The Scots College - Glengarry Dorms

369 Jacks Corner Road, Kangaroo Valley, Glengarry

Ecologically Sustainable Design Report to support Development Application

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Attention: Leith Schmidt

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Note: This report may contain details of manufacturer, products and environmental certification schemes that Efficient Living believe are examples of improved sustainability outcomes and worthy of investigation. For avoidance of doubt Efficient Living does not have a commercial relationship with third parties in this respect or warrant the statements and performance of the examples provided.

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The Scots College - Glengarry Dorms

ESD Report

CONTENTS

Local context of Site (Source: BJ Architects)

1. Introduction and Project Information

Introduction

This Ecologically Sustainable Design (ESD) report has been prepared by Efficient Living Pty Ltd to support a development application (DA) for Dormitory facilities for the Scots College at 369 Jacks Corner Road, Kangaroo Valley NSW. Efficient Living is collaborating with the architects, H&E Architects, to ensure that the proposal has strong ESD outcomes that meet or exceed the requirements of local and state regulations and controls for ESD.

The report outlines ESD commitments for the DA submission and also provides recommendations for consideration and inclusion in the later detailed design/construction certificate documentation for the proposal.

Property details

The property falls within the boundaries of Morton national Park, one of the largest parks in NSW, about 140km of Sydney. The valley's creeks, rivers and lush rainforest are rich in biodiversity and populated by iconic Australian marsupials.

- The Scots college is an outdoor education and residential experience for boys as it exposes them to natural environment and creates opportunities for them to be challenged in the context of outdoors.
- The site has direct connection to the Kangaroo River in the South and has main access by Jacks Corner Rd which connects it to Moss Vale Rd in the east.
- The Scots college campus currently includes buildings for functions such as, class rooms, dining halls, administrative, dormitories, staff accommodation, theatrette, gymnasium etc.
- Zoning C3:Environmental Management, C2 Environmental Conservation, RU2: Rural Landscape.
- The subject site is within the Shoalhaven Development Control Plan 2014.

Proposal description

The proposal is a development of three new dormitory buildings will be integrated with the existing site infrastructure and connected with the pathways on site. The building development will be integrated into the existing sloping landscape contours to create a harmonious development.

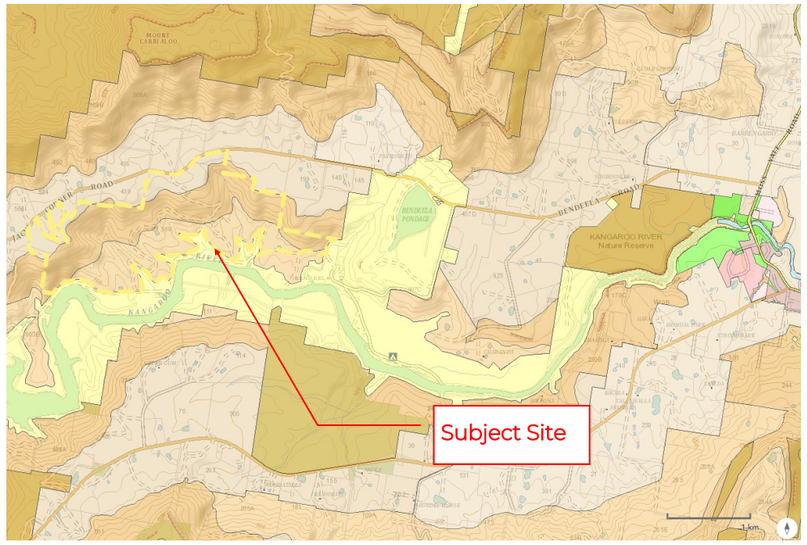
The height and scale of the new building will be in keeping with surrounding dwellings. The facility will comprise of 3 separate buildings about 3-storey high, comprising of the learning facilities in the lowest level, student + staff accommodation and amenities in the upper and landscaped open spaces around them.

Strong ESD outcomes for the new proposal will be incorporated into the design and inclusions as detailed in this report.

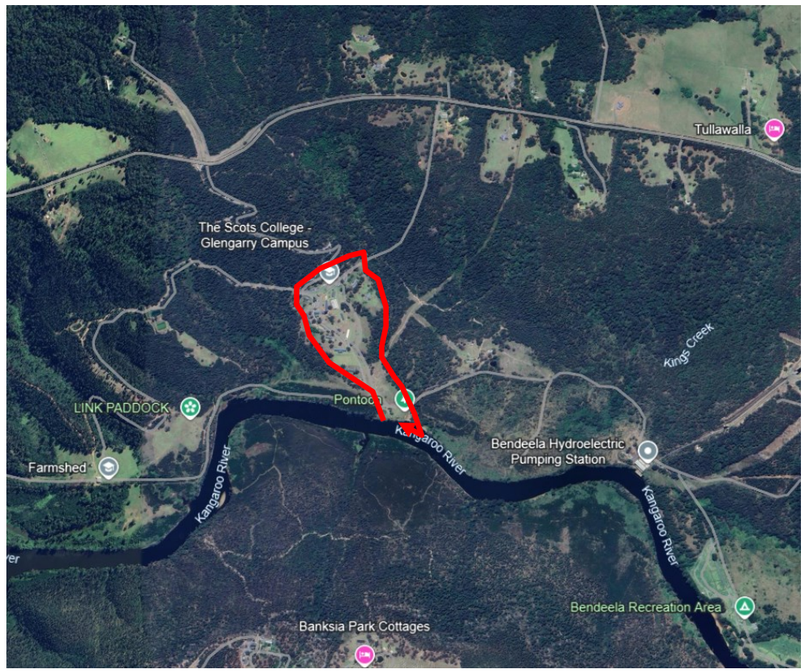
Structure of this report

This report is structured into core ESD categories consolidating the requirements of relevant planning controls for the project. These requirements are discussed in Section 2 of this report and refer primarily to:

- The Sustainable Buildings SEPP in respect to various ESD considerations that need to be taken into account
- The Shoalhaven DCP 2014 Chapter 2: General and Environmental Considerations and Generic Chapters related to specific development types
    - G1 Site Analysis, Site Design and Building Materials
    - G2 Sustainable Stormwater Management and Erosion /Sediment Control
    - G3 Landscaping Design Guidelines
    - G4 Tree and Vegetation Management
    - G5 Biodiversity Impact Assessment
    - G7 Waste Minimisation and Management Controls
    - G8 Onsite Sewage Management
- Chapter N1: Kangaroo Valley for area specific requirements



Site Location (Source: NSW Planning Portal)



Local context of Site (Source: Google earth)

2. Responding to Local and State ESD controls

Sustainable Buildings SEPP ESD considerations

As the project is expected to have a capital cost exceeding $5M Chapter 3, 3.2 of the Sustainable Building SEPP is relevant. Under the SEPP the consent authority needs to consider if the proposed design enables:

(a) the minimisation of waste from associated demolition and construction, including by the choice and reuse of building materials

(b) a reduction in peak demand for electricity, including through the use of energy efficient technology

(c) a reduction in the reliance on artificial lighting and mechanical heating and cooling through passive design

(d) the generation and storage of renewable energy

(e) the metering and monitoring of energy consumption

(f) the minimisation of the consumption of potable water

Shoalhaven Council ESD controls

The Shoalhaven DCP emphasizes to create and maintain a high level of environmental quality throughout Shoalhaven, and should result in an increased level of local amenity and environmental sustainability.

The other objectives of the Shoalhaven DCP are:

- To provide criteria for the assessment of development applications.
- Build upon the SLEP 2014 by providing detailed objectives, and controls for development.
- Foster ecologically sustainable development (ESD).
- Ensure development responds to the qualities of the subject site and to the character of the surrounding neighborhood.
- Encourage innovative housing, commercial and industrial design.
- Maintain and enhance the natural, built and cultural significance of heritage items.
- Manage the risks to new development from natural hazards including coastal, flood and bushfire risks.

Chapter N1: Kangaroo Valley

The overriding objective of the DCP for Kangaroo Valley is to protect the unique character and scenic beauty of Kangaroo Valley village and its environs.

Section 5.7 Environment and Water Quality outlines the core ESD controls. The intent for this section is laid out as follows:

- To ensure development impacts on visual amenity are neutral or beneficial to the natural, built or pastoral landscapes
- To minimise any adverse impact of development on privacy
- To ensure development is sustainable and environmentally responsible and takes into account its social impact on environmental quality and amenity
- To reduce the risk of bushfire damage to life, property and the environment
- To effectively manage bushfires for the protection and conservation of the natural cultural scenic and recreational features of the area
- To minimise any adverse environmental impact to areas supporting remnant or riparian vegetation, threatened wildlife habitat or steep vegetated slopes

The sections including specific performance criteria for developments for Kangaroo Valley are: 5.7.1 Visual amenity and privacy, 5.7.2 Flooding, 5.7.3 Slope, 5.7.4 Stormwater management, 5.7.5 Effluent management, 5.7.6 Bush fire & 5.7.7 Vegetation management

Structure of ESD Report

To ensure that the wide range of ESD planning considerations are addressed, this report has been consolidated under the following key sections.

- Energy and low carbon emissions
- Water sensitive and water efficient design
- Responsible materials
- Responsible waste management
- Human wellbeing and indoor environmental quality
- Climate change resilience

3. Energy efficiency and low carbon emissions

Energy efficiency through passive design proposed design outcomes and specifications

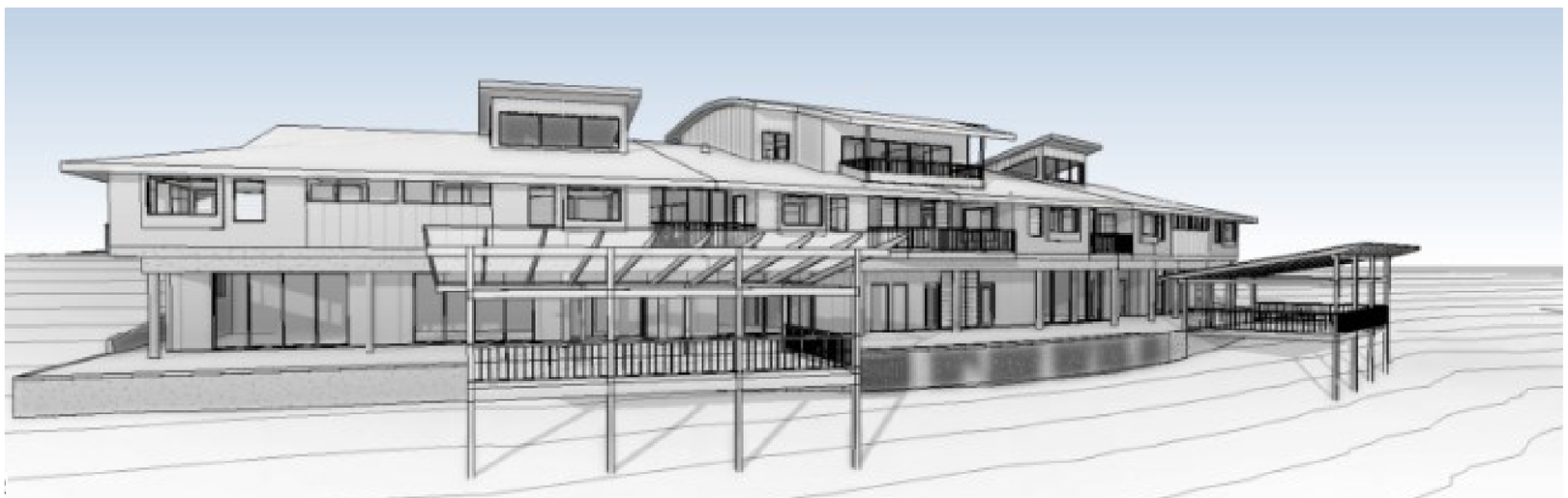
Building fabric

- Building and window size and orientation has been refined to support solar access, daylight access and beneficial cross ventilation whilst mitigating unwanted solar heat gain and thermal losses.
- All key areas benefit from cross ventilation through inclusion of large operable windows and doors on multiple aspects. Ventilation is supported through the inclusion of ceiling fans as well as integrated mechanical ventilation.
- High performance insulation materials, aligned with Section J for walls, roofs, and floors will be included to minimize heat transfer.
- Energy efficient windows will be specified consistent with exceeding Section J requirements by 10%.
- Light coloured materials and external finishes on horizontal surfaces, to reduce heat absorption and reduce urban heat island effect, have been specified.

Building sealing

Preventing air leaks through the building envelope is critical for energy efficiency. The building construction methodologies will follow all requirements from NCC 2022 Section J Part J5 .

- Install vapor barriers on the warm side of insulated assemblies, such as walls and roofs, to prevent moisture migration and condensation with in the building envelope.
- Entrance to the building spaces must have an airlock, self closing door, rapid roller door, revolving door or the like as per J5D5.
- Doors and windows with effective seals and weather stripping to minimise air leakage. Ensure doors and windows are correctly installed and sealed to prevent drafts and heat loss.
- Seal joints, seams, and connections in ductwork to prevent air leakage in HVAC systems.
- Seal roof penetrations, such as vents, pipes, HVAC units, with appropriate flashing and sealants.
- Exhaust fans must be fitted with a sealing device such as a self closing damper or the like when serving a conditioned space or a habitable room.
- Skylights to be sealed, or capable of being sealed. Ensure skylight shafts have insulation installed as per Section J.



Architectural Expression & Passive design :

Self shading structures and canopies for windows in all directions, Light weight construction married to the site contours

(Source: BJ Architects)

3. Energy efficiency and low carbon emissions

Proposed energy measures to reduce emissions

- Improved thermal performance through passive design—target 10% improvement on baseline Section J compliance.
- Fully electric services wherever feasible
- High energy efficiency systems for mechanical air conditioning (ACOP with capacity to run consistently at a COP>3.5), lighting and hot water systems.
- Effective energy metering and monitoring for core services to allow refinement in performance of key services by the facilities manager
- Significant proportion of electrical energy will be targeted from rooftop solar PV arrays—targeting annual PV array kWh production to match as much annual building electrical consumption (recognising that a net zero outcome will mean some export to the grid during the day).

Energy Efficient systems

In addition to strong passive design, buildings appliances, mechanical equipment and system automation and management must be inherently efficient to contribute to reduced energy, reduced peak load and reduced carbon emissions outcomes.

- Major services (including Cooking and hot water) to the building are proposed to be electric to drive towards reduced carbon emissions in operation.
- High efficiency Energy Star certified appliances (typically within 1 star of the highest rating available) such as refrigerators, dishwashers, washing machines, dryers, water coolers, microwaves, coffee makers, cooking equipment, and office devices to minimize energy usage and costs while ensuring efficient operations in buildings.

Air conditioning and ventilation proposed specifications

The natural ventilation of fresh outside air (helping to reduce CO2 levels and also build up of air borne pathogens) is regulated by the National Construction Code F4.6.

The following steps are recommended to guide final design and procurement of the best, and multi task, air conditioning/ HVAC system.

- Core heating an cooling efficiency of the air conditioning system to exceed an ACOP of 3.5 and ideally target 4.0. HVAC system design should balance high ACOP efficiency with functionality to vary air management (ventilation and heating/cooling) according to different demands in building rooms.
- Dormitory design should allow for cross ventilation and openable windows to benefit from the often temperate climate of the Kangaroo Valley throughout the year.
- NCC compliance for size of openable windows is sufficient to generate an acceptable health and wellbeing result—but exceedance of NCC should be considered..
- If air conditioning/HVAC design does not include an outdoor air mode then a CO2 monitor alert system should be installed to notify staff to manually open common room windows when CO2 concentration starts to approach unacceptable levels.
- HVAC design should consider inclusion of air filters for air returning to the class rooms to minimise air pollution.

Hot water proposed specifications

Electric heat pump hot water systems (with water storage) will be implemented to service the buildings. These systems are inherently up to three times more efficient than gas and electric resistance water heaters and can be cycled with renewable electricity from onsite solar PV arrays.

Lighting proposed specifications

- High efficiency and programmable LED lighting throughout the building will be included to minimise lighting energy usage.
- Lighting will be considered to minimize over lighting and glare while providing adequate illumination for various tasks and activities.
- Lighting specifications in detailed design will consider factors such as fixture placement, light distribution, and color temperature to enhance visual comfort and energy efficiency.
- The maximum illumination power density will be 4W/m^2 for the dormitories and 4.5W/m^2 for classroom spaces.
- Dynamic Lighting control devices and daylight sensors will be considered in detailed design for dimmed or stepped switching of lights adjacent to windows/glazing.

Metering and building energy management proposed specifications

Metering

It is recommended that in detailed design all important end uses (air conditioning, lighting, hot water etc) will be logged to NCC Section J requirements. In combination with installing a PV array of the size indicated solar energy generation will be metered together with matching to electricity consumption of the building.

Energy monitoring and management

The air conditioning systems operation should be the main target for monitoring and management. This system should be tailorable room by room and also ideally switched so that when outside temperatures are acceptable for comfort the system switches off in favour of open windows.

3. Energy efficiency and low carbon emissions

Renewable electricity proposed approach

Sizing of PV arrays

- An approximate assessment of roof space indicates that a 30-40kW capacity could be easily achievable — subject to final panel dimensions and installation requirements.
- The orientation of the roof spaces will be matched to strong solar PV array performance subject to an assessment of overshadowing from trees.
- The panels should be mounted directly to rails on the roof as compared to providing a complex racking system that will reduce the overall number of panels and increase cost.

System set up and battery potential

- The output from the solar PV array will feed in 'behind the meter' to service onsite electricity demand when matched—for example to provide energy to air conditioners, lights and hot water.
- A sufficient main switchboard set up should be designed so that a typical battery storage solution can be installed with the initial project or at a later date by the operators—we note that a location for a battery (as required) is on the plans.
- The set up should allow for export from the battery to the grid so that any excess production from the PV array system can be exported and so that joining virtual power plant schemes (where the renewable electricity is effectively shared with others) (VPPs) is achievable if desired.

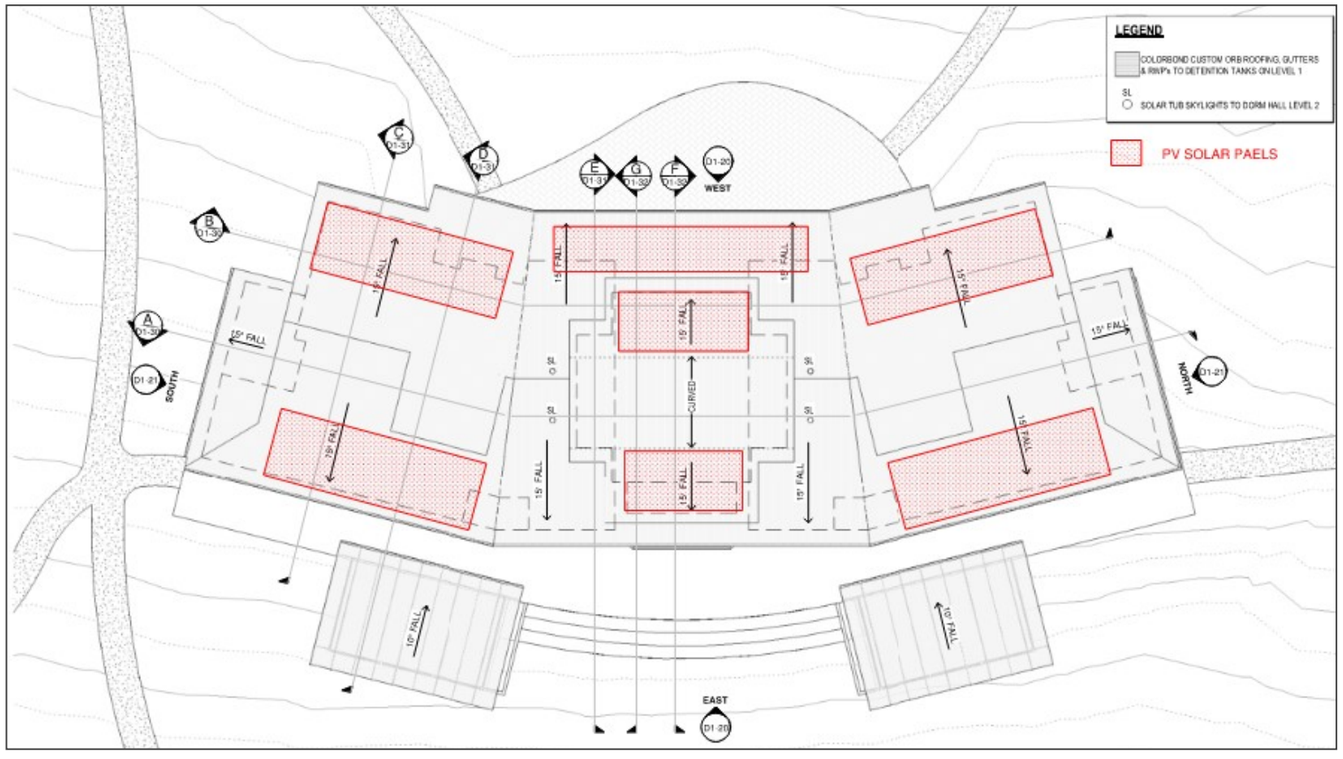
Final system design advice and procurement

- Roof design should include as a minimum that the structure of the roof has been certified to carry the weight/load of PV array system and that the electrical system design has allowed for a behind the meter, grid connected system with potential to add electricity storage/batteries in the future if desired.
- These provisions will also meet the requirements of NCC 2022 Section J

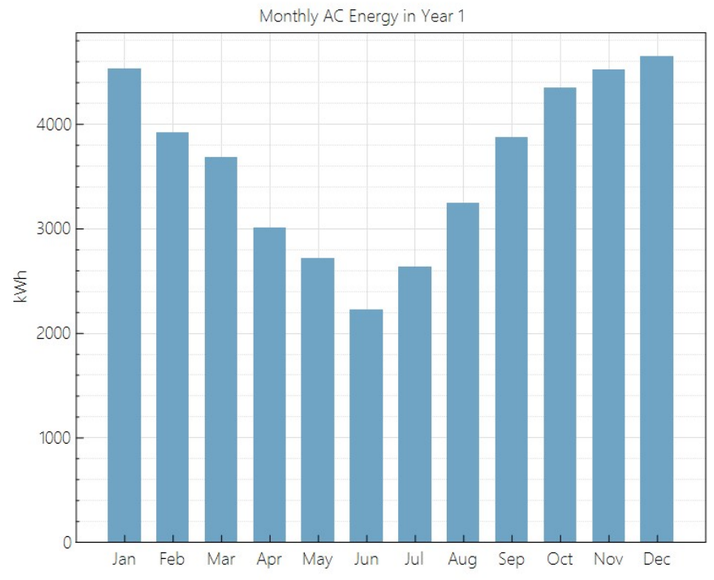
The recent amendment to the NSW Infrastructure SEPP indicates that the PV array component of the proposal could be delivered as complying development if required.

Procurement of Green Power

To help achieve a net zero carbon building in operation, the operator will check feasibility to specify Green Power from the retail electricity supplier or renewable electricity supply as part of an agreement with an embedded network operator if chosen.



Roof layout Typical Dormitory—Red hatched areas indicate potential locations for PV panels; to be refined by supplier/operator taking into account overshadowing from trees and roof limitations



Expected approximate monthly output from 30kW PV array (SAM software using Nowra climate data and northern orientation)

4. Water efficient design

Reduced potable water demand

Water resources will be managed to reduce the demand for potable water through water efficient fixtures and an alternative, rainwater based, water supply.

Proposed sustainability outcomes

- Target reduction in potable water demand of more than 25% and up to 50% against comparable buildings (combined savings from efficient fixtures and rainwater harvesting).
- 100% landscape irrigation from non-potable supply.
- High proportion of local native plant species with naturally low water demand/water demand matched to local rainfall.

Water efficient fixtures and fittings specifications

The following WELS water ratings are proposed for each key fitting:

- Toilets 4 star WELS.
- Urinals 5 Star WELS
- Showers 3 star WELS
- Taps 5 star WELS with timed flow mechanism.
- Dishwashers when installed 4-5 star WELS.
- Clothes Washing machine 4 star WELS or higher

Rainwater harvesting

Two 10kL rainwater tanks are currently proposed for all three buildings in this proposal. In detailed design a large proportion of the roof space will be plumbed to these tanks with a target of providing 100% irrigation capacity from these tanks.

These tanks will be plumbed to supply to landscape irrigation with back up supply from the potable water mains. In detailed design stages feasibility will be checked for supply to toilets.

Water sensitive urban design specifications

Water efficient irrigation methods

- Garden beds to be irrigated with undersurface/mulch drip irrigation where required.
- Irrigation water source to be connected to the rainwater tank system.
- Irrigation tap timers to be enabled with smart moisture sensors that restrict irrigation when soil moisture is already at the required level.

Water efficient plant selection

The detailed landscape design for the proposal includes:

- Extensive use of indigenous low water demand/ water demand matched to local rainfall plant species (target at least 80% of planting to Site).
- Irrigation zones that indicate areas of higher water demand and plant types that require regular irrigation (with controls above).
- No irrigation zones that indicate areas that should be resilient on local rainfall patterns after establishment.

Stormwater Quality Management

A Stormwater Quality Management Plan will be developed in detailed design stages considering the requirements of the DCP. The measures in the plan primarily address: Efficient management of stormwater quantities for high rainfall events and consistent with the overarching management strategy for the catchment. Stormwater quality must be maintained and improved according to the DCP requirements to manage gross pollutants and various nutrient levels in stormwater.

Landscape Concept Plan —supporting significant local species and canopy trees (Source: Landscape Architects)

5. Responsible materials

Focus on responsible materials outcomes

Selection of more sustainable, recycled and lower environmental impact materials will be carried out in detailed design. Materials that are durable and robust over operational phases will be selected that will help enable a lower life cycle cost of materials.

Proposed sustainability outcomes

- Reduced embodied carbon—use of concrete mixes with > 30% cement or raw aggregate replacement
- Steel and plasterboard targeting suppliers with carbon neutral certification and/or a recycled content proportion
- FSC certified structural and joinery timber products
- Building tender to require consideration of certified low environmental impact materials
- Repurposing of existing dwelling provides substantial avoidance of new embodied carbon

Lower embodied carbon materials specifications

- Feasibility check for a tender requirement for the building contractor to provide concrete options for reduced embodied carbon mixes through reduction in cement based carbon and aggregate based carbon.
- The Holcim Ecopact range is an example where embodied carbon can be reduced by 30%-60% across strength grades; Boral Envisia and Hymix 'HyLo' are other product and supplier options.
- Tender requirement for building contractor to provide steel products from suppliers/fabricators that are certified under the Australian Steel Institute ESC/SSA certification program.
- Tender requirement for building contractor to provide material supplier options where the supplier has been certified under the Climate Active program—for example Brickworks range of building products.

Holcim Ecopact lower carbon concrete range

Environmentally responsible contractors specifications

- It is recommended that the head building contractor preferred to have an established Environmental Management System for their operations compliant with ISO 14001.
- Building project team to assess key environmental risks and opportunities across building plant, equipment and materials; civil works and materials; landscape works and materials (using ISO 20400 principles).

Environmentally responsible materials specifications

It is recommended that a tender requirement is for procurement options with certified lower environmental impact products wherever feasible (with achievable cost and supply certainty).

Building structure:

- Concrete, steel and timber supply to include options from suppliers with GreenTag rating where possible and/or Environmental Product Declaration
- Timber must be FSC certified.

Building walls and façade

- Glazing/windows, insulation and cladding products to include options from suppliers with GreenTag or GECA ratings and/or Environmental Product Declarations—we note that Capral has recently introduced a range of lower embodied carbon emission aluminium windows that can be investigated.

Fitout and finishes

- Flooring, plasterboard, paints, ceilings, partitions, doors, internal glazing and furnishing to include options from suppliers with GreenTag or GECA ratings and/or Environmental Product Declaration

GECA and Green Tag ratings provide confidence on the environmental credential of key materials

6. Waste management & Human Well Being

Reduced waste to landfill and responsible materials

Together with supporting lower upfront carbon emissions, the project will investigate the inclusion of responsible materials and include space for splitting and recycling of waste 'resources' during project construction and ongoing operation.

Waste management will focus on a very high recycling and reuse rate for construction phase materials followed by a dedicated waste streaming and recycling system for the operation of the facility

Construction waste recycling

Construction and demolition waste should target a recycle or reuse rate of at least 80% of demolition and construction waste consistent with modern best practice in the NSW construction industry (NSW EPA data for 2021/22) with sufficient record keeping procedures to evidence this outcome.

Another aspect can be to design out waste and utilise pre-fabricated materials to ensure a reduction of waste generated on site.

A Construction Waste Management Plan will be prepared by the Consulting team and should be referred to.

For demolition and construction this plan sets out:

- Types and volumes of waste generated.
- How these waste volumes will be reused on site or taken to a recycling yard.
- Nil to landfill outcomes for concrete, bricks/pavers, and roof tiles
- The details of the recognised local waste recycling yard with NSW EPA licence.

This plan will focus on reuse and recycling onsite before management at a Waste Recovery and Landfill Facility. The steps in this process should identify all options to avoid waste to landfill.

Designing in Waste Sorting and Storage Facilities

An Operational Waste Management Plan will be prepared by the Consulting team and should be referred to.

The project will provide adequately sized waste storage areas on site with separation of major waste streams according to Shoalhaven Council services.

Proposed sustainability outcomes should include providing sufficient waste splitting areas to match Shoalhaven Council recycling schemes and additional holding area for organics.

Providing an organic waste composting system with finished compost to be returned to gardens (including food garden/vege patch) should be considered.

Examples of Waste Bins to be used Internally

Human wellbeing initiatives

Air quality

Air quality will primarily be protected by separating outdoor air intakes (including natural ventilation/windows) from pollution sources. AS 1668.2:2012 is the standard for this outcome.

Minimum separation distances will be identified based on the expected airflow rate into the building—the greater the air flow rate the larger the distance required from exhausts (such as food processing exhausts etc). Details will be assessed in further design stages.

Lighting Comfort

To further enhance the health and wellbeing of occupants, the proponent will investigate lighting design and quality strategies that exceed compliance to achieve high levels of human eye comfort. This exercise can take place in the detailed design and tender phase.

Low exposure to toxins

Future procurement of paints, adhesives, sealants, carpets and other large surface area materials for internal finishes will be required to meet very low Total Volatile Organic Compound' limits. The GBCA published limits from December 2021 could be used for this purpose.

The tender issued for this stage of work will include clear guidelines on the requirements for products and materials to be used. Any engineered wood products selected for the building will also have low or no formaldehyde content generally recognised as below 1mg/L.

Communal Spaces

Significant part of the site has been proposed as landscaped areas with open space and tree shade. These areas on will provide a great opportunity for communal and social interaction for the students.

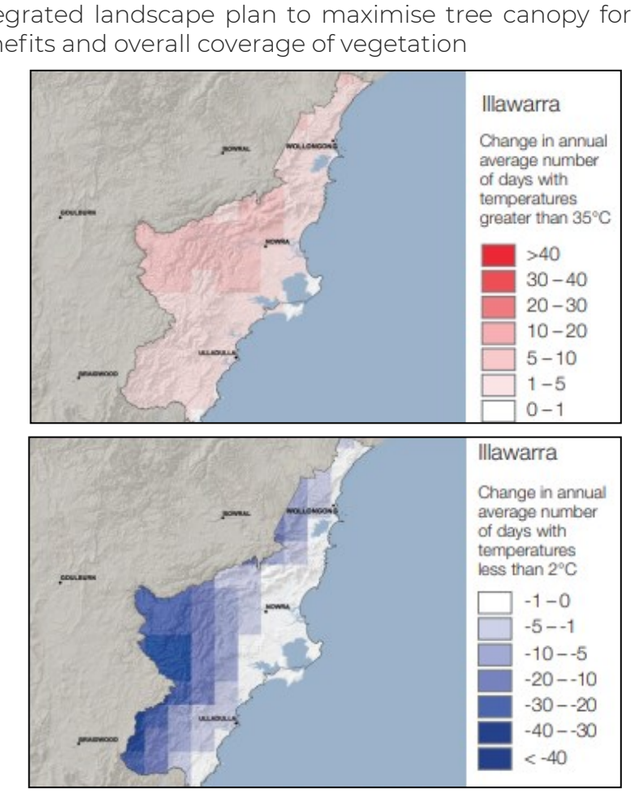
7. Climate change resilience

The building will be resilient to urban heating and help to mitigate urban heat island effect

Kangaroo Valley (part of Illawarra Shoalhaven) is projected to experience average temperature increase across all seasons, notably a major increase of 3.3°C is projected under a high-emissions scenario.

To help mitigate and adapt to urban heating the proposal includes the following measures to target mitigation measures for c.75% of the horizontal surface area.

- Minimum SRIs for roof areas on the new building (80) and ground hardstand areas (50)
- Integrated landscape plan to maximise tree canopy for shade benefits and overall coverage of vegetation



An additional 5-10 days per year over 35 degrees can be expected in the life of the building—NSW Office of Environment and Heritage

The buildings will be climate change resilient

Climate change impacts will be felt more heavily over the coming decades and particularly from 2050-2100. We note that the life of the building should exceed 50 years meaning that strong consideration should be given now to how the building and its students, carers and teachers can live and learn well with climate change.

The most recent climate modelling supporting IPCC6 predictions of climate change, and former more tailored modelling for NSW supporting IPCC5, indicate moderate to high confidence of more high temperature, high rainfall and storm extremes together with sea level rise. Increases in average winter temperatures and reduced average winter rainfalls are also indicated.

Proposed resilience outcomes

- Able to operate in heat wave events.
- Buildings designed to cope with 20-30% higher intensity short term extreme rainfall events.
- Buildings designed to cope with extreme storm events—particularly hail.
- Able to operate in bush fire smoke air pollution events.
- Landscape and materials specified to minimise urban heating.
- Building with strong Energy Efficiency measures using NCC 2022 Section J compliance will have good thermal performance and energy outcomes.
- In detailed design any roof top equipment will be assessed for resilience against storm damage (hail storms and short term high wind events) with storm protection measures considered at this time.

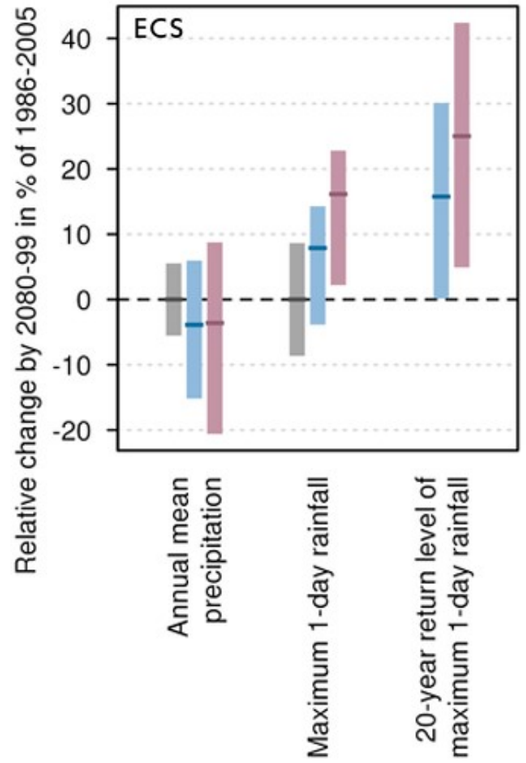


FIGURE 4.3.7: PROJECTED CHANGES IN MEAN RAINFALL, MAGNITUDE OF ANNUAL MAXIMUM 1-DAY RAINFALL AND MAGNITUDE OF THE 20-YEAR RETURN VALUE FOR THE 1-DAY RAINFALL FOR 2090 FOR EAST COAST NORTH (TOP) AND EAST COAST SOUTH (BOTTOM) (SEE TEXT FOR DEFINITION OF VARIABLES). CHANGES ARE GIVEN IN PERCENTAGE WITH RESPECT TO THE 1986–2005 MEAN FOR RCP4.5 (BLUE AND RCP8.5 (PURPLE). NATURAL CLIMATE VARIABILITY IS REPRESENTED BY THE GREY BAR. BAR PLOTS ARE EXPLAINED IN BOX 4.2.

East Coast Region Climate Change Report—CSIRO update 2021