spaces	**Noise emission (to the environment)** Generally noise emission to the environment from mechanical services noise sources (such as air conditioners) are the subject of a development consent conditions. In NSW the development consent conditions will refer to the Industrial Noise Policy (INP) or Local Council requirement. Where no condition regarding noise sources exists for a school development, noise emission from such sources should be designed, in-principle, to satisfy the requirements of the Industrial Noise Policy.	DG11.04	Not covered in Green Star		Y		Acoustic Report	Acoustic Engineer
Place	P3 – Welcoming learning spaces	**Acoustic post-occupancy evaluation** Post Occupancy evaluations are often undertaken to assess the performance of recently completed or existing facilities. Where a Post Occupancy Evaluation is to be undertaken it should be conducted by the project team or acoustic engineer and should be undertaken of selected acoustic parameters only. Evaluation may include: - Internal noise levels, - Room acoustics, - Noise emission, - Room-to-room acoustics performance	DG11.07	GSP c13 Internal Noise Levels	1. Commitment by SI to conduct acoustic post-occupancy evaluation	Y		Acoustic Report	Acoustic Engineer
Place	P3 – Welcoming learning spaces	**Low VOC-emitting materials** All surface coatings, and other volatile organic compound (VOC) emitting products including adhesives, sealants, carpets, carpet tiles, and carpet underlays, must be made from low-VOC emission materials. Paints must meet the limits stipulated in the Australian Paint Approval Scheme's (APAS) VOC limits for low VOC paints. Adhesives and sealants must not exceed the maximum VOC limits stipulated in Table 13.1.1B of the Green Star – Design & As Built v1.3 tool. Carpets must not exceed the total VOC limits stipulated in Table 13.1.2B of the Green Star – Design & As Built v1.3 tool.	DG2.5.2	DAB c13 Indoor Pollutants	Product specifications, certificates, safety datasheets that demonstrate low-VOC contents Bill of quantities	Y		Product specifications, certificates, safety datasheets, Bill of quantities	Principal Contractor
Place	P3 – Welcoming learning spaces	**Low formaldehyde-emitting materials** Only low formaldehyde-emitting engineered wood products should be used, such as those that meet the Australian Standards for formaldehyde emission limit E1 (NICNAS classification) or lower.	DG2.5.2	DAB c13 Indoor Pollutants	Product specifications, certificates, safety datasheets that demonstrate low-formaldehyde contents Bill of quantities	Y		Product specifications, certificates, safety datasheets, Bill of quantities	Principal Contractor
Place	P3 – Welcoming learning spaces	**Ventilation in printing rooms** The ventilation system is to be designed to serve the whole room and is not intended to provide localised exhaust at equipment. - Discharge air from the ventilation unit to the outside of the building via a vermin proofed louvre. - Draw make-up air from inside the building through wall or door grilles. - Locate the inlet/s and exhaust to achieve good airflow across the room in plan and elevation to pick up all machine emissions. -Ensure the airflow doesn't draw equipment emissions across operator's face. -Note that the room door in many schools may be left open in normal daily operation. Allow for this when locating the exhaust fan so that cross ventilation is achieved with make-up air drawn through the door opening. - Required speed range: minimum of 6 air changes per hour and maximum of 15 air changes per hour.	DG57.07	DAB c9.3 Exhaust or Elimination of Pollutants	1. Mechanical drawings and specifications showing compliant printing room ventilation	Y		As built mechanical drawings	Mechanical Contractor
Place	P3 – Welcoming learning spaces	**Chemical store ventilation** - Provide mechanical exhaust system with high and low level exhaust points to all chemical stores, with a minimum of 15 air changes per hour flow rate. - Discharge air according to the requirements of BCA. The discharge outlet is to be fitted with bird wire mesh. - Provide make up air to all chemical stores, (to replace exhausted air) through openings in an external wall, fitted with weatherproof louvres. All grilles and louvres are to be fitted with vandal proof bars and be fitted with vermin mesh. - For security and fire rating reasons do not use windows/doors or door grilles for air intake. - The chemical stores ventilation systems are to run continuously.	DG57.09	Not covered in Green Star		Y		As built mechanical drawings	Mechanical Contractor
Place	P3 – Welcoming learning spaces	**Pesticide free environments** Schools must be designed, constructed and maintained, without using chemicals for termite and other pest control. No chemical pesticides and termicide to be used. Preventive treatments to be by physical means and careful design to minimise risk	DG2.5.3	Not covered in Green Star	Statement by head contractor that no pesticides or termites have been used.	Y		Statement	Principal Contractor
Place	P3 – Welcoming learning spaces	**Green cleaning**	N/A	GSP c6 Green Cleaning	1) WEB Clean School User Guide 2) Green Cleaning specifications	TBC	To be confirmed		
Place	P3 – Welcoming learning spaces	**Fly free indoors** Fly screening must be provided in all schools to the doors, windows and other openings in food preparation, biology, and non-water-closet toilet spaces or where specifically nominated in the EFSG. Schools in localities where fly incidence constitutes a health hazard (especially trachoma or other nuisance) will require fly screens to all opening sashes.	DG31.01	Not covered in Green Star	As-built drawings showing fly screening has been provided as required	Y	Screens will be provided to openable windows due to BAL 12.5 requirements	As built architectural drawings	Architect
Place	P3 – Welcoming learning spaces	**Indoor CO2 levels** For mechanically ventilated spaces: 1. Outdoor air ventilation rates are in accordance with requirements of AS 1668.2. 2. Mechanical ventilation systems shall be linked to CO2 sensors to provide demand-controlled ventilation within each space to ensure that CO2 levels are maintained below the required CO2 threshold. 3. Mechanical ventilation systems shall be designed to provide adequate access for maintenance and cleaning. 4. Ventilation systems are designed to maintain an average daily CO2 concentration as per the latest NCC code, and so that the maximum concentration does not exceed 1,500ppm for more than 20 consecutive minutes in each day. 5. The required outdoor air ventilation rates and CO2 concentrations shall be maintained without the need for any human intervention e.g. the opening of windows or external louvres. 6. Ventilation systems shall be designed minimise the entry of outdoor pollutants through ensuring that the ventilation system design is in accordance with the relevant parts of AS 1668.2. and ASHRAE Standard 62.1. 7. Where local sources of pollutants are present e.g. photocopiers, minimum exhaust ventilation flow rates should be provided in accordance with AS1668.2: Table B1.	DG55.02	DAB c9 Indoor Air Quality	Mechanical drawings and specifications Extracts from commissioning report	Y		As built mechanical drawings	Mechanical Contractor

Place	P3 – Welcoming learning spaces	**Ecological conservation** Schools sites must conserve for future generations, the biological diversity of genetic materials, species and ecosystems on that site and consider the surrounding natural environment. The design of the facilities must provide unique and valuable environmental conservation learning opportunities and effective environmental modelling to the wider community. Schools must model best practice design, material use, systems and operational methodology, demonstrating human's connections to nature and the operation of natural cycles of sun, wind, rain and the four seasons. Schools must connect with nature and incorporate biophilic design principles. Open space must allow for exploration, and biodiversity and earth education to enhance the site's outdoor learning potential. New and refurbished schools must: Preserve or re-establish native flora (unless it poses a safety risk or cannot be designed around) and create new landscapes through liaising with local government authorities, Landcare and environmental groups, and the use of native low water use plants. Consider opportunities for development of community garden within the site and relationships with community groups for this to occur. Adequate due diligence must be conducted where biodiversity or high ecological value is identified on the site. For more details see DG90 Landscape Design	DG02.06	DAB c23 Ecological Value GSC c29 Ecological Value (incl Biodiversity Enhancement)	1) Biodiversity or ecological assessment / local flora and fauna survey 2) Biodiversity management plan describing measures for the conservation and protection of threatened species or communities, biodiversity enhancement, tree protection, etc. 3) Evidence demonstrating measures have been implemented to protect and enhance endangered species / ecological communities identified; to preserve or re-establish native flora; etc.	Y	A Biodiversity Development Assessment Report (BDAR) has been developed by Narla Environmental. Three ecosystem credits are required to be offset in order to mitigate the impacts upon biodiversity as a result of the proposed development. An Arboricultural Impact Assessment Report has been prepared by Sturt Noble Arboriculture. Trees that are to be retained will be protected from potential damage caused by construction activities. Landscaped areas have been developed to ensure cross collaboration with the curriculum / learning objectives of the students.	Biodiversity Development Assessment Report Arboricultural Impact Assessment Report Landscape Architectural Drawings	Ecologist Landscape Architect
Place	P3 – Welcoming learning spaces	**Accessibility** -All new facilities must meet current DTS provisions of the NCC and the associated standards. Generally AS 1428.1 is the minimum design standard for access and mobility. However, it is DoE's policy that any enhanced requirements noted in AS 1428.2 be incorporated in any new design. -Additionally, DoE have enhanced circulation requirements as noted in DG / CIRCULATION - Provide hearing augmentation system for areas that have amplification, generally within Gymnasium, libraries, movement studios and Communal Halls, provide a system to assist the aurally challenged to hear music and speech within the main auditorium and on the stage - Provide the International Symbol for Deafness to indicate that an assistive hearing device is installed.	DG19.01 DG65.14	DAB 30D Universal design	1) Accessibility plan 2) As-built drawings or other evidence demonstrating that minimum and enhanced accessibility requirements have been provided for walkways, corridors, ramps, etc. 3) Photographic or other evidence of signage installed	Y	All areas within the school are accessible to comply with AS 1428.1	1) Accessibility plan 2) As-built drawings or other evidence demonstrating that minimum and enhanced accessibility requirements have been provided for walkways, corridors, ramps, etc. 3) Photographic or other evidence of signage installed	Accessibility consultant Principal Contractor
Place	P3 – Welcoming learning spaces	**Weather protection** Circulation areas provided between administrative, staff and all student spaces (except Agriculture), should be protected from sun, rain and unfavourable winds.	DG08.05	Not covered in Green Star	As built drawings showing circulation areas are protected as required	Y	2.4m covered walkways both sides of the buildings have been provided for circulation	As built architectural drawings	Architect
Place	P3 – Welcoming learning spaces	**Open play space** Open play space must be provided for students to access during recess, lunch breaks and for outdoor learning. Open play space can be comprised of - Paved and grassed areas - Rooftops and terraces - Covered outdoor areas The designated open play space must be easily monitored and managed by school staff. Where a joint use agreement can be negotiated with a local council or land owner, the required play space can be located off-site, providing the facilities are - In close proximity to the school - Easily accessible - Safe and secure Designs must aim to achieve a minimum of 10m2 per student. Where this figure is not achievable the proposed m2 per student of the completed project must not be less than the existing m2 per student currently on the site.	DG10.03	Not covered in Green Star	Plan view drawings showing provision of open space	Y	The site is achieving more than 10sqm per student for open outdoor area	As built architectural drawings	Architect
Place	P3 – Welcoming learning spaces	**Staff room**	N/A	GSI c Amenity Space	1) Extracts from the EFSG requirements for staff rooms 2) Evidence of staff room delivered accordingly	Y		As built architectural drawings	Architect
Place	P3 – Welcoming learning spaces	**Healthy canteen policy**	N/A	DAB c30D Integrating Healthy Environments	1) Research report behind Healthy Canteen Policy 2) Evidence that policy initiative has been incorporated into the school under assessment.	TBC	To be confirmed		
Place	P3 – Welcoming learning spaces	**Safety by design** - The Work Health and Safety Act and the Department of Education principles of student safety and welfare mandate the avoidance of accidents through careful design of facilities - The designer must ensure, so far as is reasonably practicable, that the plant, substance or structure is designed to minimise risks to the health and safety of all parties who will work on a site connected with its design as well as the end users of the facility. - An important part of the Safety by Design principle is recording the risk assessments that are conducted during the design and providing to the client, owners, any users/occupiers of the facilities and those who will be building or maintaining the facilities, details of risks and hazards identified. - The design of facilities should not only be inherently safe but visually and pragmatically safe and not tempt students or the general public into unsafe practice. Examples: Glazing: The safety of occupants is paramount where glass is being used, especially in areas subject to human impact. All glazing types and thickness are to comply with the relevant AS as a minimum. Hot water: To minimise scalding risk all hand basins, showers and the kitchen sink in practical activities areas serving IO/IS classes, require "warm" rather than "hot" water provided at a specified temperature, by mixing hot and cold water through a Thermostatic Mixing Valve. (Note: Tempering Valves are not permitted in schools) Drinking water tanks: Ensure rainwater is not collected from areas containing lead materials. All coating materials used inside the reservoir must be suitable for drinking water and guaranteed against liner leakage for a period of 20 years. A filtering and UV system to be provided where drinking water tanks are present.	DG14.02 DG31.03 DG53.11 DG53.16 DG53.17	Not covered in Green Star	1. Safety risk assessments 2. Short report identifying safety-by-design principles incorporated / Sign off by head contractor confirming all mandatory requirements in DG14 have been addressed. 3. Manufacturer's certificate to AS/NZS 4020 for tanks	Y	SiD workshops have been undertaken to ensure a safe work and learning environment for the school	1. Safety risk assessments 2. Short report identifying safety-by-design principles incorporated / Sign off by head contractor confirming all mandatory requirements in DG14 have been addressed. 3. Manufacturer's certificate to AS/NZS 4020 for tanks	Design Team
Place	P3 – Welcoming learning spaces	**Microbial control** As a measure to prevent legionella, heated water to hand basins, showers etc. shall be stored at temperature above 65 C. Thermostatic mixing valves are to be used for tempered water generation at each point of use. Valves need to comply with microbe disinfection requirements - "Code of Practice for Thermostatic Mixing Valves NSW" as approved by the NSW Health Department.	DG51.09 DG53.11	DAB c28 Microbial Control	1. Letter by hydraulic engineer confirming hot water is stored above 65 deg and that valves comply with code of practice.	Y		As built hydraulics drawings	Hydraulic Contractor
Place	P3 – Welcoming learning spaces	**Security** Safety in Design and Crime Prevention Through Environmental Design (CPTED) principles are to be implemented in project planning stage. Advice on the electronic surveillance systems can be sought early in the design phase. CCTV systems are required in several locations where indicated in the Rooms and Spaces Technical Data table, including: - Secondary clinic - Primary sick bay - Library	DG14.10 DG65.08 DG65.10	GSC c15 Safe Places	1) Crime risk assessment or equivalent 2) Evidence of designing out crime principles implemented 3) Security services plans, schedules and forms by School Security Unit (SSU) 4) SSU specification and evidence of input on project specification	Y	Perimeter fencing for the outdoor areas has been incorporate, CTV and alarms will be provide in all buildings and agricultural plots will also have a secure fence to protect the animals		Principal Contractor
Place	P3 – Welcoming learning spaces	**Hazardous materials** Where a new school is to be developed a Hazardous materials study is to be conducted, including: - Asbestos Containing Materials (ACM) - Synthetic Mineral Fibres (SMF) - Polychlorinated Biphenyl's (PCB) - Lead Paint - Ozone Depleting Substances Any existing structures and all parts of the site should be examined in order to determine the presence of hazardous materials before commencement of any renovation or demolition. Inspection should be conducted by organisations with the National Association of Testing Authorities (NATA) accreditation complying with the requirements of AS/NZS ISO.IEC 17020 for the inspection of hazardous materials (HazMat) including asbestos. Hazardous Materials inspection reports should be produced in accordance with the requirements of the various Safe Work Australia "Codes of Practice" for the management and control of hazardous substances. Where hazardous materials are found a Hazardous Materials Management Plan should be prepared	DG48.01	DAB 24.2 Contamination and Hazardous Materials	1. Hazardous materials study / site inspection report / survey 2. Management plans for hazardous materials identified 3. Remediation strategies implemented 4. Environmental auditor certificates / clearance certificates	Y	A DSI has been undertaken on the site and a RAP developed for the removal / treatment of hazardous materials		Principal Contractor
Place	P3 – Welcoming learning spaces	**Digital infrastructure** New buildings and refurbishments are required to provide a common wireless solution compatible across the school, providing a consistent user experience and support mechanism. This involves the replacement of existing legacy wireless equipment, such as wireless access points and site switches	DG64.12.02	GSC c22.2 Digital Infrastructure	1) Contracts describing the network infrastructure specification and operational requirements	Y		As built electrical drawings	Electrical Contractor
Place	P3 – Welcoming learning spaces	**Sustainability benchmarking** Ecologically Sustainable Development principles must be included in any new school buildings to a level that the building could be benchmarked to achieve a 5 Star Green Star rating if located in Sydney, Newcastle, or Wollongong metropolitan areas or a 4 star Green Star rating if located elsewhere in NSW. Benchmarking must be undertaken against the Green Star credits using the edition of the Green Star scorecard current at the time of the assessment. The filled out scorecard must demonstrate the project can achieve enough points for the required rating. Formal Green Star certification is not mandatory	DG02.09	All credits	1) Green Star scorecard demonstrated the final design is benchmarked to the required rating (by a Green Star Accredited Professional)	Y	Benchmarked against 4-star Green Star		ESD Consultant

Resilience	R1 – Preparation for shocks	**Site investigations for resilience** The following detailed reports/ surveys/ information should be considered in developing the business case: - Slope, drainage and erosion issues including flood risks (if any) - Geotechnical and soil conditions - Airborne pollutants - Bushfire risks - Appraisal of available services infrastructure - Climate change risk assessment must be undertaken considering at least two different climate change scenarios An environmental risk report will be required for developments proposed within sensitive natural environments or sites subject to natural risks (i.e. flood prone sites, bush fire areas).	DG03.02	DAB c3 Adaptation and Resilience	1) Detailed reports or surveys developed 2) Environmental risk report 3) Evidence demonstrating recommendations have been implemented and risks addressed through design responses.	Y			
Resilience	R1 – Preparation for shocks	**Bushfire protection** Development applications on bush fire prone land must be accompanied by a Bush Fire Assessment Report demonstrating compliance with the aim and objectives of Planning for Bush Fire Protection and the specific objectives and performance criteria for the land use proposed. Local Authorities and the Rural Fire Service can provide advice on the design of buildings in bush fire prone areas. The Building Code of Australia and AS3959 "Construction of buildings in bushfire-prone areas" set out the requirements for buildings which are within close proximity to a defined bush fire zone. Mandatory landscape management strategies: - Keep the amount of fuel (leaves, twigs, logs, dead grass) in the vicinity of buildings to a minimum. - Ensure trees are located at away from buildings to avoid branches overhanging and leaves collecting on roofs. - Do not plant shrubs against buildings. - The crowns of trees planted on the hazard side of the development should not be contiguous. - Plant fire resistant trees and shrubs on the hazard side of the development to reduce the potential impact of wind, fire intensity, radiant heat, and rate of spread as well as intercepting burning embers. - Avoid combustible fencing materials. - Provide irrigation and garden sprinklers to water areas near the buildings (subject to water authority approval).	DG13.01	DAB c3 Adaptation and Resilience	1) Bush fire assessment report 2) Statement by Architect / fire consultant outlining building strategies implemented in line with BCA and AS3959. 3) Bush fire management plan outlining management strategies implemented 4) Landscape plans detailing bush fire management measures implemented	Y			
Resilience	R2 – Preparation for stresses	**Climate change adaptation** Sites and school communities must be able to withstand natural and urban hazards and adaptively respond to climate change over time, especially for projects involving vulnerable communities e.g. climate generating exacerbated flood, storm surge, inundation, heatwaves, bush fires, extreme storm and other weather events. School facilities must be able to withstand natural hazards and adapt to shocks and stresses to avoid social and economic costs of interrupted operation and repairing or replacing damaged assets. To achieve this, increasing resilience to natural hazards must be considered in the business case development so that associated costs are budgeted. An initial assessment of natural hazards and project vulnerability must be carried out, in consultation with resilience experts, to inform the business case and identify hazards where further analysis is required. Where significant risks are identified in the initial assessment, a comprehensive climate change risk assessment must be undertaken. Any high or extreme risks identified must be addressed through design measures.	DG02.08	DAB c3 Adaptation and Resilience	1) Climate risk assessment, and 2) Climate adaptation plan 3) Emergency management plan	Y	Climate change & adaptation report has been developed	NDY Report rp210326s0001	ESD Consultant

8.2.2 Crossover Between SINSW Requirements & Green Star D&AB v1.3

Refer over.

Crossover between SINSW requirements and Green Star - Design & As Built v1.3

Targeted Rating:	4 Star - Best Practice
Points required for 4 Star Green Star rating	45
Points achievable from Green Star - Design & As Built v1.3	50
Safety Margin	5
Rating Achieved	**4 Stars**

Green Star scheme						SINSW's approach, standards and points achievable						
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Aim**	**Compliance requirements**	**Aim**	**Approach to achieve best practice outcome**	**Governance**	**Project specific evidence (example)**	**Points Targeted**	**Equivalence to Green Star outcome**	**Consultant Responsible**
Management			**14**							**12**		
Green Star Accredited Professional (GSAP)	1.0	Accredited Professional	1	Recognises projects that engage a GSAP to support the Green Star certification process.	Appoint GSAP at all stages of the project, leading to certification	Ensure an ESD consultant is appointed to provide ESD advice, integration and verification	ESD consultant is engaged at early design and throughout development process to coordinate ESD input in building design	● Sustainability Practice Note ● ESD consultant scope of services	● ESD consultant procurement documentation ● ESD consultant outputs (e.g. letters of advice, reports, etc.)	1	High	
Commissioning and Tuning	2.0	Environmental Performance Targets	Mandatory for this Credit	Recognises commissioning, handover and tuning initiatives for building services to operate at their full potential and as designed.	● Set environmental performance targets	Ensure building systems operate efficiently and that staff are trained on efficient use of building systems and facilities.	SINSW set out environmental performance targets for each school type in SINSW's Environmental Performance Plan.	● SINSW Environmental Performance Plan	● SINSW Environmental Performance Plan	-	High	
	2.1	Services and Maintainability Review	1		Conduct a services and maintainability review during design and prior to construction and develop a 'Service and Maintainability Report'		The EFSG require all systems are installed with suitable access or maintenance. Independent design review is undertaken at key design milestones by a technical stakeholder group and/or an expert reference group to ensure adherence to EFSG requirements including maintainability, safety, etc.	● DG 16.10 - Access for Maintenance Project Governance Framework ● Technical Stakeholder Group Practice Note	● Expert review group and technical stakeholder group (TSG) meeting minutes ● TSG sign off certificates ● Design Advisory Reports	1	High	
	2.2	Building Commissioning	1		● Prepare commissioning plan and specification ● Conduct air permeability testing		SINSW's Commissioning & Handover Procedure goes above and beyond Green Star requirements. It requires that a Commissioning & Handover Plan is developed including all key systems in the scope.	● Commissioning & Handover Procedure	● Commissioning & Handover Plan ● PV installation checklist	0	High	While this is aligned with the EFSG guidelines, the project will not target the prescriptive approach outlined in the Green Star tool as air tightness testing is required. Major building services will however be commissioned in line with best practice guidelines to ensure energy efficiency is achieved.
	2.3	Building Systems Tuning	1		Commit to a tuning process for all nominated building systems including: ● quarterly adjustments ● measured first 12 months after occupation ● review of manufacture warranties		SINSW monitor optimum performance of building systems over the project life time through asset management units.	● Asset Management Units (AMU)	● Maintenance reports ● FMWeb online portal	1	High	
	2.4	Independent Commissioning Agent (ICA)	1		● Appoint an ICA from schematic design		At master planning, concept and schematic, an independent expert review group (ERG) reviews, advises and signs off the design. At construction and commissioning phases, the Commissioning & Handover Procedure requires comprehensive inspection, witness testing and validation.	● Project Governance Framework ● Technical Stakeholder Group Practice Note ● Commissioning & Handover Procedure	● Expert review group and technical stakeholder group (TSG) meeting minutes ● TSG sign off certificates ● Design Advisory Reports ● Commissioning & Handover Plan ● Witness testing reports	1	Med	The SI commissioning team, separate to the delivery project team, to be involved early on in the design process in accordace with GBCA-approved technical question.
Adaptation and Resilience	3.0	Implementation of a Climate Adaptation Plan	2	Recognises projects that are resilient to the impacts of a changing climate and natural disasters.	Engage a qualified professional to prepare a project-specific Climate Adaptation Plan (CAP) and implement recommendations into the design and construction.	Deliver development that is resilient to natural and urban hazard risks.	Site selection is informed by Eagle Eye or XDI Systems which are tools that identify bushfire, landslide, flooding and drought risks. The EFSG require consideration to how school communities will be able to adaptively respond to climate change over time, especially flood, storm surge, inundation, heatwaves, bush fires and extreme weather events.	● DG 03.02 - Site Investigations ● DG 13 - Bushfire Protection ● DG 02.08 - Climate Change Adaptation	● Service Need Report ● Site investigation reports (e.g. flooding, geotechnical, air pollution) ● Master plan report ● Concept design report ● Business case report ● Climate change risk assessment (if conducted) ● Bushfire assessment report ● Environmental risk report	2	Med	
Building Information	4.0	Building Information	1	Recognises projects that make available building information that facilitates understanding of building systems operation and maintenance requirements, and their environmental targets for optimised performance	● Provide operations and maintenance (O&M) information and log book to facilities management team and stakeholders, and ● Provide building user information to all relevant stakeholders	Ensure all building information, manuals, plans, warranties, BIM, etc., are handed over and staff are trained on how to operate building systems.	The EFSG require a building user's guide is developed and the Commissioning & Handover Procedure requires on-site training is provided to staff as well as handover of manuals, as builts and warranties.	● DG 64.10 - Manuals and Training ● DG 65.02 - Energy Conservation ● DG 16.10 - Access for Maintenance ● Commissioning & Handover Procedure	● Project specific manuals, as-builts, warranties, etc. ● Signage and posters ● Training records ● AMS online portal	1	High	
Commitment to Performance	5.1	Environmental Building Performance	1	Encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance.	Set, measure and report for at least 2 building performance metrics i.e. energy, water, waste and IEQ	Encourage operational energy and water efficiency and reduce waste in schools.	SINSW monitor energy and water performance of schools and report annually for GREP. Energy efficiency programs are developed based on this monitoring.	● SINSW Environmental Performance Plan	● ERM Power customer online portal ● Principal's Dashboard ● GREP annual reports	1	High	
	5.2	End of Life Waste Performance	1		Commitment to extend the life of the interior fitout or finishes to at least ten years.		Life of interiors in schools extend further than 10 years. The EFSG specify materials and systems that have proven durability.	● EFSG multiple specifications ● DG 40 - Materials and Finishes		1	High	
Metering and Monitoring	6.0	Metering	Mandatory for this Credit	Recognises the implementation of effective energy and water metering and monitoring systems	Install accessible meters to monitor building energy and water consumption. Meters must comply with the current National Measurement Regulations and NABERS rating protocol	Identify promptly water leaks and enable water efficiency.	The EFSG require all main water end uses are to be separately submetered but contains no provisions for energy submetering.	● DG 53.04 - Metering Supplies	● As built hydraulic drawings	0	Low	
	6.1	Monitoring Systems	1		Auto monitoring system to capture, process and present data		A monitoring program at portfolio level is under development and almost ready to be rolled over but will be discussed as part of EFSG realignment project.			0	Med	Metering and monitoring system is proposed for the building, however it is unlikely to be ciompliant with the specific requirements of this Green Star credit.

Responsible Building Practices	7.0	Environmental Management Plan (EMP)	Mandatory for this Credit	Rewards responsible construction practices that manage environmental impacts, enhance staff health and wellbeing, and improve sustainability knowledge on site	Develop and implement a best practice EMP	Ensure responsible building practices	An EMP is required for all SINSW SSD projects	● NSW Environmental Management Systems Guidelines.	● EMP	-	High	
	7.1	Formalised Environmental Management System	1		A responsible party for the site has a formalised approach to planning, implementing and auditing is in place during construction, to ensure conformance with the EMP		ISO accredited EMS contractors required	● GC21 provisions	● Head contractor's ISO certificate	1	High	
	7.2	High Quality Staff Support	1		Promote mental and physical health of staff and train up in sustainability practices through on-site, off-site and/or online classes		No EFSG requirement but usually the head contractor has programs in place that address the credit requirements. Also, SINSW is investigating 5-day work weeks for construction workers to prevent suicide.			1	Low	While less aligned with the EFSG requirements, where contractors are local workers, this credit ensure their health and wellbeing is considered - mindful of the community impact of the development.
Operational Waste	8A	Performance Pathway		Recognises projects that implement waste management plans that facilitate the re-use, upcycling, or conversion of waste into energy, and stewardship of items to reduce the quantity of outgoing waste.	Qualified waste auditor prepares and Implements an Operational Waste Management Plan (OWMP) which is then reflected in design of building facilities	Minimise operational waste generation	School Waste Management Plans are required. Whole-of-government contract is being reviewed to increase stream collection.	● Contract 9698 Waste Management	● School waste management plan	1	High	A performance pathway will be selected for this project as pescriptive requirements do not always reflect for the most suitable approach for an educational facility. An operational waste management plan will be developed in future stages of the project and recommendations/advice will need to be catpured in the building design.
	8B	Prescriptive Pathway	1		Project team to comply with the following: ● separation of waste streams ● dedicated waste storage area ● access to waste storage areas must adhere to best practice		EFSGs require waste storage areas are included, with the provision of space for the separation of waste and receptacles for multiple waste streams. Safe methods for vehicle access and the transfer of waste must also be considered.	● DG 02.07 - Waste Management	● As built architectural drawings ● Schedule of accommodation	0	High	
Indoor Environment Quality			**17**							**9**		
Indoor Air Quality	9.1	Ventilation System Attributes	1	Recognises projects that provide high indoor air quality to occupants.	● Minimise outdoor air pollutants ● Design HVAC for ease of maintenance ● Clean prior to occupation ASHRAE Standard 62.1:2013 is referenced	Ensure good indoor air quality that supports teaching and learning	The EFSG require ventilation systems are designed for ease of maintenance and to minimise the entry of outdoor pollutants through ensuring that the ventilation system design is in accordance with the relevant parts of AS 1668.2. and ASHRAE 62.1. Cleaning is a commissioning requirement.	● DG 55.02 - Thermal Comfort and Indoor Air Quality Performance Brief ● Commissioning and Handover Procedure	● As built mechanical drawings ● Confirmation of cleaning by contractor	1	Low	Aligned with requirements for access to HVAC systems for maintenance and in reducing the intake of pollutants into regularly occupied spaces.
	9.2	Provision of Outdoor Air	2		● 1 point - Outdoor air is provided at a rate 50% greater than min required by AS 1668.2:2012 or maintain CO_2 concentrations below 800ppm ● 2 points - Outdoor air is provided at a rate 100% greater than min required by AS 1668.2:2012 or maintain CO_2 concentrations below 700ppm ● Naturally ventilated spaces must meet the requirements of AS 1668.4-2012		Schools are naturally ventilated most of the time and only when climate is not appropriate mechanical systems are operated (a traffic light system is used to control this). Provision of outdoor air required in the EFSG is in accordance with requirements of AS 1668.2.	● DG 55.02 - Thermal Comfort and Indoor Air Quality Performance Brief	● As built mechanical drawings ● Commissioning report	0	Med	
	9.3	Exhaust or Elimination of Pollutants	1		Sources of pollutants (printing, photocopying, cooking and vehicle) compliant with minimum emissions standards or be exhausted directly to outside		The EFSG contain provisions for exhaust or elimination of pollutants for multiple spaces, incl printing rooms and kitchens	● DG 57.07 - Duplicating / Printing Room Ventilation ● DG 57.08 - Fume Cupboard - Single Side or Double Side ● DG 57.09 - Chemical Store Ventilation ● DG 57.16 - Toilet and Change Room Ventilation ● DG 57.17 - Laundry	● As built mechanical drawings	1	High	
Acoustic Comfort	10.1	Internal Noise Levels	1	Rewards projects that provide appropriate and comfortable acoustic conditions for occupants.	● Internal ambient noise levels no more than 5db(A) above lower figure in table 1 of AS/NZA 2107:2016 ● Compliance shall be demonstrated through measurement provided by a qualified acoustic consultant	Ensure good acoustics that supports teaching and learning	The EFSG set acoustic performance requirements for the different spaces, including noise levels, reverberation and acoustic separation. These requirements are best practice for schools.	● DG 55.02 - Thermal Comfort and Indoor Air Quality Performance Brief (noise levels from HVAC) ● DG 11.07 - Acoustic post occupancy evaluation	● Detailed drawings ● Acoustic report ● Commissioning report ● Acoustic post occupancy evaluation	1	High	
	10.2	Reverberation	1		● Reverberation time below max stated in table 1 of AS/NZS 2107:2016 ● Compliance shall be demonstrated through measurement			As above		1	High	
	10.3	Acoustic Separation	1		Reduce noise transmission between enclosed spaces Rw of at least 35 for partitions with doors and at least 45 for partitions without a door			● DG 11.05 - Room to Room Noise Control		0	High	This requirement is satisfied in all areas except for the Block F residential areas. Block F acoustic separation is in accordance with NCC Part F5, however would require uplift to achieve Green Star requirements which is not currently proposed.
Lighting Comfort	11.0	Minimum Lighting Comfort	Mandatory for this Credit	Recognises well-lit spaces that provide a high degree of comfort to users	Lights in the nominated area (all primary and secondary spaces) are Flicker-free lights and min Colour Rendering Index (CRI) of 80	Ensure good indoor lighting that supports teaching and learning	The EFSG include best practice provisions for lighting comfort, illuminance levels, glare reduction, surface illuminance and lighting controls. Modelling is required to inform design and demonstrate outcomes.	● DG 63.03 - Lighting Design	● Lighting drawings ● Architectural drawings ● Lighting specifications / schedules ● Isolux drawings	-	High	
	11.1	General Illuminance and Glare Reduction	1		● Lighting levels and quality comply with the GBCA best practice guidelines and ● Glare is reduced					1	High	
	11.2	Surface Illuminance	1		Combination of lighting and surfaces improve uniformity of lighting					0	High	While aligned with the EFSG objectives, the perscriptive requirements outlined by the GBCA make this credit undesirable in design and in cost.
	11.3	Localised Lighting Control	1		Occupants are be able to control the lighting in their immediate environment Example of immediate environment: ● open-plan office - light shone on the workstation ● residential unit - light hitting the work surface in the kitchen where food is prepared					0	Med	

Visual Comfort	12.0	Glare Reduction	Mandatory for this Credit	Recognises well-lit spaces that provide high levels of visual comfort to building occupants.	Reduce glare through a combination of blinds, screens, fixed devices, or other means	Maximise daylight indoors and and enable visual connection to outdoors for biophilic effects to support teaching and learning	The EFSG require daylight glare controls are implemented on exposed facades subject to direct sunlight. Specifically, external window shading.	● DG 12 - Light - Natural ● DG 07 - Sun Control ● DG 2.3.1 - Energy Conservation (shading devices)	● Architectural drawings	-	High	
	12.1	Daylight	2		● 1 point - 40% of the nominated area (all primary spaces) receives high levels of daylight ● 2 points - 60% of the nominated area (all primary spaces) receives high levels of daylight		The EFSG require to maximise natural daylight in all habitable spaces to improve indoor amenity and create a pleasant environment.	● DG 2.3.1 - Lighting ● DG 12 - Light - Natural	● Daylight modelling report	0	High	Based on preliminary daylight modelling, this Green Star credit it not achieved.
	12.2	Views	1		60% of the nominated area (all primary spaces) has a clear line of sight to a high quality internal or external view ● External View – A high quality external view must extend to the outside towards natural elements such as large bodies of vegetation, a body of water, frequent movement of (people, vehicles, or animals) or sky ● Internal View - A high quality internal view is defined as a view towards an area that is landscaped or contains a water feature, or an atrium		This is not explicitly required in the EFSG but 100% achievable based on typical room design, window location and quality landscaping in new schools.	● DG 90 - Landscape Design	● Landscape design report ● Architectural drawings	1	High	
Indoor Pollutants	13.1	Paints, Adhesives, Sealants and Carpets	1	Recognises projects that safeguard occupant health through the reduction of internal air pollutant levels.	● No paints, adhesives, sealants or carpets are used in the building; or ● 95% of all internal paints, adhesives, sealants and carpets meet total VOC limits	Ensure pollutant-free environments	The EFSG require low VOC and formaldehyde content in line with Green Star requirements.	● DG 2.5.2 - Low VOC	● Materials specifications	1	High	
	13.2	Engineered Wood Products	1		● No new engineered wood products are used in the building; or ● At least 95% of all engineered wood products meet formaldehyde emission limits			As above	As above	1	High	
Thermal Comfort	14.1	Thermal Comfort	1	Recognises projects that achieve high levels of thermal comfort.	80% of occupants satisfied - equivalent to PMV between -1 and +1		Schools are naturally ventilated except when outside climate is not adequate. Inclusion of active cooling is directed by DoE's thermal comfort policy. The EFSG require thermal comfort is automatically controlled within specified parameters. Thermal modelling is undertaken to demonstrate that learning spaces and libraries have been designed to achieve a predicted mean vote (PMV) of +/- 0.5 for 95% of occupied hours	● DG 06.03 - Cooling ● DG 55 - Cooling Policy	● Drawings ● Thermal comfort modelling report	1	Med	
	14.2	Advanced Thermal Comfort	1		90% of occupants satisfied - equivalent to PMV between -0.5 and +0.5					0	Med	
Energy			**22**							**7.3**		
Greenhouse Gas Emissions	15E.0	Conditional Requirement: Reference Building Pathway	Mandatory for this Credit and Certification	Encourages energy efficient buildings and the reduction of greenhouse gas (GHG) emissions associated with the use of energy in building operations.	Projects targeting: ● 4 Star - Proposed building must achieve 10% improvement on NCC Section J reference building. Equivalent to GBCA Benchmark Building ● 5 Star - Minimum points threshold = 3 points ● 6 Star - Minimum points threshold = 6 points	Minimise energy consumption and associated GHG emissions from school operation	The EFSG require 'energy consumption is predicted to be at least 10% lower than if build to minimum compliance with National Construction Code requirements'.	● DG 02.03 - Energy Conservation	● Section J modelling report	-	High	
	15E.1	Reference Building Pathway	20		Points awarded for emissions reduction: ● Building fabric relative to NCC Section J to Reference Building - 1 point for 5%, 2 point for 10%, 3 point for 15%, max. 4 point for 20% ● Proposed building relative to GBCA Benchmark Building - 1.6 point for 10%, 3.2 point for 20%, 4.8 point for 30%, 6.4 point for 40% etc.		The EFSG require a number of measures for reduced energy consumption including: - Passive design (building envelope, orientation, daylighting, insulation, etc.) - Energy efficient air conditioning, ventilation and lighting systems - Solar PV (large systems up to 100 kW) Six points are conservatively estimated based on the above and Green Star benchmarking done for SINSW projects	● DG66 - Photovoltaic Solar Power Generator ● DG 02.03 - Energy Conservation ● DG 65.02 - Energy Conservation (special electrical systems) ● DG 12 - Light - Natural ● DG 07 - Sun Control ● DG 63 - Lighting ● DG 65.03 - Automatic Lighting Control ● DG 55 - Cooling Policy (energy efficient AC) ● DG 16.09 - Energy Efficiency ● DG 04 - Heat loss / gain ● DG 06.02 - Principles of Energy Efficient Design ● DG 27.12 - Coloured Roof Sheeting ● DG 57 - Ventilation ● DG 05 - Air Movement ● DG 37 - Roof mounted turbo ventilators ● DG 53.09 - Hot Water Heaters for Schools ● DG 56 - Heating	● Energy modelling report	6.4	High	
Peak Electricity Demand Reduction	16A	Prescriptive Pathway - On-site Energy Generation		Encourages the reduction of peak demand load on the electricity network infrastructure.	1 point - On-site electricity generation systems reduces the total peak electricity demand by at least 15%		The EFSG require installation of PV systems. Batteries may be installed if substantiated	As above	As above	0	High	
	16B	Performance Pathway - Reference Building	2		Project's predicted peak electricity demand has been reduced below that of a Reference Building: ● 1 point - 20% reduction ● 2 points - 30% reduction					0.9	High	
Transport			**10**							**0**		
Sustainable Transport	17A	Performance Pathway	10	Rewards projects that implement design and operational measures that reduce the carbon emissions arising from occupant travel to and from the project, when compared to a reference building. This also promotes the health and fitness of commuters, and the increased liveability of the location.	● The Travel Plan or Transport Plan must be developed by a suitably qualified transport professional ● Completion of the Sustainable Transport Calculator ● Most appropriate for suburban or regional projects	Encourage uptake of active transport modes for staff and students	A Green Travel Plan is developed for SINSW projects including targets for cycling and walking and adequate provision of bicycle parking and end of trip facilities for staff. A Rapid Transport Assessment is completed during the Master Planning phase.	● SEARs	● Green Travel Plan ● Architectural drawings	0	High	Traffic consultant to confirm if site specific transport assessment will be undertaken in line with the GBCA-approved approach for SINSW. It is understood this can yield 10 points - currently listed as 'Potential Extra' in the Green Star scorecard.
Water			**12**							**3**		
Potable Water	18A	Performance Pathway	12	Encourages building design that minimises potable water consumption in operations.	Completion of the Green Star Potable Water Calculator that awards points based on water saving in comparison with a reference building	Reduce water consumption in schools	EFSGs require a number of initiatives to reduce potable water consumption. This includes rainwater harvesting, water efficient fixtures and fittings, drought tolerant vegetation for landscaping, etc.	● DG 53 - Water ● DG 2.4.1 - Water Conservation ● DG 51.01 - Hydraulics	● Hydraulic drawings ● Potable water calculations	3	High	At this stage, descriptive measures will be implemented. Performance approach may be more suited as the design develops.
Materials			**18**							**6**		

Life Cycle Assessment (LCA)	19A.1	Comparative Life Cycle Assessment (LCA)	6	Rewards projects that undertake conduct LCA and inform the design process or as-built outcome.	Whole building LCA is conducted and points are awarded based on reduction of environmental impact compared to reference building		The EFSG recommend whole of life cost assessment is done for material and building system selection including assessment of environmental products and materials.	● DG 01.03 - Whole of life - General Design Considerations		0	Low	
	19A.2	Additional Life Cycle Impact Reporting	4		LCA is used to inform improvements such as material selection and construction process improvement					0	Low	
Projects that choose to use the 'Life Cycle Assessment' credit may not use the 'Life Cycle Impacts' credit and vice-versa												
Life Cycle Impacts	19B.1	Concrete	3		Requires reduced use of Portland cement content, potable water and aggregates in concrete mixes.		EFSG recommend fly ash can be used in concrete mixes	● DG 21.02 - Concrete		0	N/A	
	19B.2	Steel	1		Requires reduced use of steel in building frame		Not required in EFSG			0	N/A	
	19B.3	Building Reuse	4		Requires a percentage of the building façade or structure is retained.		Not required in the EFSG but typically facades and structure are retained in refurbished buildings.		● Demolition drawings	0	N/A	
	19B.4	Structural Timber	3		Requires a percentage of the building structure is made of timber		Not required in EFSG			0	N/A	
Responsible Building Materials	20.1	Structural and Reinforcing Steel	1	Rewards projects that include building materials that are responsibly sourced or have a sustainable supply chain.	Requires a percentage of the steel is sourced from a responsible steel maker		Not required in EFSG but typically steel from responsible manufacturers is procured.			1	Low	
	20.2	Timber Products	1		95% (by cost) of all timber used is certified or reused	Ensure only sustainable timber is used in schools	The EFSG require that only sustainable timber is procured	● DG 2.5.1 - Sustainable Materials (timber)	● Timber specifications	1	High	
	20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1		Requires that only sustainably produced PVC is used		Not required in EFSG			1	Low	
Sustainable Products	21.0	Product Transparency and Sustainability	3	Encourages sustainability and transparency in product specification.	Requires a proportion of all materials used in the project to meet transparency and sustainability requirements.		The EFSG encourage the use of sustainable materials.	● DG 02.05 - Sustainable Materials		2	Low	
Construction and Demolition Waste	22.0	Reporting Accuracy	Mandatory for this Credit	Rewards projects that reduce construction waste going to landfill by reusing or recycling building materials.	All waste contractors and waste processing facilities that provide waste management and reporting services must demonstrate compliance with *Green Star Construction and Demolition Waste Reporting Criteria*	Reduce construction and demolition waste that goes to landfill	GC21 construction contract contains provisions to minimise construction and demolition waste.	● GC21 ● DG 02.07 Waste Management	● Environmental Management Plan ● C&D waste report	-	Med	
	22A	Fixed Benchmark			90% of construction and demolition waste generated to be diverted from landfill or Less than 10kg/m^2 of GFA goes to landfill					0	Med	
	22B	Percentage Benchmark	1							1	Med	
Land Use & Ecology			**6**							**2**		
Ecological Value	23.0	Endangered, Threatened or Vulnerable Species	Mandatory for this Credit	Rewards projects that improve the ecological value of their site.	No critically endangered or vulnerable species or ecological communities were present on site at the date of site purchase or option contract	Ensure school sites conserve the biological diversity of species and ecosystems and consider opportunities to preserve or re-establish native flora	The EFSG require due diligence studies and appropriate management of vulnerable species or communities.	● DG 02.06 - Ecological Conservation	● Biodiversity and ecology studies ● Arborist studies ● Landscape drawings	-	High	
	23.1	Ecological Value	3		Requires improving ecological value of the site		The EFSG contain requirements ecosystem protection and an Ecology and Biodiversity study is typically undertaken to inform design.			1	Med	
Sustainable Sites	24.0	Conditional Requirement	Mandatory for this Credit and Certification	Rewards projects that choose to develop sites that have limited ecological value, that reuse previously developed land, and that remediate contaminated land.	Site did not include old growth forest, prime agricultural land, wetland of high national importance or impact on matters of national significance	Ensure projects do not negatively impact ecosystems or lands of high ecological value and that adequate remediation is undertaken when contamination is identified.	The EFSG require comprehensive due diligence studies are undertaken to inform site selection when a new school is developed.	● DG03 - Site Selection	● Service Need Report ● Business case report	-	High	
	24.1	Reuse of Land	1		Requires that 75% of the site was previously developed land at the date of site purchase		Most of SINSW projects are refurbishments of existing schools i.e. previously developed land. SINSW preferred approach is to avoid the need for new development	As above	As above	0	High	
	24.2	Contamination and Hazardous Materials	1		Environmental site assessment concludes site is contaminated and is to be remediated prior to development		The EFSG require investigation of presence of contamination and hazardous materials and appropriate remediation measures.	● DG48 Hazardous materials	● Hazardous materials surveys ● Decontamination reports	0	High	
Heat Island Effect	25.0	Heat Island Effect Reduction	1	Recognises projects that reduce the contribution of the project site to the 'heat island effect'.	75% of the total project site area comprises of elements to reduce heat island effect - vegetation, light colour roof, shading	To improve thermal comfort in buildings and grounds	The EFSG contain multiple provisions to this end: - Recommend use of lightly coloured roofs. - Minimum open space provision typically include landscaped areas - Tree preservation - PV installation (absorb heat)	● DG 27 - Roofing ● DG 66 - PV solar generator ● DG 90 - Landscape design	● Landscape drawings ● Roofing specifications	1	Med	
Emissions			**5**							**4**		
Stormwater	26.1	Stormwater Peak Discharge	1	Rewards projects that minimise peak storm water outflows from the site and reduce pollutants entering the public sewer infrastructure or other water bodies.	Post-development peak average recurrence interval (ARI) event discharge from site does not exceed pre-development	Ensure responsible stormwater management in school sites	EFSGs require stormwater system to be integrated with relevant authority requirements, especially the local council and water authority.	● DG 2.4.3 - Stormwater Management	● Civil drawings and specifications ● Water sensitive urban design report	1	Med	
	26.2	Stormwater Pollution Targets	1		Additional point awarded for stormwater site discharge to meet GBCA pollution reduction targets		EFSGs require stormwater treatment to minimise the transportation of toxicants to waterways and other offsite environments, and maintain the existing hydrological regimes.			1	Med	
Light Pollution	27.0	Light Pollution to Neighbouring Bodies	Mandatory for this Credit	Rewards projects that minimise light pollution.	Requires that external luminaires meet Australian Standard to avoid light pollution to neighbouring development	Ensure external lighting is designed to standard and avoid nuisance to neighbours and pedestrians.	EFSGs require external lights to be designed to prevent glare to nearby residents	● DG 63.08.01 - External Access Lighting	● As built drawings ● Confirmation by lighting designer	-	Med	
	27.1	Light Pollution to Night Sky	1		Requires that external luminaires do not emit light pollution to the night sky above a given benchmark		Not an EFSG requirement, however external lighting is minimal and luminaires typically meet the benchmark required.			1	Med	
Microbial Control	28.0	Legionella Impacts from Cooling Systems	1	Minimise the impacts associated with harmful microbes in building cooling systems.	● Building naturally ventilated, or ● Has waterless heat rejection system, or ● Has water-based heat rejection systems that includes measures for Legionella control and Risk Management	Prevent microbial growth in warm water systems in schools	Typically waterless air conditioning systems are installed.	● DG 51.09 - Microbial Control	● Mechanical system specifications	1	High	
Refrigerant Impacts	29.0	Refrigerant Impacts	1	Encourages practices that minimise the environmental impacts of refrigeration and air conditioning equipment.	Requires use of refrigerants with low ozone depletion potential		Not required in EFSG			0	Med	
Innovation			**7**							**6.7**		
	30A	Innovative Technology or Process	2	To use a technology or process that is considered innovative in Australia or the world.	One point available if onsite renewables (e.g. solar PV) contributes at least 15% to the overall annual energy consumption (30% for two points).	-	-	-	● As built drawings ● Confirmation by PV contractor	1.7	Low	
	30B	Market Transformation - Design for Manufacture & Assembly	1	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	As per GBCA approved technical question R-14427	-	-	-	● As built drawings	1	Low	
	30C	Improving on Green Star Benchmarks - Stormwater	1	The project demonstrates a substantial improvement on the benchmark	Additional point awarded for stormwater site discharge to meet GBCA pollution reduction targets	-	-	-	● Civil drawings and specifications ● Water sensitive urban design report	1	Med	
	30C	Improving on Green Star Benchmarks - Ultra Low VOCs	1	The project demonstrates a substantial improvement on the benchmark	Over 50% of paints (by volume) have a maximum TVOC content of 5g/L	-	-	-	● As built drawings ● Product datasheets & certificates	1	Med	

Innovation Challenge	30D	Community Benefits	1	Encourages investment in infrastructure for use by the broader community, such as the incorporation of spaces that are publically accessible.	Requires a needs analysis of the surrounding community and a strategy for how the project will provide social/community benefits and consult with the broader community on the proposed plan.	Maximise use of school facilities for community uses	The GBCA have accepted the Department of Education's policy 'Community Use of School Facilities' and 'Share Our Spaces' program guide in lieu of the Needs Analysis Report.	● Community Use of School Facilities Policy ● Share Our Spaces program ● DC16.08 Community Use Facilities	● Confirmation of spaces accessible for community uses	0	High	
	30D	Integrating Healthy Environments	1	Supports high-performance, cost-effective and health-promoting project outcomes through an early analysis of the interrelationships among systems.	Requires an analysis of community health needs and to address those needs through implementation of adequate strategies	Promote childhood health through healthy food habits	The GBCA have commended the Department of Education for encouraging healthy dietary options in an effort to help reduce childhood obesity through the healthy canteen policy which has been approved for this innovation challenge.	● Healthy Canteen Strategy	● Healthy Canteen Strategy	0	High	
	30D	RAP	1	Encourages organisations to take formalised steps to provide opportunities for Aboriginal and Torres Strait Islander peoples.	A reconciliation action plan endorsed by Reconciliation Australia is required		The Department of Education has a RAP in place which has been accepted by the GBCA in a technical question.	● Reconciliation Action Plan	● Aboriginal community engagement or measures implemented in project	1	High	
	30D	Universal Design	1	Encourages projects to provide safe, equitable and dignified access for persons with disabilities.	Require to develop and implement an accessibility plan based on a needs analysis	Ensure schools are accessible	The EFSG contain extensive provisions to ensure universal design. The GBCA have accepted the EFSG provisions for universal design in lieu of needs analysis.	● DG19 Access for People With Disabilities ● DG 65.14 - Hearing Augmentation System	● As built drawings ● DDA compliance reports	1	High	
	30D	Amenity Space	1	Recognises the provision of high quality amenities for fitout occupants' use.	Require provision of high quality amenity space intended for use by staff or regular occupants suitable for their enjoyment. The size and qualities of the space are determined via a needs analysis.	Provide high level of amenity that supports teaching and learning, and occupant health and wellbeing.	Compliance demonstrated using staff room amenities has been accepted by the GBCA.	● PS602.01 Staff Room	● Architectural drawings	0	High	
Global Sustainability	30E	Digital Infrastructure	1	Recognises projects that use digital infrastructure to create greater efficiencies in the connection of individuals with other people, goods, services, and information.	Require FTTP and Fixed wireless connectivity to be provided	Ensure technology supports teaching and learning	SINSW projects go above and beyond this credit requirements and this has been accepted by the GBCA in a technical question.	● DG 64 Communications	● Confirmation by head contractor	0	High	
	30E	Green Cleaning	1	Rewards use of green cleaning services that prevent the use of contaminants that impact on indoor environment quality, occupant health and the natural environment.	The credit requires a green cleaning policy is developed and implemented	Ensure sustainable, non-toxic cleaning products are used	Whole of Government Facilities Management Services (Asset Maintenance and Cleaning) contract contains Green Cleaning provisions that have been accepted by the GBCA for this credit.	● General Cleaning Specifications (Part F2) ● WEBClean School User Guide	● Confirmation by school principal	0	High	
Global Sustainability - Green Star - Communities v1.1	2.1	Site Planning and Layout	4	Recognises projects that undertake a design review process designed to facilitate sustainable urbanism.	Requires independent design review is undertaken against urban design themes to inform project design	Provide assurance for improved design outcomes in projects	Design review is undertaken on all SINSW projects by an independent technical stakeholder group and the EFSG and Design Advisory teams. Additional independent design reviews may also be undertaken by the State Design Review Panel managed by the Office of the	● Project Governance Framework	● Expert review group and technical stakeholder group (TSG) meeting minutes ● TSG sign off certificates	0	High	
	2.2	Urban Design	4						● Design Advisory Reports	0	High	
	3.1	Stakeholder Engagement Strategy	3	Recognises projects that develop and implement a comprehensive, project specific stakeholder engagement strategy early in the planning process.	The project has a Stakeholder Engagement Strategy prepared in accordance with specified requirements.	Ensure projects are responsive to the needs of key stakeholders and local community	Extensive stakeholder engagement is undertaken for all capital projects via project reference groups (PRG), project control groups (PCG) and broader community consultation. Stakeholders needs and comments are assessed and responded.	● Project Governance Framework	● Service need report ● Education rationale ● PRG meeting minutes ● Business case report ● Community consultation strategy and materials ● Responses to community feedback	0	High	
	3.2	Strategy Implementation	3		The Stakeholder Engagement Strategy is being implemented and formal monitoring, evaluation and corrective action is being undertaken.					0	High	
	9.3	Healthy Places	1	Recognises projects designed and built in line with holistic active and healthy living principles.	Requires project to be designed to achieve five key principles around walkability, active and public transport, wayfinding, good public space design and social interaction.	Improve student and staff health and wellbeing through good design and place making.	The education rationale process requires key principles are considered in new school development. The EFSG contains provisions for wayfinding, open play space and improved public spaces.	● DG 90.04 - School Landscape Design Principles ● Transport Practice Note ● DG 10.03 Open Play Space Requirements	● Education Rationale Report ● Traffic & Transport Report and Green Travel Plan ● Master Plan report ● Landscape drawings	0	High	
	12.1	Understanding Culture, Heritage, and Identity	1	Recognises projects that celebrate and incorporate the heritage, culture and historical context of the project site, supporting communities and places with the development of a sense of place and identity.	Requires that culture, heritage and identity of the project is investigated to inform the design and incorporate interpretation measures.	Ensure that schools respond to and celebrate local character and history.	Culture, heritage and identity of school places and sites are always investigated and interpretation measures incorporated. The EFSG require site investigations for place making and community connections such as: - Local environment/ character - Heritage significance / impact - Appraisal of physical and visual factors affecting site	● DF 03.02 - Site Investigations	● Education Rationale Report ● Heritage reports ● Master Plan report	0	High	
	12.2	Enhancing Community Culture, Heritage, and Identity	2						● Aboriginal and European history reports ● Project specific measures implemented (artwork, wayfinding,	0	High	
	14.1	Access to Fresh Food	1	Recognises projects where occupants have access to fresh food within walking distance	Requires access to fresh food in projects	Ensure students have access to healthy, fresh food.	A canteen is always included in the project design to ensure students have access to healthy food. Larger canteens are provided in projects that include student accommodation	● PS 604 - Canteen Unit	● Architectural drawings	0	High	
	14.2	Local Food Production	1		Requires the project has a strategy to integrate productive landscape within the landscape objectives for the project site.	Encourage hands-on learning activities for students and the school community	Typically, schools include food gardens to provide hands on education opportunities for students and for the local community.	● DG 02.06 - Ecological Conservation	● Landscape drawings	0	High	
	15.0	Visibility	-	Recognises projects that take into consideration designing out crime principles.	Requires direct lines of sight to all public areas	Ensure safety and security within school grounds.	The EFSG contain provisions to guarantee occupant safety and security. Safety in Design and Crime Prevention Through Environmental Design (CPTED) principles are to be implemented in project planning stage.	● DG14 - Safety - Accident Avoidance ● DG65.08 - Electronic Surveillance ● DG65.10 - CCTV Installations ● DG31.03 - Safety Glass	● CPTED assessment ● Safety by design report ● CCTV drawings	0	High	
	15.1	Design for Safety	2		Requires incorporation of CPTED principles					0	High	

8.3 Climate Change & Adaptation Report

Refer over.

Norman Disney & Young
A TETRA TECH COMPANY

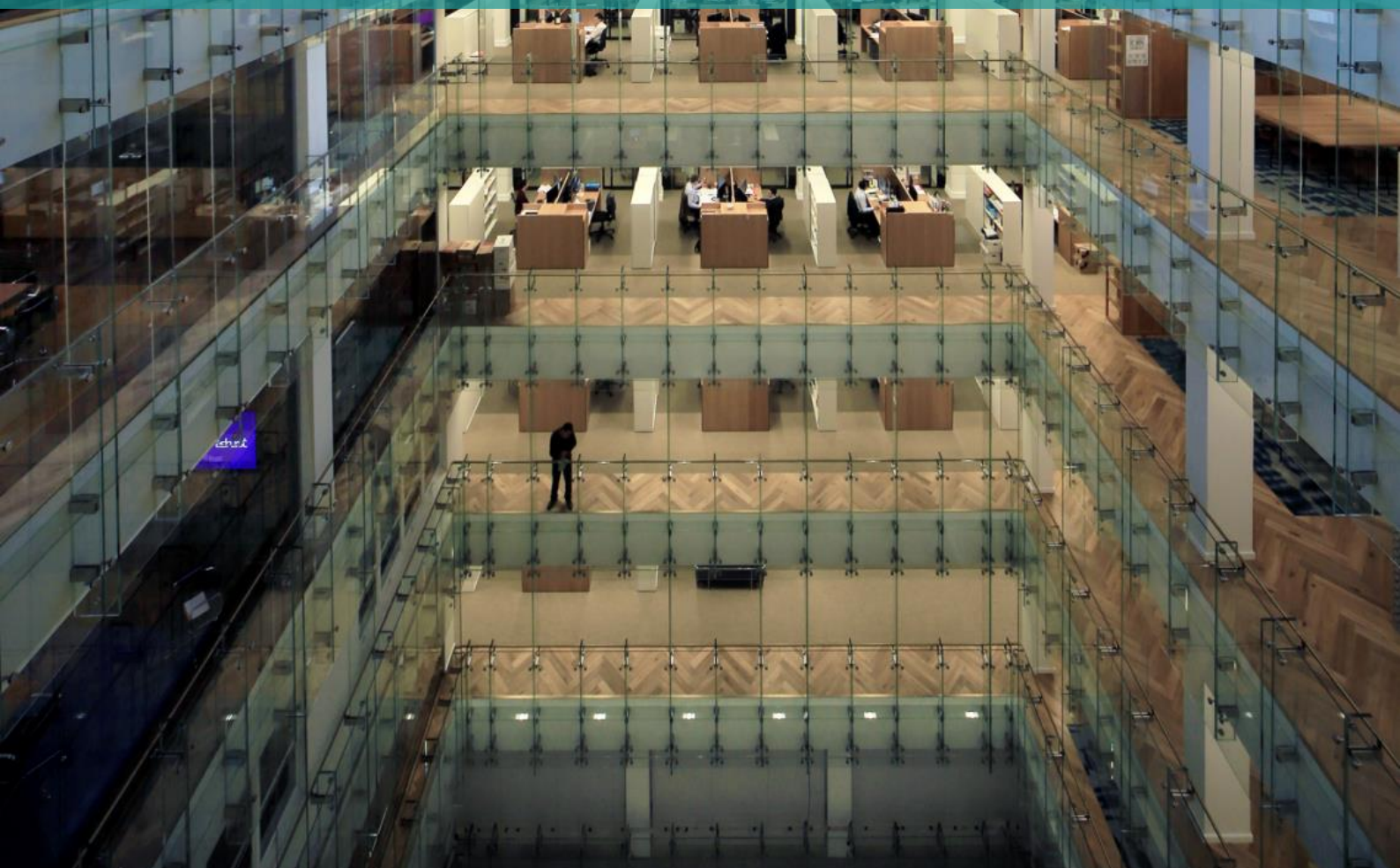
School Infrastructure NSW

Hawkesbury Centre of Excellence

Climate Change Adaptation Plan

8 April 2021

CONFIDENTIAL | **Revision:** 1.0 – FINAL | **Issued:** 8 April 2021



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EXECUTIVE SUMMARY

East Australia faces a combination of potential climate change scenarios. NDY assessed the impacts of predicted climate change models on the design and operation of the new Hawkesbury Centre of Excellence in Agricultural Education, NSW, over the expected 50-year life of the development. Projections in this report were based on outputs from global climate models (GCMs) with data provided by CSIRO's Climate Change in Australia's database relevant to the Sydney region. The results showed the following (CSIRO Climate Change Projections, East Coast Cluster Report 2015):

- Extreme temperatures are projected to increase with very high confidence, and substantial increases in temperatures reached on hot days, as well as the frequency of hot days.
- Average temperatures will continue to increase in all seasons (very high confidence).
- Generally, less rainfall is expected in winter (medium confidence), but the intensity of extreme rainfall events is projected to increase (high confidence).
- There is high confidence that climate change will result in a harsher fire-weather climate in the future.
- Time spent in drought projected to increase (medium confidence) over the course of the century.

A climate change risk assessment was undertaken as per AS 5334-2013 and Green Star Design & As Built v1.3 requirements using CSIRO projections for the East Coast (South) sub-cluster to identify expected impacts from climate change. A stakeholder workshop was undertaken to seek input from the design team members to identify the likely risks and how these would impact the project. Design mitigation strategies were developed to reduce these risks and design the building to be more resilient to future climate change. The climate change risk analysis identified no 'High' or 'Extreme' risks due to climate change impacts after design elements were considered for this project. Therefore, the credit criteria under Green Star Adaptation and Resilience (Credit 3) is deemed to be met.

1 INTRODUCTION

1.1 Development Description

1.1.1 Site

Hawkesbury Centre of Excellence in Agricultural Education ("Hawkesbury CoE") is situated in Richmond, a suburb of Sydney, in the Hawkesbury River region of New South Wales (NSW). The site coordinates are 33° 36' 50.69" S, 150° 44' 32.75" E. The new development consists of the following major scope elements:

- Six new teaching blocks surrounded by agricultural plots
- The project is committed to achieving the following:
  - 4 star Green Star Design & As-Built v1.3
  - NCC Section J 2019 Compliance
  - SINSW's Sustainable School Infrastructure Strategy Priorities: Energy & Carbon, Water, Waste & Materials, Place & Resilience
  - SINSW EFSG

1.1.2 Location

Hawkesbury CoE falls within the East Coast (South) Sub-cluster, which categorises data within natural resource management (NRM) regions that are defined by catchments and bioregions by the CSIRO and Australian Bureau of Meteorology's "Climate Change in Australia" climate projections.

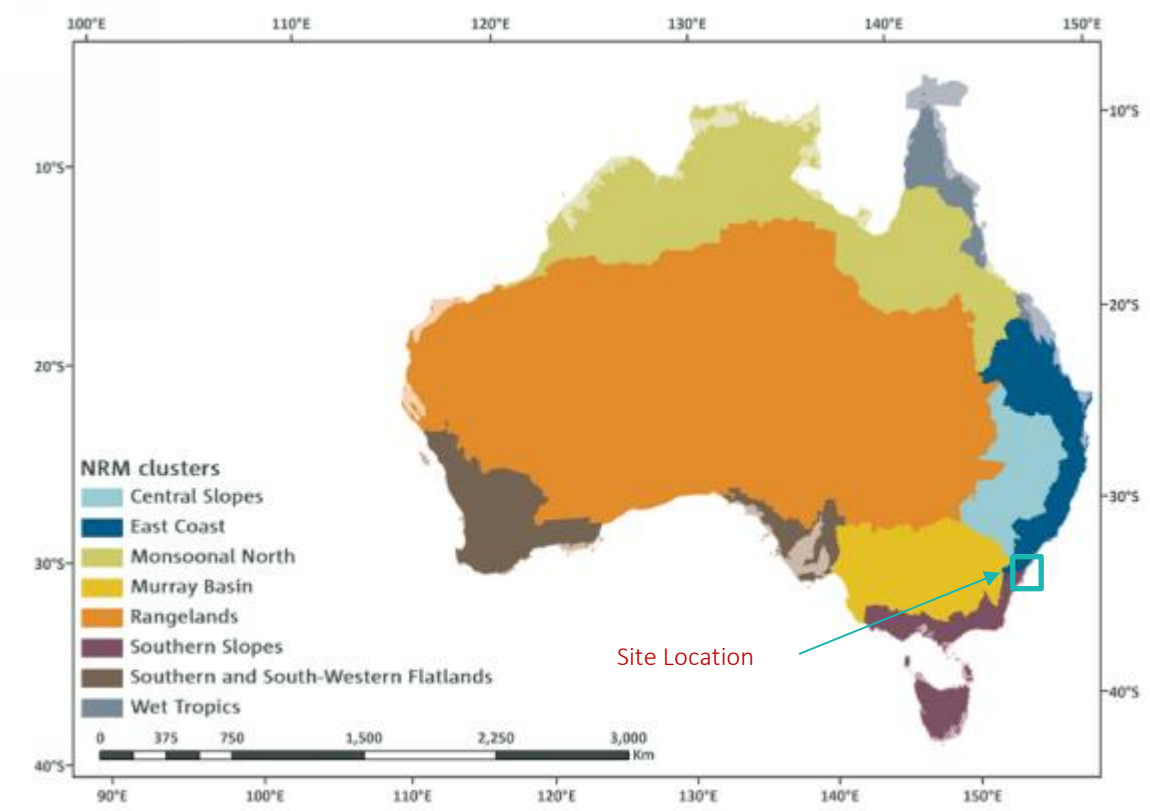


Figure 1 NRM Clusters – East Coast (South) Sub-cluster Location

1.1.3 Climatic Characteristics

The East Coast Cluster includes an area of ~395,000km^2 across NSW and Queensland, comprising 6 natural resource management regions with a Subtropical (East Coast North) or a Temperate (East Coast South) climate, and stretching across an extensive coastal zone (CSIRO Climate Change in Australia Projections, 2015).

As it spans a large range of latitudes and altitudes, the East Coast Cluster experiences a range of climate influences and drivers, both within and between regions, which result in a vast array of diverse bioclimatic zones. The cluster comprises the central part of the eastern seaboard of Australia and includes the drainage basins of several major rivers. The cluster contains both temperate broadleaf and mixed forests as well as tropical and subtropical grasslands, savannahs and shrublands.

The daily mean temperatures in the East Coast (South) sub-cluster ranges from 10°C (winter) to 22°C (summer), with a minimum of 4°C in July and maximum of 28°C in January (CSIRO Climate Change Projections, East Coast Cluster Report 2015). The rainfall characteristics of the region are a result of the interactions between several rain-bearing weather systems with monthly mean rainfall ranging from around 45 to 135mm (CSIRO Climate Change Projections, East Coast Cluster Report 2015). As a result of the varying rainfall and diverse landforms, the vegetation types, hydrology regimes, and land-uses vary greatly across this sub-cluster (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

1.2 Climate Change Risk Assessment Overview

Norman Disney & Young (NDY) were commissioned to undertake a climate change risk assessment for Hawkesbury CoE development in line with current predictions to determine the hazards and risks associated with future climatic conditions, and how these are likely to affect this building into the future.

This report details the methodologies and outcomes of the climate change risk assessment, which was performed during the design phase and used to inform detailed design for the project. The climate change risk assessment used scientific projections to inform the identification of hazards and respective risks specific to the site. The assessment was developed in accordance with AS 5334-2013 Climate Change Adaptation for Settlements and Infrastructure, with reference made to the Australian Government guideline document Climate Change Impacts & Risk Management: A Guide for Business and Government (2006).

The risk assessment is detailed in Section 3 of this report and is broken into a description of the predicted climate scenarios and effects (temperature, sea level rises, increases in rainfall, evaporation, and flooding likelihoods in storm surge events, etc.), and risk assessments of how these climate change conditions are likely to impact the building and its users into the future.

2 CONTEXT ESTABLISHMENT

2.1 Scope & Purpose

NDY was engaged to prepare a Climate Adaptation Plan in accordance with a recognised standard for Hawkesbury CoE development, in order to be awarded 2 points under Credit 3: Adaption and Resilience within the Green Star Design & As Built v1.3 rating tool. This assessment was undertaken during the design stage of the project to assess the effectiveness of adaptation measures that had already been incorporated. It set out to identify any additional risks and consequently identify any additional adaptation measures that may be required for implementation in order to mitigate any risks identified as "High" or "Extreme".

NDY set out to assess the site's climate conditions and select and consider climate change scenarios for two time scales relevant to the project's lifespan, which in this case included 2030 (~Practical Completion + 10 years) and 2070 (+ 50 years), and identify associated potential direct and indirect climate change impacts.

The preparation of a climate change risk assessment was undertaken based on AS5334 which identified the likelihoods and consequences of potential risks of expected climate change projections sought from the CSIRO's Climate Change in Australia Projections (CSIRO Climate Change in Australia Projections, 2015), with reference made to the NSW Government's NSW and ACT Regional Climate Modelling (NARCliM) projections.

NDY then facilitated a workshop with key project stakeholders and the design team to identify key issues and discuss climate change projections identified for the site and relevant to the project. This included collaborating with the design team to map climate variables and direct/indirect effects to different aspects of the design and then evaluate the potential adaptation actions and responsibilities to manage unacceptable risks to the project, owner and end-users.

2.2 Suitably Qualified Professional Undertaking Assessment

This Climate Adaptation Plan has been developed by Claudia Burbidge (Sustainability Consultant).

Claudia has a formal tertiary qualification in Civil and & Environmental Engineering from the University of New South Wales, Sydney (Bachelor of Engineering), graduating with Honours. Claudia is also a qualified Green Star Accredited Professional (GSAP), and WELL Accredited Professional (WELL AP), and has undertaken CC&R assessments on numerous project typologies including offices, residential and education facilities (secondary and tertiary).

2.3 Objectives

Success criteria for future-proofing Hawkesbury CoE development against climate change impacts included the following, as per the Department of the Environment and Heritage Australian Greenhouse Office Climate Change Impacts and Risk Management: A Guide for Business and Government (2006):

- Public Safety - Maintaining public safety
- Local Economy and Growth - Protecting and enhancing local business
- Community and Lifestyle - Protecting the existing lifestyle enjoyed by the local community and visitors
- Environment and Sustainability – Protecting environmental amenity
- Administration - Ensuring sound public administration and governance

2.4 Climate Change Context/Scenarios

2.4.1 Greenhouse Gas Emissions Scenarios

Although future emissions growth is complex and uncertain, the Intergovernmental Panel on Climate Change (IPCC) developed a range of potential future greenhouse gas emissions scenarios to address this uncertainty and represent a plausible set of future economic and social conditions on which emission levels were generated (Australian Government Department of Climate Change, 2009).

The following IPCC climate change scenarios from the CSIRO's Climate Change in Australia Projections (as at 2015) were referenced in this impact assessment. These reflect the global climate model (GCM) simulations, as defined by the Representative Concentration Pathways (RCPs) used by the IPCC, with a particular focus on RCP4.5 and RCP8.5.

Representative Concentration Pathway 4.5 (RCP4.5)

This scenario represents a pathway consistent with low-level emissions, which stabilise the carbon dioxide concentration at about 540 ppm by the end of the 21st century and assumes that global annual GHG emissions (CO2-e) peak around 2040 before declining (CSIRO Climate Change in Australia Projections, 2015).

Representative Concentration Pathway 8.5 (RCP8.5)

This scenario is representative of a high-emission scenario, for which the carbon dioxide concentration reaches about 940 ppm by the end of the 21st century and assumes that global annual GHG emissions (CO2-e) continue to rise through to 2100 (CSIRO Climate Change in Australia Projections, 2015).

2.4.1.1 JUSTIFICATION FOR SELECTING THESE RCP SCENARIOS

As per guidance in the AGO's Guide, "Climate Change Risks and Impacts: A Guide for Government and Business", Section B4.1, a limited number of scenarios covering the most plausible future climate changes was used for this analysis. This was deemed necessary to gain a holistic picture of predicted climate change impacts for this site.

These include the high emissions scenario (RCP8.5) which represents 'business as usual' and combines assumptions regarding the absence of climate change policies with higher world populations and modest rates of technological change or energy intensity improvements which culminate in higher energy demands and therefore Greenhouse Gas emissions increasing year on year. The final impact assessment used RCP8.5 as the basis for all projections.

The other, more optimistic emissions scenario referenced in this assessment includes emissions peaking at around 2040 and then declining due to rapid stabilization of Greenhouse Gas emissions in the global economy as a result of implementation of effective climate change policies (such as a price on emissions) and swift introduction of new, more resource efficient technologies that balance renewable energy sources with fossil-fuel sources and keep global mean warming within a 2 °C increase from pre-industrial levels.

2.4.2 Future Time Slices

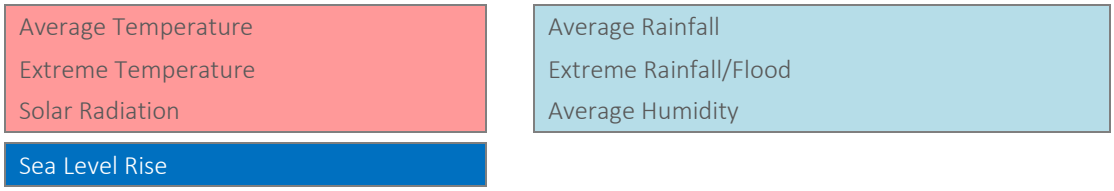
In accordance with the requirements of Green Star, two time slices were chosen for the site.

On the basis that the project will reach practical completion in approximately 2022 and will have a life of approximately 50 or 60 years before major refurbishment, 2030 and 2070 were selected as the most appropriate time slices.

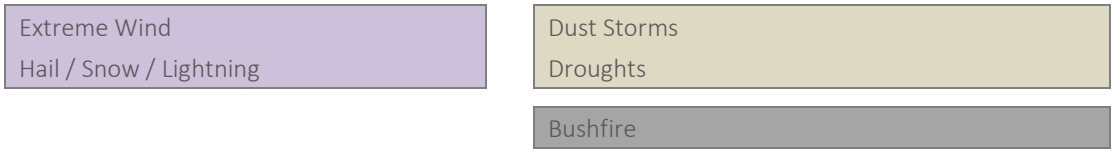
2.4.3 Climate Variables

Based on the site's location, vulnerabilities, and the explicit requirements of Green Star, the following climate variables have been considered:

Primary Effects



Secondary Effects



2.4.4 Standards

The recognised standard used to carry out this assessment was AS5334. Section B, Sub-sections 4 to 6 of the AGO Guide, "Climate Change Risks and Impacts: A Guide for Government and Business" were also used to establish the context for this assessment prior to the stakeholder workshop and to ensure that all risks were identified, analysed, evaluated and mitigated accordingly.

2.4.5 Climate Data

In summary, the following are key projections for the East Coast (South) Sub-cluster (CSIRO Climate Change Projections, East Coast Cluster Report 2015):

- Mean, maximum and minimum temperatures will continue to increase in all seasons (very high confidence)
- More hot days and warm spells are projected with very high confidence. Fewer frosts are projected with high confidence
- Natural climate variability will remain the major driver of rainfall changes (high confidence). Generally, less rainfall in the winter is projected with medium confidence. Increases and decreases to summer, spring, and autumn rainfall are possible but less clear
- Increased intensity of extreme rainfall events is projected, with high confidence
- Greater time spent in meteorological drought is projected, with medium confidence. An increase in frequency and duration of extreme drought is projected, with low confidence
- Small changes in mean surface wind speed are projected with high confidence. Winter decreases are projected with medium confidence whilst spring increases are projected with low confidence
- Little change is predicted for solar radiation (high confidence) for the near future (2030)
- Little change in relative humidity (high confidence) for the near future (2030)
- Mean sea level will continue to rise (very high confidence)
- A harsher fire-weather climate is projected in the future (high confidence).

2.4.6 Past Meteorological Records

Data from the Penrith weather station was used due to the proximity to the site and its extensive records. The 1981 – 2010 time period was chosen as it aligned most closely with the base case climate data used in the Climate Change in Australia projections (1986 – 2005).

2016 Intensity-Frequency-Duration (IFD) data regarding individual rainfall events was obtained for the site from the Bureau of Meteorology website.

2.5 Stakeholders

The following key stakeholders were identified for the project:

- Colliers International Project Leaders
- NBRS Architecture
- Woolacotts
- Richard Crookes
- Schools Infrastructure NSW
- Norman Disney & Young

2.6 Risk Criteria

2.6.1 Risk Assessment Likelihood Scale

The following likelihood scale, taken from AS 5334-2013, was used in the risk assessment for the project for recurrent and single events.

Table 1 Risk Assessment Likelihood Scale

Rating	Descriptor	Recurrent or Event Risks	Long Term Risks
Almost Certain	Could occur several times per year	Has happened several times in the past year and in each of the previous 5 years or Could occur several times per year	Has a greater than 90% chance of occurring in the identified time period if the risk is not mitigated
Likely	May arise about once per year	Has happened at least once in the past year and in each of the previous 5 years or May arise about once per year	Has a 60-90% chance of occurring in the identified time period if the risk is not mitigated
Possible	May arise a couple of times in a generation	Has happened during the past 5 years but not in every year or May arise once in 25 years	Has a 40-60% chance of occurring in the identified time period if the risk is not mitigated
Unlikely	May arise once in a generation	May have occurred once in the last 5 years or May arise once in 25 to 50 years	Has a 10-30% chance of occurring in the future if the risk is not mitigated
Rare	May arise once in a lifetime	Has not occurred in the past 5 years or Unlikely during the next 50 years	May occur in exceptional circumstances, i.e. less than 10% chance of occurring in the identified time period if the risk is not mitigated

2.6.2 Risk Assessment Consequence Scale

The following consequence scale, adapted from Climate Change Impacts & Risk Management, was adopted for the risk assessment.

Table 2 Risk Assessment Consequence Scale

Descriptor	Service Quality	Compliance	Infrastructure	Financial
Insignificant	Minor deficiencies in principle that would pass without comment	Concerns about compliance would be resolved without special attention	No infrastructure damage, little change to infrastructure service	Little financial loss or increase in operating expenses
Minor	Services would be regarded as satisfactory but personnel would be aware of deficiencies	Minor perceived or actual breaches of compliance would be resolved	Localised infrastructure service disruption, no permanent damage. Some minor restoration work required. Early renewal of infrastructure by 10-20%. Need for new/modified equipment	Additional operational costs. Financial loss is small <10%.
Moderate	Services would be regarded as barely satisfactory by the general public and the organisation's personnel	Formal action would be required to answer perceived breaches or charges of compliance failure	Limited infrastructure damage and loss of service. Damage recoverable by maintenance and minor repair. Early renewal of infrastructure by 20-50%	Moderate financial loss 10-50%
Major	The general public would regard the organisation's services as unsatisfactory	Significant amounts of management and advisers' effort would be required to answer charges of compliance failures	Extensive infrastructure damage requiring major repair. Major loss of infrastructure service. Early renewal of infrastructure by 50-90%	Major financial loss 50-90%
Catastrophic	Services would fall well below acceptable standards and this would be clear to all	Obvious and proven breaches of legal and regulatory requirements with the prospect of corporate or individual penalties	Significant permanent damage and/or complete loss of the infrastructure and infrastructure service. Loss of infrastructure support and translocation of service to other sites. Early renewal of infrastructure by >90%	Extreme financial loss >90%

2.6.3 Risk Rating Matrix

The following risk rating matrix, taken from AS 5334-2013, was used to determine risk levels.

Table 3 Priority Matrix

		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost Certain
Consequence	Catastrophic	Low	Medium	High	Extreme	Extreme
	Major	Low	Medium	Medium	High	Extreme
	Moderate	Low	Low	Medium	High	Extreme
	Minor	Low	Low	Medium	Medium	High
	Insignificant	Low	Low	Low	Medium	Medium

3 CLIMATE CHANGE PROJECTIONS FOR EAST COAST (SOUTH)

The following climate change projections have been assigned a confidence rating which follows IPCC likelihood terminology. The IPCC uses the following terminology for certainty/likelihood of outcomes.

The confidence rating does not equate to a probabilistic confidence, rather it covers the type, amount, quality, and consistency of evidence, and the extent of agreement (CSIRO Climate Change Projections, East Coast Cluster Report 2015). The following terminology for certainty/likelihood of outcomes are used in this report:

- Low confidence
- Medium confidence
- High confidence
- Very high confidence

It is important to understand that climate change is not expected to be linear or smooth. It is anticipated that climate change will be characterised by extreme events that are hard to predict and even harder to manage and as a result many ecosystems, both natural and man-made, will find it difficult to adapt (IPCC, IPCC WGI AR5 Climate Change 2013: The Physical Science Basis, 2013).

3.1 Temperature

3.1.1 Higher Temperatures

Continued increases in mean, daily maximum and daily minimum temperatures are projected for the East Coast cluster with very high confidence with the near future (2030) projected increase of mean annual temperature around 0.4 to 1.3 °C above the climate of 1986–2005, with only minor differences between RCPs (CSIRO Climate Change Projections, East Coast Cluster Report 2015). Late in the century (2090), there is a large difference between scenarios, with projected warming of 1.3 to 2.5 °C for RCP4.5 and 2.7 to 4.7 °C for RCP8.5 (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

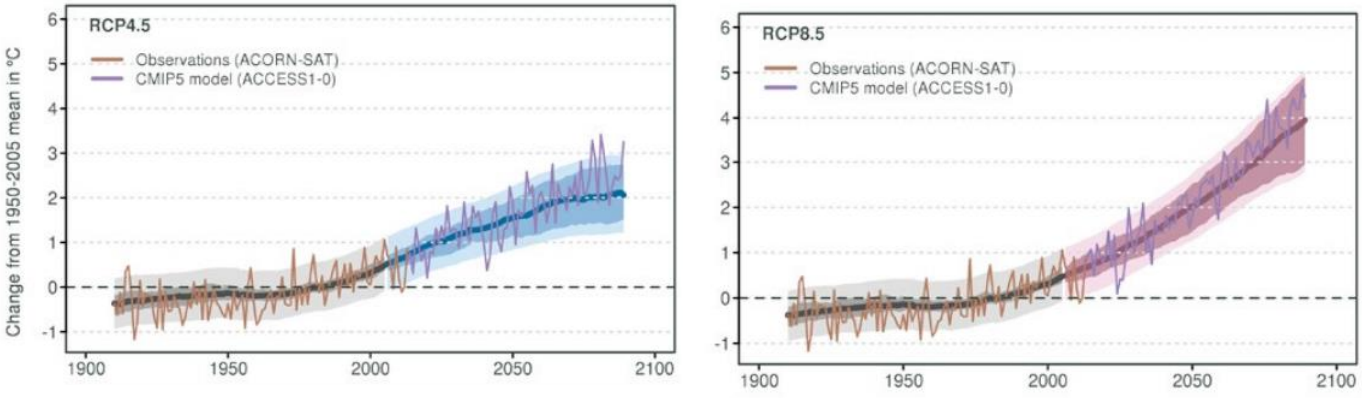


Figure 2 East Coast Annual Average Surface Air Temperature (°C) for 1910–2090 (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Table 4 Penrith Average Maximum Seasonal Temperature (Bureau of Meteorology) and Future Projections (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Season	Baseline (1981-2010)	2030 @ RCP8.5	2070 @ RCP8.5
Summer	28.1° C	29.1° C (+1° C)	30.4° C (+2.25° C)
Autumn	23.1° C	24.1° C (+1° C)	25.4° C (+2.25° C)
Winter	17.4° C	18.4° C (+1° C)	19.7° C (+2.25° C)
Spring	23.6° C	24.6° C (+1° C)	25.9° C (+2.25° C)

3.1.2 Hotter and More Frequent Hot Days, Fewer Frosts

A substantial increase in the temperature reached on the hottest days, the frequency of hot days and the duration of warm spells are projected with very high confidence and as a result, an expected decrease in the frequency of frost-risk days is projected with high confidence (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

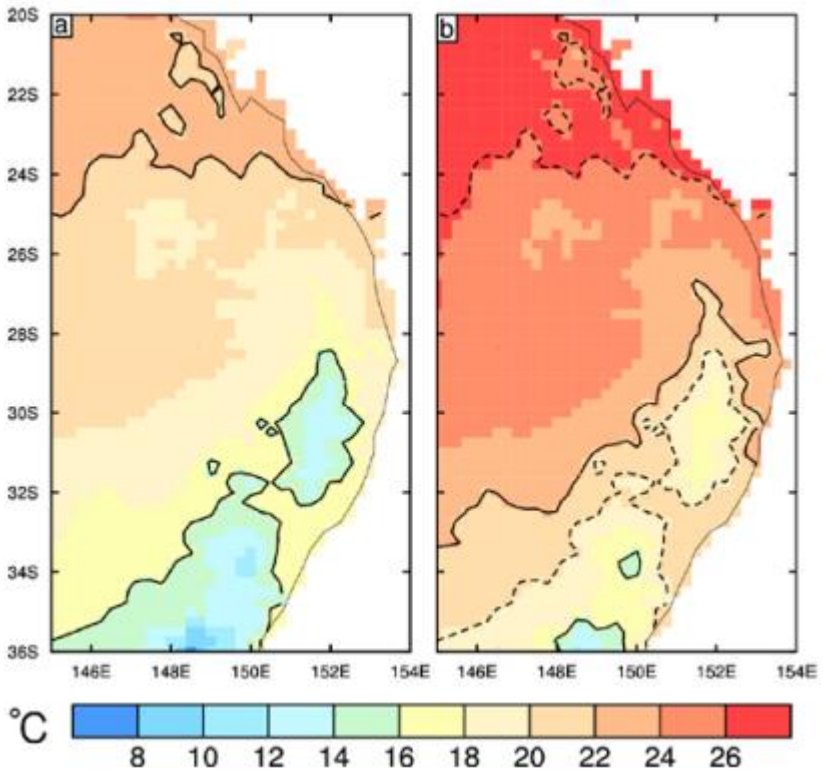


Figure 3 Annual Mean Surface Air Temperature (°C), for the Present Climate (a), and Median Warming under RCP8 5 for 2090 (b) (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Table 5 East Coast South – Average Annual Number of Days above 35°C and below 2 °C {Frosts} (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Threshold	East Coast (South) Sub-cluster			
	Current	**2030 RCP4.5**	**2090 RCP4.5**	**2090 RCP8.5**
Over 35 °C	3.1	4.3 (4.0 to 5.0)	6.0 (4.9 to 8.2)	11 (8.2 to 15)
Over 40 °C	0.3	0.5 (0.5 to 0.8)	0.9 (0.8 to 1.3)	2.0(1.3 to 3.3)
Below 2 °C	0	0	0	0

The risk of line outages, blackouts, and asset failures is likely to increase (IPCC, IPCC WGI AR5 Climate Change 2013: The Physical Science Basis, 2013). This is due to increases in peak demand from increased air-conditioning use exceeding baseload increases. Although the main drivers for energy consumption are demographic and socio-economic factors, climatic conditions are also linked to average and peak energy demands. (CSIRO Climate Change in Australia Projections, 2015).

Higher rates of infectious and water-borne disease, as well as increased rates of heat-related stress and mortality, particularly among the aged and vulnerable populations, are likely outcomes (Grose et. al, 2015).

The frequency of hot days and the frequency of high fire risk weather is likely to increase. The East Coast (South) currently experiences temperatures above 35°C, on average, 3.1 days per year. Studies have highlighted that by 2030 this is predicted to increase to 4.3 days per year and by 2090 to between 6 and 11 days per year (CSIRO Climate Change Projections, East Coast Cluster Report 2015). This has important ramifications for air pollution and health, with ozone pollution events linked to the frequency of hot, sunny days and with the highest particle pollution concentrations linked to the presence of bushfire smoke (Grose et. al, 2015).

3.2 Precipitation

3.2.1 Extended Drought Periods

There is medium confidence that the time spent in drought will increase over the course of the 21st century in line with changes to mean rainfall, but low confidence in projecting the frequency and duration of extreme droughts (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

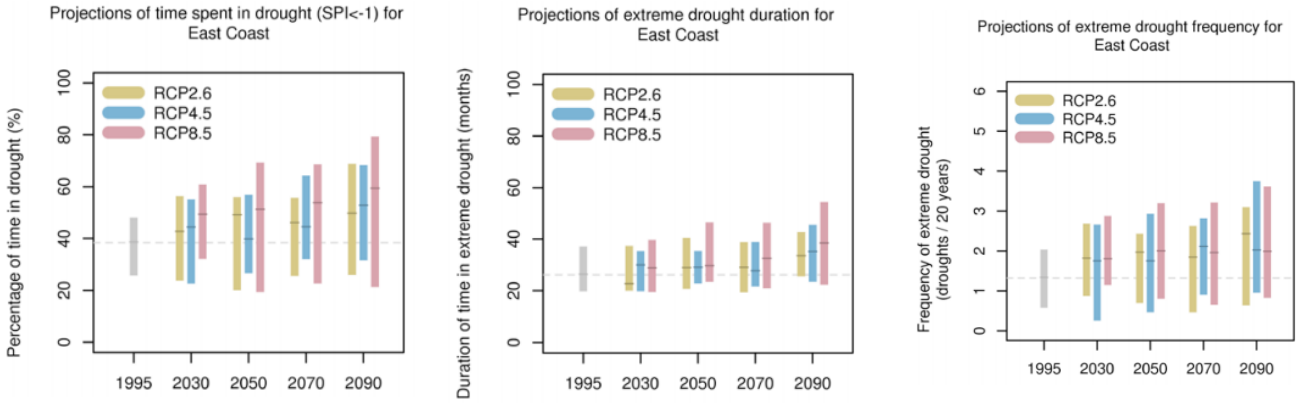


Figure 4 Time in Drought (Left), Duration of Extreme Drought (Middle), and Frequency of Extreme Drought (Right) (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

3.2.2 Extreme Rainfall Events

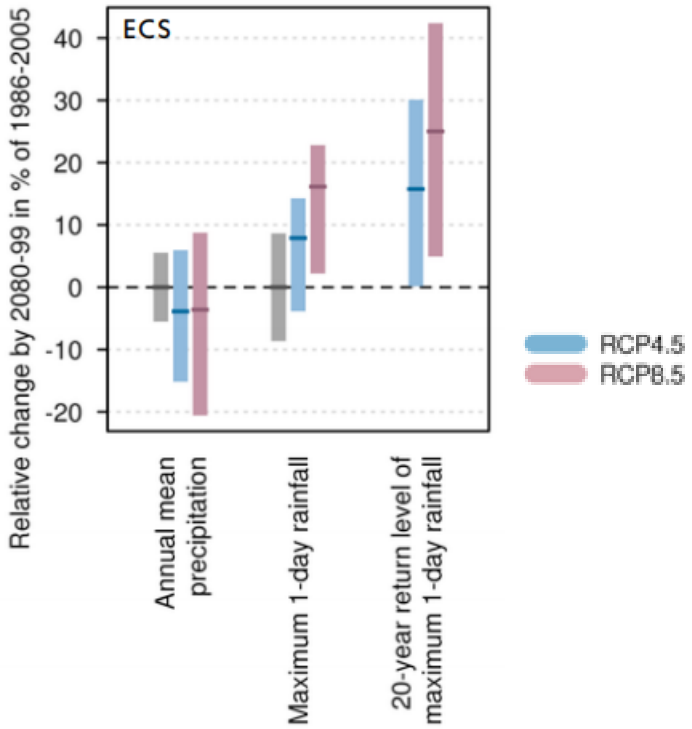
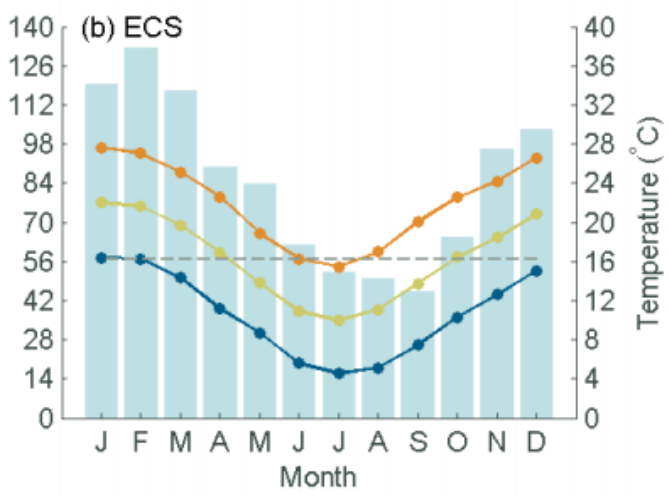


Figure 5 Projected Changes in Mean Rainfall, Magnitude of Annual Maximum 1-Day Rainfall, and Magnitude of 1 in 20-Year Rainfall Events for 2090 (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

There is high confidence that whilst the intensity of heavy rainfall extremes will increase, the magnitude of change cannot be reliably projected (CSIRO Climate Change Projections, East Coast Cluster Report 2015). The trend of annual mean rainfall is unclear and tending toward decrease whilst increased magnitudes of extreme rainfall events are projected. The magnitude of the anticipated extremes of rainfall are highly dependent on the emission scenario and the future time period.

3.2.3 Average Rainfall



Rainfall has not shown any long-term trends, rather the East Coast cluster has experienced intermittent wetter and drier periods. The observed trends in rainfall throughout the East Coast cluster are not very significant, with low confidence in both the magnitude and sign of observed trends. (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Rainfall is projected to decrease in winter, consistent with a reduction in the number of storms (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 6 Penrith Average Seasonal Rainfall (Bureau of Meteorology) and Future Projections (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Season	Baseline (1981-2010)	2030 @ RCP8.5	2070 @ RCP8.5
Summer	92.7 mm	83.4 mm (-10%)	78.8 mm (-15%)
Autumn	53.9 mm	Little change	45.8 mm (-15%)
Winter	36.4 mm	30.9 mm (-15%)	30.9 mm (-15%)
Spring	56.1 mm	50.5 mm (-10%)	47.7 mm (-15%)

3.3 Sea Level Rise

Relative sea level has risen around Australia at an average rate of 1.4 mm per year between 1966 and 2009, and 1.6 mm per year after the influence of the El Niño Southern Oscillation (ENSO) on sea level is removed (CSIRO Climate Change Projections, East Coast Cluster Report 2015). Increasing global temperatures have a direct impact on sea level as the water expands with temperature and increases can also be expected from melting glaciers and ice caps. As temperatures are virtually certain to rise, sea levels are similarly virtually certain to rise, in line with IPCC predictions (CSIRO Climate Change in Australia Projections, 2015). There is very high confidence that sea level will continue to rise during the 21st century. In the near future (2030), the projected range of sea-level rise for the cluster coastline is 0.08 to 0.18 m above the 1986–2005 level, with only minor differences between RCPs (CSIRO Climate Change Projections, East Coast Cluster Report 2015). As the century progresses, projections are sensitive to emissions pathways. By 2090, RCP4.5 gives a rise of 0.30 to 0.65 m, and RCP8.5 gives a rise of 0.44 to 0.88 m (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 7 East Coast (South) Sea Level Predictions for 2090

IPCC Year Emissions Scenario	Sea Level Rise
RCP 4.5	0.30-0.65m
RCP 8.5	0.44-0.88m

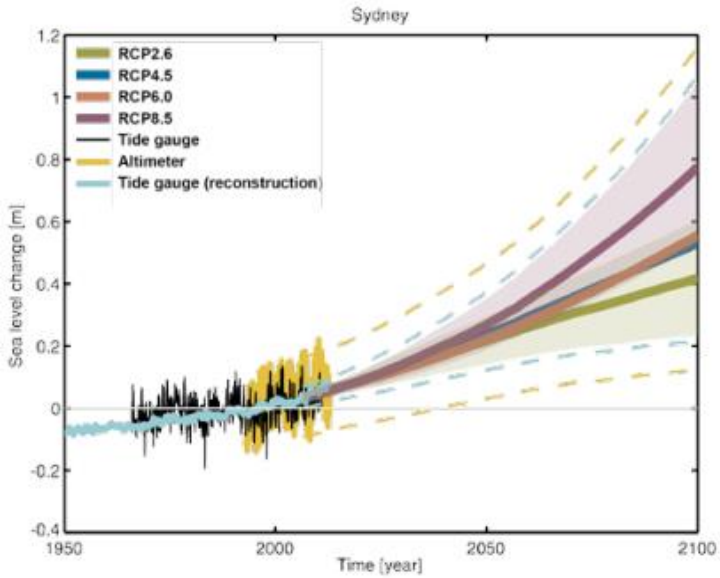


Figure 6 Observed and Projected Relative Sea Level Change (m) for Sydney (which has continuous records available (1966–2010) (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

The Hawkesbury CoE development is located approximately 23m above sea level – well above even the most extreme CSIRO Climate Change Projections. Sea level rise is, therefore, not an impact that is relevant to the project.

3.4 Gustier Wind Conditions

There is high confidence in little change to mean wind speed under RCP4.5 and RCP 8.5 scenarios by 2030. For 2090 changes are projected to remain small with medium confidence under RCP4.5, and winter wind speed is projected to reduce with medium confidence under RCP8.5. These reduced winter wind speeds are assumed to be due to a projected southward movement of storm tracks and the subtropical ridge, thus weakening westerly winds. There is medium confidence that there will be a reduction in extreme wind speeds (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

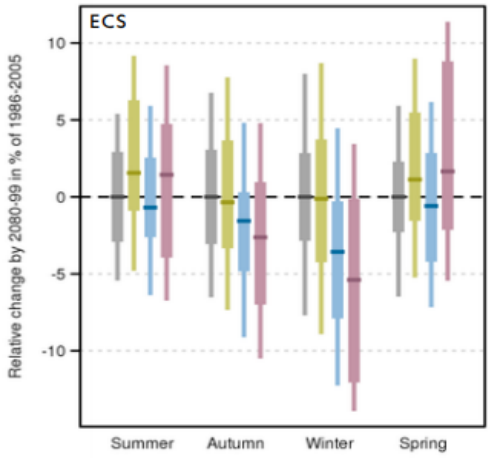


Figure 7 Projected Near-Surface Wind Speed Changes for 2090. Anomalies Are Given As A Percentage With Respect to the 1986-2005 Mean

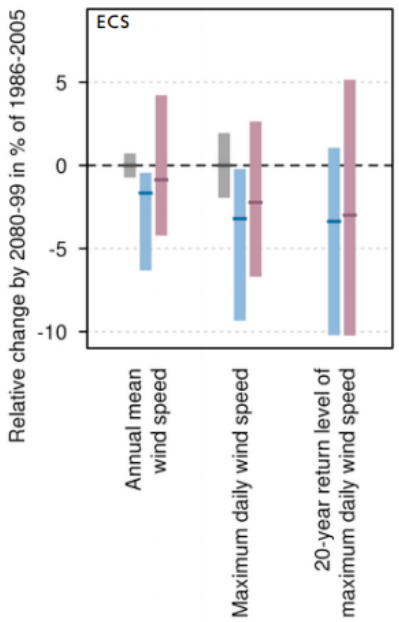


Figure 8 Projected Near-Surface Annual Mean Wind Speed, Annual Maximum Daily Wind Speed and the 20-year Return Value for the Annual Maximum Daily Wind Speed for 2090. Anomalies Are Given As A Percentage With Respect to the 1986-2005 Mean.

3.5 Solar Radiation & Relative Humidity

Solar radiation and relative humidity are projected to have little change for 2030 with high confidence. By 2090 there is medium confidence in a decrease in relative humidity and low confidence in increased winter and spring solar radiation with little change in other seasons (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 8 Penrith Solar Radiation and Relative Humidity (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Climate Variable	Baseline	2030 @ RCP8.5	2070 @ RCP8.5
Yearly Average Daily Solar Radiation	16.0 MJ/m²	Little change	Little change
Yearly Average 3 pm Humidity	52% RH	Little change	Little change

3.6 Increased Evaporation Rates, Reduced Soil Moisture, and Runoff

There is high confidence that potential evapotranspiration will increase in the East Coast cluster in all seasons however, there is medium confidence about the magnitude of the increase. Changes to rainfall and evapotranspiration are projected to lead to a decrease in soil moisture, particularly in winter and spring, with medium confidence (CSIRO Climate Change Projections, East Coast Cluster Report 2015). There is low confidence that runoff will decrease by 2090 under RCP4.5 and RCP8.5 (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

3.7 Bush Fire

Bushfire occurrence depends on four 'switches': 1) ignition, either human-caused or from natural sources such as lightning; 2) fuel abundance or load; 3) fuel dryness, where lower moisture contents are required for fire, and 4) suitable weather conditions for fire spread, generally hot, dry and windy (Bradstock, 2010). There is high confidence that climate change will result in a harsher fire-weather climate in the future. However, there is low confidence in the magnitude of the change, as this depends on the rainfall projection (CSIRO Climate Change Projections, East Coast Cluster Report 2015).

Table 9 Cluster Mean Annual Values of Maximum Temperature (°C), Rainfall (mm), Drought Factor, and Number of Severe Fire Danger days greater than 50 days per year (CSIRO Climate Change Projections, East Coast Cluster Report 2015)

Variable	1995 Baseline	2030 RCP4.5	2030 RCP8.5	2090 RCP4.5	2090 RCP8.5
T	24.9	26.0	26.3	27.2	28.8
R	1077	946	917	916	896
DF	6.3	6.4	6.5	6.6	6.9
SEV	0.9	1.1	1.3	1.3	2.1

4 RISK ASSESSMENT & ADAPTATION PLAN

4.1 Risk Management

Climate change adaptation is a risk management process just like any other risk considered by a successful modern business. The prioritisation of risk management actions comes from an informed understanding of the potential risks and the adaptation opportunities within the challenges ahead of us.

Modern business is ideally placed to tackle climate change, because businesses are inherently pragmatic and are used to change. However, the reason and time to act will be varied across the business community and must extend beyond legislated reporting of emissions and desire to curb energy use, to management of business risk for:

- Fiduciary liability
  - Fiduciary liability on Company Directors to consider and mitigate for climate change risk.
  - There is a real risk of 'litigation against a director who has failed to perceive, disclose or take steps in relation to a foreseeable climate-related risk that can be demonstrated to have caused harm to a company'. (Hutley SC, 2016)
- Risk disclosure
  - Publicly listed companies are increasingly being pressured to normalise their climate risk disclosure practices. Particularly as the world moves towards a carbon-constrained future.
- Financial risk
  - Long term financial planning. 'Climate change is a financial risk if you've got a long-term asset portfolio'. Paul Fisher who retired as deputy head of the Bank of England's Prudential Regulation Authority (climatealliance.org.au, 2016).
- Social license
  - Social license to operate. Failure to maintain your business social license with customers and the broader community at large has often resulted in real consequences for business operations because the market place is savage to businesses that ignore reality.

4.2 The Process

This Climate Adaptation Plan (CAP) for Hawkesbury CoE is the result of a collaborative and iterative risk management process engaging all relevant areas of the business as presented below:

- Step One: Climate projections with justification of modelling scenario
- Step Two: Risk management workshop records potential climate change impact and risk level
- Step Three: Risk management workshop records design and operational adaptation action and re-assessed risk level.

4.3 Step One: Before the Workshop – Establishing the Context

Prior to the stakeholder workshop, NDY established the frameworks for identifying and analysing the risks identified for the project in relation to the climate projection data to ensure a common understanding amongst project stakeholders.

A Consultant Advice Note (reference number me210223s0007[1.0]) was issued by Justin Peberdy on 4th March 2021, prior to the workshop (Appendix B). This noted to stakeholders the difference between climate change mitigation versus adaption and summarised the following:

- The site specific climate change scenarios used to assume future changes
- The scope of the assessment including the boundaries, timescales and emissions scenarios utilized
- A 'Consequence Scale for Risk Assessment' and a 'Likelihood Scale for Risk Assessment' that would be required to be used in defining how the project risks would be defined and evaluated to measure the consequences, likelihoods and risk priorities for the project

- Set the priorities of the workshop as identifying and describing the risks posed by climate change for the development, rating these using the above scales, as well as identifying and evaluating potential adaptation actions to mitigate any risks identified as unacceptable.

4.4 Step Two: During the Workshop

The following stakeholders attended the workshop and/or included their views to contribute to the climate change assessment and analysis of risks for the project:

Attendees:

- Ryan Hahn – Norman Disney & Young (Services Lead)
- Justin Peberdy – Norman Disney & Young (Sustainability Lead)
- Sanjeev Ganda - Norman Disney & Young (Sustainability Consultant)
- Satheeshun Dashidaran – Norman Disney & Young (Hydraulic Engineer)
- Kristina Fernandez – Norman Disney & Young (Electrical Engineer)
- Paul Hover - SINSW (Client)
- Lizza Young – Colliers (Project Manager)
- Maddy Stenniken – Colliers (Project Manager)
- Anthony Maughan-Wright - Colliers (Project Manager)
- Stephanie Ferguson – NBRS Architecture (Architect)
- Elias Khamis – NBRS Architecture (Architect)
- Carmit Harnik Saar – NBRS Architecture (Architect)
- Simon Clemmett – Woolacotts (Civil / Structural)

Facilitators:

- Claudia Burbidge - Norman Disney & Young (Sustainability Engineer)

Additional Contributors to this Assessment:

The following people were contacted separately in addition to those listed above, as they were unable to attend the workshop. Their project knowledge was sought to gain insight into the building's design and adaptability to risks identified in the assessment during the workshop:

- Aslaug Blitzner – Norman Disney & Young (Mechanical Engineer)
- Tom Hemmett – Woolacotts (Civil / Structural)
- Kevin Christesen – Woolacotts (Civil / Structural)
- Johnsen Lim – NBRS Architecture (Architect)

All participants were provided with quantitative and descriptive information on the climate change scenarios and data produced by NDY's analysis.

The workshop generated a list of risks directly related to the site-specific data and project risks associated with climate change. These risks were then evaluated using knowledge of existing controls that are already designed to mitigate these risks, the consequences of the risks identified as well as the likelihood of their occurrence for this site. This, in turn, informed the priority rating for each risk identified in Table 11. The workshop included a brainstorming exercise to identify additional risk controls or future measures to reduce the risk of hazards at the site.

4.5 Step 3: After the Workshop

The risk register established for the project was circulated to all attendees and project stakeholders for comment on 12 March 2021. All outstanding items were collated by Claudia Burbidge at NDY and closed out and agreed by the project stakeholders by 19 March 2021.

As a result, the final table of risk items was identified and evaluated as the project-specific Climate Change Risk Register.

No 'High' or 'Extreme' risks were identified during the assessment.

All risk items identified had design elements and/or policies in place prior to this assessment to mitigate the risks identified.

4.6 Design Life of Asset

It is important to select a timeline relevant to the design life of the infrastructure components and one that is appropriate to cover the asset investment horizon, such as leasing tenure, as this will affect the climate projections used, the level of climate risk the asset may potentially be exposed to and the climate Adaptation response.

Where local data is available, it has been used in preference to larger-scale regional data. The time frame for the 'near future' is 2030, and for 'far future' are 2070 and 2090 depending on the available climate data.

4.6.1 5.2.2.1 Design Life

Design life is defined as the period within which an element of the works must continue to meet the performance and technical requirements for the project and remain within specified limits of reliability, availability and maintainability without major renewal beyond normal cyclic maintenance activities. It also benchmarks the requirements for durability.

The preliminary design life of asset elements are defined below.

Table 10 Design life of asset elements

Asset Type	Design Lifespan (Years)
Structure	50
Drainage (Civil and Hydraulic)	50
Building Pavement (Civil and Hydraulic)	50
Road pavement (Civil and Hydraulic)	15
Critical infrastructure systems – security & communications	25
HVAC	25
Façade	30
Materials and Finishes (Architectural elements)	20

4.7 Identifying Adaptation Actions and Reassessing Risk

Once climate risk ratings have been applied to potential climate change risks, adaptation actions are identified to reduce the risk rating of extreme, high, medium and low risk rated climate risks.

Generally, there are four possible approaches in responding to climate change:

- Avoid: Avoid locating assets in vulnerable areas or ignore and replace when required
- Adapt: Design systems and adaption measures to operate in predicted future climate conditions. There are two approaches: 1. Respond Now (future proof through current measures), OR Anticipate and Respond Later (enable future adaptive measures)
- Defend: Install defences at or around critical infrastructure

- Retreat: Develop and implement plans to relocate from the vulnerable area.

The project has looked to incorporate the above 'Adapt' measures where risks to the project have been identified. These have either been through design considerations or through future-proofing the asset to allow for flexible responses that will allow for adaptive measures to be implemented in the future. To address potential climate change impacts and inform further design development and operational considerations, the mitigation measures are detailed in the Climate Change Risk Register spreadsheet (Table 11).

4.8 Green Star Requirements

A climate change risk assessment was undertaken as per AS 5334-2013 and Green Star Design & As Built v1.3 requirements using CSIRO projections for the East Coast (South) sub-cluster to identify expected impacts from climate change. A stakeholder workshop was undertaken to seek input from the design and construction team members to identify the likely risks associated with a changing climate and how these changes would impact on the project. Design mitigation strategies were developed to reduce the risks highlighted and design the building to be more resilient to future climate change. A climate change risk analysis was produced and identified no 'High' or 'Extreme' risks due to climate change impacts after design elements were considered for this project. Therefore, the credit criteria under Green Star' Adaptation and Resilience (Credit 3) is deemed as met.

4.8.1 Summary of initial and reassessed risks

Figure 9 Number of Risks Identified

Risk Rating	Low	Medium	High	Extreme	Total
Number of Initial Risks	6	12	0	0	18
Number of Reassessed Risks	5	4	0	0	9

4.8.2 Green Star Submission Requirements

Figure 10 Green Star Submission Requirements

Requirement	Design Review Submission	As Built Submission
Climate Adaptation Plan — Details of the two risk items that have been addressed by a specific design response — Details of any 'high' or 'extreme' risks	Not applicable	✓ This report
CV of professional that developed the Climate Adaptation Plan	Not applicable	✓ This report (Appendix A)
Drawings and specifications demonstrating design responses to the Climate Adaptation Plan	Not applicable	✓ To be provided at Practical Completion
Commissioning report or other technical document demonstrating design responses to the Climate Adaptation Plan	Not applicable	✓ To be provided at Practical Completion

4.9 Review

As a minimum the Climate Adaptation Plan should be reviewed whenever the base information utilised to develop site specific climate change scenarios has been updated or every five (5) years, as good practice.

Table 11 Climate Change Risk Register (Adaptation Measures and Residual Risks Omitted)

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Surrounding sewer / stormwater infrastructure impacted by storm surge.	Extreme Rainfall	Civil	It is a Council requirement for the floor level to be a minimum of 500 above the design 1-in-100 year flood levels which is reflected in the current design. Expectation is that Council required 500 freeboard includes an adequate allowance for an increase in extreme rainfall intensity unto 2070. As the site is approximately 23m above existing sea level the projected rise in sea level of 0.66 m will have no direct impact on the site or site drainage.	Insignificant	Unlikely	Low	Insignificant	Possible	Low
Structural stability of buildings and foundation systems affected by water table height increase causing changes to ground structure.	Extreme Rainfall Extreme Wind	Structural	As noted in item 1, the maximum potential flood would be equal to, or less than the 500 freeboard. All elements of the building structure that would be exposed to the potential flooding shall be designed for a 500mm flood depth. With respect wind loads, the design wind load for the school shall be based on an importance level 3 classification in accordance with the BCA. Importance level 3 requires the design wind to be based on a 1:1000 event compared to normal structures which are based on 1:500 event. The more stringent design event will mitigate the effects of increase extreme wind events.	Major	Rare	Low	Major	Rare	Low

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Extended blackouts due to transmission infrastructure failure or capacity being exceeded.	Bushfire Extreme Wind Extreme Rainfall Extreme Temperature	Electrical & Comms, Mechanical	Each site is provided with a dedicated site substation, sized per the EFSGs to provide 15% spare capacity. Site has provision for generator connection in the main switchboard. In case of blackout, the school can hire and connect the hired generator into dedicated supply. Installation of a new PV system is currently allowed under design. Project cannot control the supply authorities infrastructure.	Major	Possible	Medium	Major	Possible	Medium
HVAC not maintaining internal conditions during heat waves.	Extreme Temperature	Mechanical	Specification for heat rejection equipment requires plant to operate up to 5oC above the current design external ambient. Balancing efficiency on the average day compared to meeting peak demands. Equipment has 15-20 year design life. Shading on the facade to reduce direct solar load. Design implements outdoor air modulation, that will reduce outdoor air load on the space.	Insignificant	Likely	Medium	Insignificant	Almost Certain	Medium
Accelerated material deterioration (colour fading or failure) due to solar radiation / higher temperatures.	Solar Radiation	Architectural	Roof sheeting selected is light in colour to mitigate the heat island effect. Covered walkways and sun shading screens shall provide protection from material deterioration. Selection of non-combustible materials and fire-rated materials for future increased temperatures. Planting is incorporated across the site, with significant landscaping on the ground plane.	Moderate	Unlikely	Low	Moderate	Unlikely	Low

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Water entering ground floor or building flooding as a result of overland flow / heavier rainfall events / localised flooding.	Extreme Rainfall	Electrical & Comms, Civil, Architectural	Hawkesbury flood analysis (TTW, 2018) confirmed site is impacted by overland flow in south eastern corner of site (1:100 year flood). Project buildings are located away from this area.	Moderate	Possible	Medium	Moderate	Possible	Medium
Soft landscaping damage due to scouring or hail, or planting dieback due to extended periods of drought.	Extreme Rainfall Droughts	Landscape	The site is an agricultural facility with multiple water sources (dams) to irrigate the plots. A significant part of the landscape design are plots which are intended to be harvested and turned over regularly. Areas close to buildings feature planting using over 50 % of native species.	Minor	Possible	Medium	Minor	Possible	Medium
Smoke / dust impacting upon air quality, or accidentally shutting down air handling units that have smoke detectors. Airborne dust soiling ventilation filters more quickly than maintenance regimes allow for cleaning.	Dust Storms Bushfire	Mechanical	High efficiency F4/F5 filters specified.	Major	Possible	Medium	Major	Possible	Medium
Lightning strike due to increased intensity of storm events.	Hail / Snow / Lightning	Electrical	Surge protection devices specified and good earthing design.	Catastrophic	Rare	Low	Catastrophic	Rare	Low

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Roofing / roof-mounted equipment damaged by hail / lightning	Hail / Snow / Lightning	Mechanical	Nil. No box gutters, overflow in case of hail blocking drainage.	Moderate	Unlikely	Low	Moderate	Unlikely	Low
Façade damage by hail / lightning	Hail / Snow / Lightning	Architectural, Façade	Any glazed façades are protected by covered walkways, large COLA's and sun shading screens therefore limiting and breakages due to hail and lighting. All other façade elements are prefinished CFC. Any sheet metal façade elements have been articulated to a recess in the facade and are protected by first floor overhangs and sun shading screens. No glazed awnings are proposed.	Minor	Possible	Medium	Minor	Possible	Medium
Fire protection system performance affected by reduced water supply pressure.	Bushfire	Fire Protection	Compliant hydrant booster coverage provided. Board authority advises on 95% percentile pressure/flow rates, and design based on this.	Major	Rare	Low	Major	Unlikely	Medium
External materials being stained by settling of airborne ash (ember attack).	Bushfire	Architectural	Site is within bushfire-prone land and is being designed to comply with Bushfire Attack Level 12.5 requirements, AS 3959:2009.	Moderate	Unlikely	Low	Moderate	Unlikely	Low

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Water needs of the site not met due to reduced rainfall and prolonged periods of drought.	Average Rainfall Droughts	Hydraulic, Landscaping, Architectural	Water efficient fixtures specified to reduce the water demand of the site. This however is partially outside of project boundary / council infrastructure. Water authority to mitigate this risk. The site has been designed with multiple water sources (dams). Overland flow water is being captured in swales and directed to dams to irrigate the agricultural plots. All gardens are to be mulched to assist soil moisture retention. Rainwater is captured and reused for toilet flushing and irrigation to reduce the potable cold water demand.	Moderate	Unlikely	Low	Moderate	Possible	Medium
Gutters, downpipes and inground stormwater network unable to handle the increase in 1-20 year rainfall event.	Extreme Rainfall	Hydraulic, Civil	Eaves gutters and downpipes will be designed to the predicted 1-in-20 year rainfall event in 2070. Overflow provided and no box gutters. OSD design (dams) will control and contain water, to be used to irrigate agricultural plots.	Moderate	Possible	Medium	Moderate	Possible	Medium
Health impacts (e.g. heat stroke) due to warmer temperatures	Average Temperature	Landscaping, Civil, Architectural	High performance building façade supported by covered walkways, large COLA's, sun shading screens and cross ventilation where possible. Significant landscaping and agricultural plots, and low solar absorptance materials to support a reduction in the heat island effect experienced at the site.	Moderate	Possible	Medium	Moderate	Possible	Medium

Description of Hazard (Cause & Effect)	Aspect	Discipline	Project Design Responses	Timeframe 2030 @ RCP8.5			Timeframe 2090 @ RCP8.5		
				Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Risk of any exposed or sub-soil hydraulic pipework cracking due to increased extreme weather conditions or soil changes	Extreme Temperature	Hydraulics, Civil	All inground pipework to be in PE with flexible joints to allow for any soil movement. With respect to stormwater pipework, soil reactivity / cracking poses no significant impact. Cracking in soil from prolonged drought to be infilled and maintained as part of regular stormwater maintenance.	Moderate	Unlikely	Low	Moderate	Possible	Medium
Extreme winds and dry weather could cause some trees to fall onto buildings or people.	Extreme Temperature	Landscape, Architectural	Trees known to suffer heat stress and drop limbs have not been selected. Existing large trees onsite will be managed to ensure student safety.	Major	Rare	Low	Major	Unlikely	Medium

5 ASSUMPTIONS AND LIMITATIONS

The key assumptions underpinning this risk assessment are as follows:

- The purpose of the risk assessment is to highlight the potential for climate change induced risks and inform the decision-making process, which in turn enables the design and operation of climate resilient infrastructure
- Risk assessment and mitigation is a dynamic and iterative process for the duration of the asset's life cycle. This report is the first step in the process as described in the Green Star Requirements section
- The assessment of risks and possible adaptation measures is qualitative and not quantitative
- The climate change projections adopted are those that have been reasonably predicted for future climatic conditions. It should be noted that some projections currently involve a considerable degree of uncertainty
- The climate projections are regional, not localised (climate change modelling would be required to provide more localised data, which was not considered necessary for the purposes of this risk assessment), so their accuracy is limited and subject to the uncertainties of scientific and technical research; but sufficient for the purposes of this assessment with recommendations representing professional judgement.

6 RECOMMENDATIONS

The climate change risk assessment process has assessed the above risks, including existing controls, as being either 'low' or 'medium.' This is a reflection on the fact that the designers of the project have already incorporated a number of adaptation measures into the design.

The credit requirements of Green Star require that all high and extreme risks are identified and addressed by specific design responses however, no high and extreme risks were identified. The following table outlines the residual risk assessment following implemented adaptation measures.

Table 12: Residual Risk Following Adaptation Measures

Description of Hazard (Cause & Effect)	Aspect	Adaptation Measures	Residual 2030			Residual BAU 2070 @ RCP8.5		
			Conseq.	Likel.	Risk	Conseq.	Likel.	Risk
Water entering ground floor or building flooding as a result of overland flow / heavier rainfall events / localised flooding.	Extreme Rainfall	Substation to be located above 1:100 flood level, rooms within buildings, such as comms and main switch room will be 500mm above 1:100 year flood level. The buildings are to be designed to be on an elevated platform to prevent water ingress. Overland flow water will be directed away from buildings, captured in swales and directed to dams to irrigate the agricultural plots.	Major	Rare	Low	Major	Rare	Low
Roofing / roof-mounted equipment damaged by hail / lightning.	Hail / Snow / Lightning	Specify hail protection on condenser coils.	Minor	Unlikely	Low	Minor	Unlikely	Low

The process has identified additional adaptation measures that may be adopted to reduce risk to ALARP (as low as reasonably practicable) levels. Key recommendations include those listed below:

- In the event that the building cannot be inhabited for an extended period – through extended blackout, bushfire, health pandemic - school management should ensure teaching by distance / schooling from home arrangements for students and staff
- During drought and after periods of heavy rainfall, increase maintenance of rainwater and stormwater drainage systems to avoid blockages and clean out siltation
- School management should ensure management of landscaping during operation includes strategies to replace soft landscaping in the event of dieback, and consideration of species most appropriate to site at the time of replacement (e.g. drought-tolerant planting, species from locations which reflect future climate predictions rather than current local climate)
- Building management should have an emergency management plan (with effective incident response actions) in place for major and catastrophic events. The plan should include a methodology for effective communication to building users and regular updates

- If dust storms or bushfires with heavy smoke do eventuate, urgently undertake cleaning of ventilation system filters, and prioritise cleaning of solar panels and the facade.

NDY recommends that this adaption plan should be reviewed on a regular basis (every five years). This should include:

- Review of previous climate data and comparison with potential new climate predictions at the site
- Review of previously identified risks against the new climate projections, and evaluation of any new potential adaptation actions to mitigate any risks identified as unacceptable.

7 APPENDIX A: CV

CLAUDIA BURBIDGE

ENGINEER | SUSTAINABILITY

YEARS EXPERIENCE

3+

SERVICES EXPERTISE

Green Star, Life Cycle Assessment, Sustainability Strategy, Masterplanning, Carbon Neutrality

OFFICE LOCATION

Sydney

Qualifications: Bachelor of Engineering (Civil and Environmental) – University of New South Wales (UNSW), WELL Accredited Professional, Green Star Accredited Professional

BIO

Claudia joined Norman Disney & Young (NDY) in 2016 as an Undergraduate Sustainability Engineer before transitioning to a Sustainability Consultant role in 2019. During this time, Claudia has developed technical and practical experience through involvement on various projects in the commercial, residential, retail, transport, and education sectors. Claudia currently has multi-disciplinary expertise in sustainability frameworks, Life Cycle Assessment, Climate Change Adaptation and Resilience, sustainability strategy, masterplanning and carbon neutrality.

Relevant Project Experience

EDUCATION

- Monaro Schools - Bungendore and Jerrabomberra – Climate Adaptation – Bungendore/Queanbeyan NSW
- Mulgoa Rise – Climate Adaptation – Sydney NSW
- Hawkesbury Centre of Excellence – Climate Adaptation – Sydney NSW
- Richmond High School – Climate Adaptation – Sydney NSW
- Marsden Park Secondary School – Green Star – Sydney NSW
- Green Square Integrated Community Facility and Public School Development – Green Star – Sydney NSW

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- 1 Eden Park Drive – Section J, NABERS Energy, Green Star & WELL – Sydney NSW

RETAIL

- 17 Cordelia Street – Climate Adaptation – Brisbane NSW

8 APPENDIX B: PRE-WORKSHOP CONSULTANT ADVICE NOTE

MEMORANDUM

Project:	SINSW - Greater Western Sydney – Schools Projects
Date:	4 March 2021

Name	
To:	All workshop attendees

SUSTAINABILITY- CLIMATE CHANGE ADAPTATION WORKSHOP: PRE-WORKSHOP NOTES

The purpose of this memorandum is to provide information to all stakeholders that will attend NDY's climate change adaptation workshop to facilitate the consultation process for establishing the Climate Adaptation Plan for the Greater Western Sydney (GWS) schools projects. Information in this memorandum has been prepared for the Richmond High School, Hawkesbury Centre of Excellence and Mulgoa Rise schools projects. Please familiarise yourself with this information before the workshop scheduled for Tuesday 9th March 2021.

Climate change adaptation is something quite distinct from climate change mitigation:

- Mitigation is about making climate change less severe - this is where our focus to date on this project has been (energy efficiency, renewable energy, low-carbon materials).
- Adaptation accepts that there will be some degree of climate change no matter how successful our combined mitigation efforts are - and looks to design buildings that are resilient to it. This will be the focus of our workshop.

This memorandum consists of the following parts:

- Climate Change Projections
- Consequence Scale for Risk Assessment
- Likelihood Scale for Risk Assessment

The two 'time slices' that will be referenced throughout the risk assessment and adaptation planning process are +/-2030 (~Practical Completion + 10 years) and 2070 (+ ~50 year building life). The United Nations Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathways (RCP) correspond to different greenhouse gas (GHG) concentration trajectories with each level based on different assumptions. RCP8.5 is representative of a high-emissions scenario, assuming that emissions continue to rise throughout the 21st century.

Climate change projection data has been sourced from CCIA (a joint BoM and CSIRO initiative), and baseline data has been sourced from BoM for the Greater Western Sydney area. Full references will be included in the final report.

The priorities for the workshop will be two-fold:

- Identify and describe risks posed by climate change to the development and rate the consequence and likelihood of each.

Identify and evaluate potential adaptation actions and/or design strategies to mitigate those risks which are deemed unacceptable.

CLIMATE CHANGE PROJECTIONS – PENRITH, NSW (STATION NO. 067113) SYDNEY EAST COAST (NORTH) SUB CLUSTER

Climate Variable		Baseline	2030 @ RCP8.5	2070 @ RCP8.5	Commentary
Average Maximum Temperature	Summer	28.1° C	29.1° C *(+1° C)*	30.4° C *(+2.25° C)*	There is *very high confidence* in continued **substantial increases** in projected **mean, maximum and minimum temperatures**. By late in the century (2090), there is a large difference between scenarios. The projected range of warming is 1.3 to 2.5°C above the climate of 1986-2005 for RCP4.5 and 2.7 to 4.7°C for RCP8.5.
	Autumn	23.1° C	24.1° C *(+1° C)*	25.4° C *(+2.25° C)*	
	Winter	17.4° C	18.4° C *(+1° C)*	19.7° C *(+2.25° C)*	
	Spring	23.6° C	24.6° C *(+1° C)*	25.9° C *(+2.25° C)*	
Maximum Recorded Temperature		48.9° C *(4th Jan 2020)*	49.9° C *(+1° C)*	51.2° C *(+2.25° C)*	More hot days and warm spells are projected with *very high confidence*. Extreme temperatures are projected to increase at a similar rate to mean temperature, with a **substantial increase in the temperature reached on hot days, the frequency of hot days, and the duration of warm spells** *(very high confidence)*.
Number of Hot Days (over 35°C)		3.1 days	4.3 days **2030 RCP4.5*	11 days **2090 RCP8.5*	
Number of Hot Days (over 40°C)		0.3 day	0.5 days **2030 RCP4.5*	2.0 days **2090 RCP8.5*	
Average Rainfall	Summer	92.7 mm	83.4 mm *(-10%)*	78.8 mm *(-15%)*	Annual rainfall shows no long-term trend, however there has been prolonged periods of extensive drying throughout the 20th Century to the present, particularly in winter and spring. **Decreasing winter rainfall** is projected with medium confidence based on good understanding of the contributing underlying physical mechanisms driving this change (relating to a southward shift of winter storm systems).
	Autumn	53.9 mm	little change	45.8 mm *(-15%)*	
	Winter	36.4 mm	30.9 mm *(-15%)*	30.9 mm *(-15%)*	
	Spring	56.1 mm	50.5 mm *(-10%)*	47.7m *(-15%)*	
1-in-20 Year Rainfall Event (24 Hour)		139.0 mm *(12th Feb 1997)*	152.9 mm *(+10%)*	166.8 mm *(+20%)*	Increased intensity of extreme rainfall events is projected, with high confidence. Even though annual mean rainfall is projected to decrease in the region, projections indicate increases in extreme rainfall.
Time in Drought (%)		40%	50%	55%	**Time spent in drought is projected to increase** (low confidence) over the course of the century.
Fire Weather (Severe Fire Danger Days FFDI >50)		1.1 days	1.53 days 40% increase	2.3 days 110% increase **2090 RCP8.5*	There is high confidence that climate change will result in a **harsher fire-weather climate** in the future. However, there is low confidence in the magnitude of the change, though predicted to be extreme, as this is strongly dependent on rainfall projections, which as we have seen are declining in almost all seasons.
Sea Level Rise *Change relative to 1986-2005*		-	14cm above baseline	66cm above baseline **2090 RCP8.5*	There is very high confidence in future sea-level rise. **Mean sea level will continue to rise and height of extreme sea-level events will also increase** (very high confidence).
Yearly Average Daily Solar Radiation		16.0 MJ/m²	16.2 MJ/m² *(+1.08%)*	16.2 MJ/m² *(+1.08%)*	**Little change is projected for solar radiation** (high confidence), except for winter and spring increases.
Yearly Average 3pm Humidity		52% RH	little change	little change	A tendency for a decline in relative humidity away from coasts although changes in the near term will be small (high confidence).
Yearly Average 3pm Wind Speed		15.2 km/h	little change	little change	There is high confidence in little change.

CONSEQUENCE SCALE FOR RISK ASSESSMENT

Descriptor	Service Quality	Compliance	Infrastructure	Financial
Insignificant	Minor deficiencies in principle that would pass without comment	Concerns about compliance would be resolved without special attention	No infrastructure damage, little change to infrastructure service	Little financial loss or increase in operating expenses
Minor	Services would be regarded as satisfactory but personnel would be aware of deficiencies	Minor perceived or actual breaches of compliance would be resolved	Localised infrastructure service disruption, no permanent damage. Some minor restoration work required. Early renewal of infrastructure by 10-20%. Need for new/modified equipment	Additional operational costs. Financial loss is small <10%.
Moderate	Services would be regarded as barely satisfactory by the general public and the organisation's personnel	Formal action would be required to answer perceived breaches or charges of compliance failure	Limited infrastructure damage and loss of service. Damage recoverable by maintenance and minor repair. Early renewal of infrastructure by 20-50%	Moderate financial loss 10-50%
Major	The general public would regard the organisation's services as unsatisfactory	Significant amounts of management and advisers' effort would be required to answer charges of compliance failures	Extensive infrastructure damage requiring major repair. Major loss of infrastructure service. Early renewal of infrastructure by 50-90%	Major financial loss 50-90%
Catastrophic	Services would fall well below acceptable standards and this would be clear to all	Obvious and proven breaches of legal and regulatory requirements with the prospect of corporate or individual penalties	Significant permanent damage and/or complete loss of the infrastructure and infrastructure service. Loss of infrastructure support and translocation of service to other sites. Early renewal of infrastructure by >90%	Extreme financial loss >90%

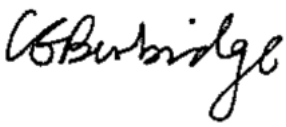
LIKELIHOOD SCALE FOR RISK ASSESSMENT

Rating	Descriptor	Recurrent or event risks	Long term risks
Almost Certain	Could occur several times per year	Has happened several times in the past year and in each of the previous 5 years *or* Could occur several times per year	Has a greater than 90% chance of occurring in the identified time period if the risk is not mitigated
Likely	May arise about once per year	Has happened at least once in the past year and in each of the previous 5 years *or* May arise about once per year	Has a 60-90% chance of occurring in the identified time period if the risk is not mitigated
Possible	Maybe a couple of times in a generation	Has happened during the past 5 years but not in every year *or* May arise once in 25 years	Has a 40-60% chance of occurring in the identified time period if the risk is not mitigated
Unlikely	Maybe once in a generation	May have occurred once in the last 5 years *or* May arise once in 25 to 50 years	Has a 10-30% chance of occurring in the future if the risk is not mitigated
Rare	Maybe once in a lifetime	Has not occurred in the past 5 years *or* Unlikely during the next 50 years	May occur in exceptional circumstances, i.e. less than 10% chance of occurring in the identified time period if the risk is not mitigated

Should you have any queries or would like further information prior to the workshop please do not hesitate to contact me.

Regards,

NORMAN DISNEY & YOUNG



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9 INFORMATION SOURCES AND REFERENCES

Australia, Department of Environment and Heritage (2006). Climate Change Impacts & Risk Management, A Guide for Business and Government. Canberra.

Australia, Department of Climate Change. (2009). Climate Change 2009: Faster Change and More Serious Risks. Canberra.

Bradstock, R. A. (2010). A biogeographic model of fire regimes in Australia: current and future implications. In Global Ecology and Biogeography (pp. 145-158).

CSIRO. (2015). CSIRO Climate Change in Australia Projections.

CSIRO. (2015). CSIRO Climate Change in Australia Projections, East Coast Cluster Report.

IPCC AR4 (2007). IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC. (2013). Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC. (2014). IPCC Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.

IPCC. (2014). IPCC WGII AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B:

PMSEIC (2007). PMSEIC Independent Working Group 2007, Climate Change in Australia: Regional Impacts and Adaptation - Managing the Risk for Australia, Report Prepared for the Prime Minister's Science, Engineering and Innovation Council, Canberra, June.

Regional Aspects: Australasia. Reisinger, A., R.L. Kitching, F. Chiew, L. Hughes, P.C.D. Newton, S.S. Schuster, A. Tait, and P. Whetton, 2014: Australasia. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1371-1438.

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Client Contact:	Paul Hover
Project Leader:	Ryan Hahn
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NDY QA SYSTEM

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