ESD REPORT FOR SSDA

NARWEE PARKLANDS CARE COMMUNITY

ESD SERVICES

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DOCUMENT CONTROL SHEET

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Project Name	Narwee Parklands Care Community
Description	Ecologically Sustainable Design (ESD) Report for SSDA
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CONTENTS

1. EXECUTIVE SUMMARY

This report has been prepared by JHA to identify and summarise the Ecologically Sustainable Design (ESD) initiatives that have been considered in the design of the proposed aged care, Narwee Parklands Care Community located at 59-67 Karne St N, Narwee, NSW 2209.

This report demonstrates compliance with the Industry-specific Secretary's Environmental Assessment Requirements (SEARs) for senior housing that apply to the project and has been prepared to accompany a State Significant Development (SSD) application to the NSW Department of Planning, Industry and Environment (DPIE). This report should be read in conjunction with the architectural design drawings and other consultant design reports submitted as part of the application.

The ESD objectives of this project are to encourage a balanced approach to designing new facilities for the project; to be resource-efficient, cost-effective in construction and operation; and to deliver enhanced sustainability benefits concerning impacts on the environment and well-being of residents, patients, staff, and visitors whilst providing the best possible facilities for a constructive environment.

The proposed key ESD commitments for the development are listed below:

- On-site 99kWp of solar PV system
- Passive solar design measures to reduce reliance on HVAC, including:
  - Performance glazing
  - Appropriate Insulation
  - Appropriate shades
  - Operable windows for natural ventilation
- Energy-efficient air-conditioning systems
- Energy-efficient LED lighting systems throughout
- Provision for low emission vehicles
- High WELS-rated water fixtures & fittings
- Water-efficient washing machines and dishwashers
- Rainwater capture and reuse for landscape irrigation
- Use of recycled materials, including:
  - Recycled road base below concrete slabs and pavements
  - Recycled aggregate for drainage layer behind retaining walls

2. INTRODUCTION

This ESD SSDA Report is submitted to the Department of Planning, Industry and Environment (DPIE) in support of a State Significant Development Application for the proposed development of Narwee Parklands Care Community which is an aged care facility on land identified as 59-67 Karne St N, Narwee (the site). The extent of the site is shown below.

The subject proposal is for the detailed design and construction of the facility and seeks approval through a Complying Development Certificate planning pathway for the following:

- Demolition of the existing buildings at the site;
- Construction of a new aged care facility. The proposed building provides 165 beds which include ten companion rooms and 145 single rooms;
- Construction of associated site facilities and services, including pedestrian and vehicular access and basement parking; and
- Site landscaping and infrastructure works.

In accordance with Part 8 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) and the *State Significant Development Guidelines*, the project is to comply with *Planning Secretary's Environmental Assessment Requirements* (SEARs) for Seniors Housing. This report has been prepared to address the following key issues:

9. Ecologically Sustainable Development (ESD)	The relevant section of the report
▪ Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development.	Section 3, Appendix A
▪ Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	Section 4, Section 5
▪ Demonstrate how the development minimizes greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050) and	Section 4

consumption of energy, water (including water-sensitive urban design) and material resources.	

In accordance with the above industry-specific SEARS, the development will implement a holistic and integrated approach to ESD, maximising passive opportunities with the selective application of modern technology where appropriate.

The ESD initiatives outlined within this document have been compiled to exceed the regulation, design tools, and design guidelines of the National Construction Code (NCC) Section J – Energy Efficiency.

The SEARs items listed above are addressed in Sections 3, 4, 5 and Appendix A of this report.

3. PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The ESD principles as defined in section 193 of the EP&A Regulation have been incorporated into the design and ongoing operation phases of the development as follows:

3.1 THE PRECAUTIONARY PRINCIPLE

The precautionary principle is that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In applying the precautionary principle, public and private decisions should be guided by

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and;

(ii) an assessment of the risk-weighted consequences of various options.

PROJECT RESPONSE:

This development is being designed in accordance with a wide range of ESD goals that pertain to the design, construction and operational stages. The development team will ensure that the building minimises the impact on the environment in the areas of energy, water and materials. The design will incorporate external high-performance glazing and shading devices, together with energy efficiency favoured passive design features to minimise severe or irreversible environmental damages.

In addition to the above, a Climate Adaptation Plan including a Risk Assessment has been undertaken to include the assessment of natural and urban hazards (e.g. flood, storm, heatwaves, bush fires, extreme storms and other weather events). Increasing resilience to natural hazards has been considered in the development so that associated costs are budgeted. Refer to Appendix A - Climate Adaptation Plan for the details of climate risks identified for this project and the relative responses, actions and responsibilities for high and extreme risks identified.

3.2 INTER-GENERATIONAL EQUITY

The principle of inter-generational equity is that the present generation should ensure the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

PROJECT RESPONSE:

This development will not cause any significant impact on the health, diversity and productivity of the environment and will provide a community benefit in the form of increased residents, employee capacity, upgraded living, caring, and working facilities. The project will contribute to a lively community environment and add architectural interest to the surrounding area.

3.3 CONSERVATION OF BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

The principle of the conservation of biological diversity and ecological integrity is that the conservation of biological diversity and ecological integrity should be a fundamental consideration.

PROJECT RESPONSE:

A Landscape Report has been prepared to ensure the proposed development will not have a significant effect on any threatened species, endangered communities, or their habitat. Ecological integrity has been considered for development, with careful consideration to ensure the retaining of significant vegetation. The design will include practical strategies to increase the ecological value of the site, such as with tree species that are consistent with the prevailing species set and the Castlereagh Ironbark Forest Ecological Community. For further details, please refer to Landscape Report by Taylor Brammer Landscape Architects.

3.4 IMPROVED VALUATION, PRICING AND INCENTIVE MECHANISMS

The principle of improved valuation, pricing and incentive mechanisms is that environmental factors should be included in the valuation of assets and services, such as

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, and,

(ii) the users of goods and services should pay prices based on the full life cycle of the costs of providing the goods and services, including the use of natural resources and assets and the ultimate disposal of waste, and

(iii) established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

PROJECT RESPONSE:

The project team has assessed the materials proposed for this project using industry recognised building sustainability standards. The construction material will be selected based on the outcomes of relative cost-benefit analysis with decisions being made based on the whole-of-life costs rather than capital expenditure only. Certified recycled and reused materials, as well as materials with low embodied energy, will be preferred over others.

4. SUSTAINABLE DESIGN INITIATIVES

The sustainable design framework for this development aims to incorporate the best practice design initiatives and ESD principles into the development. The ESD initiatives outlined below have been selected based on the following:

- National Construction Code (NCC) Section J Energy Efficiency; &
- Industry recognised sustainability standards, including Green Star Buildings v1 guidelines.

4.1 THERMAL COMFORT

Appropriate design and material selection ensure that thermal comfort is achieved by passive means for significant portion of the year. Passive design initiatives such as performance glazing, shading and the use of insulation will reduce demand on mechanical air conditioning systems resulting in a reduction in energy consumption and greenhouse gas emissions.

The building fabric will be designed to meet the NCC Section J requirements for the building envelope. Thermal breaks will be incorporated into walls, floors and roofs where appropriate to ensure a continuous thermal barrier on the building envelope, reducing the flow of thermal energy between conductive materials.

An energy model will be created to optimise the thermal performance of the building and to show compliance during the detailed design stage of the project. The indicative total construction R-value specifications for the development are provided below. The detailed assessment will be carried out in during detailed design to optimise the configuration to suit the project's needs.

4.1.1 BUILDING FABRIC

The building fabric will aim to achieve a 10% improvement over minimum requirements in reference to Industry recognised sustainability standards. The thermal performance targets based on Section J Deemed-to-Satisfy (DTS) provision and an allowance for 10% improvement for a Class 9c development at the proposed location (Climate Zone 5) are:

Building Elements	Indicative Thermal Performance Targets
Envelope Roof/Ceiling	Total R-Value of 4.1 (Downwards, Solar Absorptance of the upper surface of roof TBC pending detailed design.)
Envelope Walls	Total R-Value of 1.6
Envelope Floors	Total R-Value of 2.2 (Downwards)

Appropriate insulation will be provided to the walls, floors and roofs to achieve the thermal performance targets. Insulation reduces heat flow and consequent heat loss in winter and heat gain in summer. This minimises the heating and cooling load demand on the air conditioning systems. Light-coloured roof material with a low solar absorptance (SA) is recommended to be used to isolate more sunlight and reduce summer heat gain. It also has the effect of reducing elevated localised temperatures (the heat island effect) and potentially can improve the efficiency of solar PV panels (if any) as they perform more efficiently in reduced temperatures.

4.1.2 GLAZING

Glazing is a major source of unwanted heat gain in the summer and can cause significant heat loss in the winter due to its low insulation performance compared to wall constructions. It is thus recommended that windows will be high-performance glazing systems. Performance glazing substantially reduces heat transmission. This particularly reduces heat loss in winter; therefore, internal heat gain from equipment, lighting and people are better contained. Also, performance glazing absorbs the infrared portion of sunlight and reduces the amount of heat transferred into the conditioned space. This will correspond to a reduction of both heating and cooling loads.

The building will comply with NCC Section J Energy Efficiency. An energy model will be carried out to show compliance during detailed design stage of the project. The indicative glazing specifications below are based on previous similar-scale projects within the same climate zone.

Glazing Element	Window Assembly (Glass & Frame)		Description
	Total U-value	Total SHGC	
External Vertical Glazing	2.0 – 4.5	0.3 – 0.6	High performance glazing

4.1.3 SHADING AND DAYLIGHTING

Solar access can enhance indoor environmental quality through access to daylighting and reduce lighting energy consumption. However, excessive solar access and hence, direct solar radiation heat can increase HVAC energy demand and can also cause thermal discomfort. The passive solar heating principle which aims to prevent solar heat gain in the summer and harvest it in the winter for a free source of heating, and the passive cooling principle which prevents heat from entering the building during the summer months, are strategies that can conveniently take advantage of the site-specific solar access for optimised indoor environmental quality and reduction of HVAC energy demand through the use of tailored shadings.

Appropriate glazing with good visual light transmittance will be provided to all bedrooms to ensure a good level of natural daylight. The proposed buildings have been designed to reduce direct solar gains from the high summer sun from entering the building with the provision of generous balconies for bedroom whilst allowing the low winter sun to enter the building for passive heating during the cooler months.

These passive design features allow for enriched daylighting and greater access to external views for occupants. Additional daylighting reduces the reliance on artificial light and benefits alertness, mood and productivity.

4.1.4 NATURAL VENTILATION

Adequate natural air movement makes an important contribution to creating a comfortable indoor environment and reducing the need for mechanical ventilation by carrying accumulated heat out and replacing it with cooler external air. This is important during the summer months when heat build-up within spaces can be quickly removed with the availability of a suitable breeze at the site. The design team proposed to utilise natural ventilation and air circulation through operable windows provided to all bedrooms.

4.2 ENERGY EFFICIENCY

In addition to the above passive thermal comfort measures, the proposed development will further reduce greenhouse gas emissions, reflecting the Government's goal of net zero emissions by 2050, with the following energy efficiency initiatives:

4.2.1 ONSITE PHOTOVOLTAICS

Collecting solar energy has been chosen as a key ESD strategy for the project, with the goal of minimising the building's energy consumption and greenhouse gas emissions from a renewable source via the provision of a roof-mounted photovoltaic system.

A 99kWp PV system has been proposed for the development and over 600m^2 of roof space has been dedicated along North Home for its installation. It is anticipated this PV system will significantly reduce the grid electricity demand of the building during daytime.

4.2.2 ENERGY-EFFICIENT HVAC SYSTEMS

The heating, ventilation and air-conditioning (HVAC) systems shall be designed to comply with or exceed the minimum requirements of NCC Section J requirements.

The proposed underground car park will be provided with a mechanical exhaust system that will discharge through the roof. The car park mechanical ventilation system will be controlled via a carbon monoxide (CO) monitoring system, and the car park exhaust fan will also be provided with a variable speed drive (VSD) to optimise energy efficiency.

The bedrooms with single and companion occupancy will be provided with high-efficiency VRF heat recovery systems air conditioning. The air-cooled heat rejection system will help minimise the impacts associated with harmful microbes (e.g. Legionella impact).

The control of the air conditioning system shall be designed to minimise energy consumption with a system such as an after-hour push-button for adjustable timer controller and/or motion detector controls. Further, high-efficiency equipment for the HVAC system will be selected to assist with the energy conservation of the building.

All bathrooms will be provided with mechanical ventilation with switch controls (for example manual switches, timer and interlocked to light). The design will have a sufficient amount of exhaust fans to ensure the liveability of the residents.

Ductwork systems will be designed to reduce system pressure losses to reduce fan motor power. This includes the selection of equipment for reduced coil and fittings drops and being generous with ductwork sizes to reduce friction losses.

These initiatives will provide significant savings in energy use.

4.2.3 ENERGY-EFFICIENT LIGHTING

Lighting will be designed to comply with or exceed the minimum requirements of NCC Section J. Fittings incorporating the latest lamp technologies will be installed to minimise energy use and provide efficient artificial lighting systems. The proposed development shall be illuminated using LED fittings throughout the building and be controlled via an automatic control system with timer controls, PIR occupancy sensors and microwave occupancy sensors.

Lighting in common spaces shall be provided with an occupancy sensing and/or daylight sensor as appropriate to reduce light output or turn off lights when the space is unoccupied and/or sufficient daylight is provided within the space. For large common spaces, where appropriate the perimeter lighting shall be designated on a separate zone to make maximum use of the daylight. External lighting will have 50% dusk/dawn control on a mix of PE cell and time switch. Underground car parking will operate on occupancy sensing with threshold lighting operating independently.

4.2.4 ENERGY-EFFICIENT APPLIANCES AND EQUIPMENT

Energy consumption shall be reduced by installing energy-efficient appliances. Appliances with higher energy stars will provide a return in saving energy and decrease greenhouse gas emissions. Where possible, appliances shall be selected within 1 star of the highest energy efficiency rating available on the market. Provision of sufficient plant space to facilitate the installation of heat pump hot water systems in future.

4.2.5 LOW EMISSION VEHICLE INFRASTRUCTURE

To encourage the use of low-emission vehicles, the development will provide five bicycle spaces for employees and visitors in accordance with the Traffic Report by Colston Budd Rogers & Kafes Pty Ltd. The facility will also include shower and change facilities for employees. Provision for electric vehicles infrastructure (i.e. electrical demand allowed or sub-board) to facilitate the installation of charging equipment in future.

4.2.6 ELECTRICITY METERS

Electricity metering and sub-metering shall be specified in accordance with Section J to monitor and manage electricity consumption in the building. Sub-metering is to be provided to distinct floors and distinct usage.

4.3 WATER CONSERVATION

The following initiatives are proposed to ensure that significant water saving is achieved.

4.3.1 FITTINGS AND FIXTURES

Water consumption shall be reduced by incorporating water-efficient fixtures and fittings in accordance with the Australian Government's Water Efficiency Labelling Scheme (WELS). The fixtures and fittings are to have the following minimum WELS Rating. In addition, flow restrictors or taps with timed flows can be used to minimise water usage.

Water Fittings/Fixtures	Targeted WELS Rating
Showerhead rating	3-star
Toilet and urinals rating	4-star dual flush toilets 3-star urinals
Taps and flow controllers	4-star

Dishwashers	5-star
Washing machines	4-star

4.3.2 RAINWATER HARVESTING AND REUSE

Rainwater tanks shall be installed on the site to reduce the demand for potable water supplies and will be connected for the purpose of irrigation reuse.

4.3.3 WATER-SENSITIVE URBAN DESIGN (WSUD)

External area design will implement best practices of water-sensitive urban design, including indigenous and/or low water usage plants, to increase stormwater retention and decrease total suspended solids in stormwater. The post-development peak average recurrence interval (ARI) event discharge from the site shall not exceed pre-development levels. Integrated water management (IWM) Plan including Water Sensitive Urban Design (WSUD) and detailing the proposed alternative water supplies, proposed end uses of potable and non-potable, and water-sensitive urban design shall be prepared by a stormwater/civil specialist.

4.4 SUSTAINABLE MATERIALS

4.4.1 LOW VOC / LOW FORMALDEHYDE MATERIALS

Adhesives, sealants, flooring and paint products will be selected where possible to contain low or no Volatile Organic Compounds (VOCs) and all engineered timber products used in exposed or concealed applications shall contain low or no formaldehyde to avoid harmful emissions that can cause illness and discomfort for the occupants.

4.4.2 RECYCLED MATERIALS

Reducing the embodied emissions in new development, that is the greenhouse gas emissions resulting from the materials used to construct a building, is also an important component to achieving the goal of net zero emissions.

One way to reduce embodied emissions is include more recycled materials to replace new/virgin construction materials in new development. This project will incorporate recycled aggregate for drainage layer behind retaining walls and recycled road base below concrete slabs and pavements.

4.4.3 WASTE

Waste collection and disposal play an important role in the protection of the environment and the health of the population in the modern world. A Waste Management Plan has been prepared UFD to address the operational requirements of the proposed development. The waste management plan details how to minimise the amount of waste generated, maximise the reuse, recycling and reprocessing of waste during operation. For detailed information refer to the waste consultant’s report.

5. PEOPLE, CULTURE AND HERITAGE

The proposed development aims to celebrate Aboriginal and Torres Strait Islander people, culture and heritage through its building designs. The building's design and construction will incorporate design elements using the Indigenous design and planning strategies and principles. The project team is committed to incorporating Aboriginal design principles as part of the project's sustainability strategy and addressing the three essential elements of designing with Country:

- Passive Design – the project will take into consideration local knowledge, of prevailing winds, views, water flows etc. to inform the passive design of the building. A cultural mapping of the site has been created to inform the cultural flows and pressures on the site.
- Caring for Country – the project will preserving high value trees where possible, ensuring good solar access to outdoor areas, encouraging biodiversity through appropriate plants selection, capturing rainwater for onsite reuse, creating share spaces for residents and visitors to enjoy.
- Reconnecting people with Country – the project will prioritise the use of natural materials, recycled timber and orche palette. All aboriginal design elements will be indigenous led or co-designed and approved before finalising.

Outcomes of the workshops with elders stakeholder led by Michael Hromek, the project's Indigenous Design Consultant, that are currently in progress will be incorporated during detailed design.

APPENDIX A: CLIMATE ADAPTATION PLAN

CLIMATE RISK ASSESSMENT REPORT

NARWEE PARKLANDS CARE COMMUNITY

CLIMATE ADAPTATION PLAN

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EXECUTIVE SUMMARY

JHA Consulting Engineers has been commissioned by Opal Healthcare to prepare Climate Adaptation Plan (CAP) for the proposed development of Narwee Parklands Care Community located at 59-67 Karne St N, Narwee, NSW 2209.

The impacts of climate change were assessed across two-time scales (2050 & 2070) and two Representative Concentration Pathways (RCP4.5 & RCP 8.5). Climate Futures matrices were used to determine the key climate projections based on multiple climate variables for this risk assessment. The key climate projections were used to inform the climate risk assessment.

The risk priority levels of the climate risks identified pre- and post-adaptation are summarised below:

Risk rating	2050 Pre-adaptation	2050 Post-adaptation	2070 Pre-adaptation	2070 Post-adaptation
Low	2	3	0	2
Medium	3	2	3	3
High	0	0	2	0
Extreme	0	0	0	0

The results of the climate risk assessment identified two high risks items pre-adaptation. These high risks were mitigated to medium and low risks by the proposed adaptation actions. The responses to high risks are summarised as follows:

1. Higher average surface temperature and less rainfall conditions cause an increase in the frequency and/or severity of bushfire events directly damaging the building. This risk is mitigated by ensuring non-combustible building elements are used in the fabric of the building and by implementing good management practices to remove potential fuel sources around the building once the building is in operation.
2. Higher maximum daily temperature and lower humidity conditions result in higher frequency and/or duration of heatwaves resulting in an insufficient capacity of the HVAC system to maintain thermal comfort. This risk is mitigated by the incorporation of passive thermal principles such as appropriate external shades and thermal insulation and by upgrading the capacity of the HVAC system once the current system has reached the end of its service life.

In summary, all risk items identified as 'high' or 'extreme' are addressed by specific design responses in addition to the two risk items identified in the risk assessment being addressed by specific design responses.

1 INTRODUCTION

This Climate Adaptation Plan (CAP) has been prepared for the proposed development of Narwee Parklands Care Community located at 59-67 Karne St N, Narwee, NSW 2209.

In accordance with *Green Star – Buildings v1, Credit "Climate Change Resilience"* the purpose of the CAP is to provide:

- Details of stakeholder consultation that was undertaken during plan preparation, incorporating their responses (see Section 1.3)
- Summary of the project's characteristics (site, location, climatic characteristics) (see Section 2)
- Assessment of climate change scenarios and impacts on the project using a two-time scale relevant to the project's anticipated lifespan (see Section 3)
- Summary of potential direct and indirect climate change impacts (environmental, social and economic) (see Section 4)
- Identification of the potential risks for the project and people based on recognised standards (see Section 4)
- A list of actions and responsibilities for 'high' and 'extreme' risks identified (see Section 4)

1.1 PROJECT DESCRIPTION

The proposed development includes the construction of an aged care facility which will be situated in north Narwee in the City of Canterbury-Bankstown, which is 15km southwest of Sydney CBD and 4.5km southeast of Bankstown.

The subject proposal is for the detailed design and construction of the facility and seeks approval through a Complying Development Certificate planning pathway for the following:

- Demolition of the existing buildings at the site;
- Construction of a new aged care facility. The proposed building provides 165 beds which include ten companion rooms and 145 single rooms;
- Construction of associated site facilities and services, including pedestrian and vehicular access and basement parking;
- Site landscaping and infrastructure works.

The site constitutes four lots amalgamated into a single larger block over approximately 7,160 sqm size and is afforded ample access to open space, retail amenities and community facilities. The site is accessed via Karne Street North and the South Western Motorway runs east-west to the south of the site. The site is primarily surrounded by single-storey dwellings, with that newer development to the site's east being up to two storeys.

Figure 1: Ariel Photo of Site

1.2 REFERENCE DOCUMENTS AND STANDARDS

This CAP will assess potential risks and propose mitigation strategies as necessary in accordance with the following documents and standards:

- Green Star Design and As-Built v1.3 Submission Guidelines;
- ISO 31000-2009 – Risk Management:- Principles and Guidance (adopted in Australia and New Zealand as AS/NZS ISO 31000:2009)
- The AGO's Climate Change Risks and Impacts: A Guide for Government and Business

1.3 STAKEHOLDERS CONSULTATION

As a part of the CAP development process, the stakeholders consulted are listed below.

Stakeholder	Role
Opal Healthcare – Tony Chung	Development Manager
CYRE – Marlon Zunac	Project Manager
Group GSA – Pei Goh	Architect
Ethos Urban – Eliza Arnott	Urban Planning
Taylor Brammer – Aaron Lakeman	Landscape
JHA Consulting Engineers – Gary Tang, Tarun Thottungal & Lawrence Yu	ESD
CBRK – Josh Hollis	Traffic

2 PROJECT'S CLIMATIC CHARACTERISTICS

Narwee Parklands Care Community is located in NCC Climate Zone 5, which is described as warm temperate.

As part of the Greater Sydney region, Narwee enjoys a sunny climate with mild winters and warm summers. The main aims of this zone are to reduce the need for cooling in summer and heating in winter.

2.1 BASELINE CLIMATIC CONDITIONS

The baseline climatic conditions for Narwee are taken from the closest weather station data available from the Bureau of Meteorology. The closest weather station is the Canterbury Racecourse AWS which is approx. 5.8 km away from the building location.

Weather station details:

- Site name: Canterbury Racecourse AWS
- Site number: 066194
- Latitude: - 33.91 °S Longitude: 151.11 °E
- Elevation: 3 m
- Commenced: 1995
- Status: Open

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	An.
Maximum temperature													
Mean maximum temperature (Degrees C)	27.9	27.2	25.9	23.6	20.7	18.1	17.7	19.0	21.9	23.6	24.8	26.6	23.1
Highest temperature (Degrees C)	45.9	43.1	39.0	35.4	28.0	25.6	26.1	29.0	34.7	37.3	40.9	42.3	45.9
Mean number of days >= 35 Degrees C	2.0	1.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.1	1.3	6.4
Minimum temperature													
Mean minimum temperature (Degrees C)	18.6	18.3	16.6	12.8	9.2	7.1	5.7	6.4	9.3	12.2	14.9	16.9	12.3
Lowest temperature (°C)	10.3	11.1	6.9	2.4	1.5	-0.9	-1.6	0.3	2.7	4.4	6.5	8.5	-1.6
Mean number of days <= 2 Degrees C	0.0	0.0	0.0	0.0	0.1	0.9	2.5	1.3	0.0	0.0	0.0	0.0	4.8
Rainfall													
Mean rainfall (mm)	78.1	123.6	117.3	98.9	75.2	101.7	67.8	62.9	48.5	63.9	73.8	65.1	972.5
Highest rainfall (mm)	259.6	448.4	626.6	397.6	314.6	392.8	354.2	247.4	156.6	218.4	172.4	176.2	1706.4
Mean number of days of rain ≥ 25 mm	0.9	1.4	1.5	1.0	0.8	1.2	0.6	0.8	0.5	0.4	0.6	0.6	10.2
Solar Exposure													
Mean daily solar exposure (MJ/m2)	22.6	19.7	16.6	13.5	10.4	8.7	9.8	13.1	16.8	19.9	21.4	23.0	16.3

2.2 PAST EXTREME EVENTS

Extreme events that have impacted a site in the past are indicative of possible extreme events that will impact the site in the future. The identification of past extreme events will help highlight the climate risks that should be the focus of this risk assessment.

- Bushfire – Bush fire-prone land (BFPL) is the land that has been identified by NSW Rural Fire Service which can support a bush fire or is subject to bush fire attack and this site is not identified as a bushfire-prone area [source: https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection/bush-fire-prone-land/check-bfpl].

  From the NSW Planning Portal spatial viewer, it is observed the site is not within bushfire-prone land and is free from vegetation which can act as fuel for bush fires (refer to the map below).

Figure 2: Bushfire Prone Land (Non-EPI); [Source: https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address]

- Heatwaves – A heatwave is defined as three or more days of high maximum and minimum temperatures that are unusual for that location. Over the period 1911–2013, heatwaves in parts of NSW have become longer, hotter and occur more often [Source: AdaptNSW Heatwaves Climate Change Impact Snapshot]. Hotter and more frequent heatwaves will contribute to the risk of bushfires. Research shows a link between excessive heat and childhood emergency department attendances for diseases such as asthma, fever, gastroenteritis, and electrolyte imbalances.
  Studies have shown that staff performance can be impacted by higher temperatures. Warm buildings may decrease interest and alertness, distracting staff and other workers. In hotter buildings, headaches and heat exhaustion symptoms may develop that can hinder the performance of the staff and badly affect the health of the elderly people. High temperatures may be accompanied by higher levels of humidity and increased humidity can cause drowsiness. Studies have also shown that concentration performance is lower in humid, hot environments. The NSW Heat Vulnerability Index (HVI) dataset identifies the site currently as low/medium vulnerability (with a score of 3) to the adverse effects of urban heat.
  [Source: https://climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Heat/Urban-heat]

Figure 3: Heat Vulnerability Index Map;
[Source: https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU&runWorkflow=AppendLayerCatalog&CatalogLayer=SEED_Catalog.206.Heat%20Vulnerability%20Index%202016]

- Storms/Gustier Wind – Thunderstorms are the most common type of storm in New South Wales, causing more damage than any other short-duration weather event. They are most likely to hit Sydney from October to March. They can last from 10 minutes to several hours, with very strong winds, heavy rain and hail causing flash flooding, power outages and property damage. Historically, this area has experienced low rainfall intensity for 60minute 1:100yr Storm. Predicted to receive 63.3 mm, or up to 419 mm over 3 days. [Source: Bureau of Meteorology http://www.bom.gov.au/water/designRainfalls/]

- Extended drought periods – The site is identified as the "Non-Drought" area and no historical drought events have been found. [Source: NSW Combined Drought Indicator; https://edis.dpi.nsw.gov.au/]

- Floods/Extreme Rain – The site is not located within Flood Planning Area. The nearest flood planning area is near Salt Pan Creek which is approximately 2.5 km away from the site.

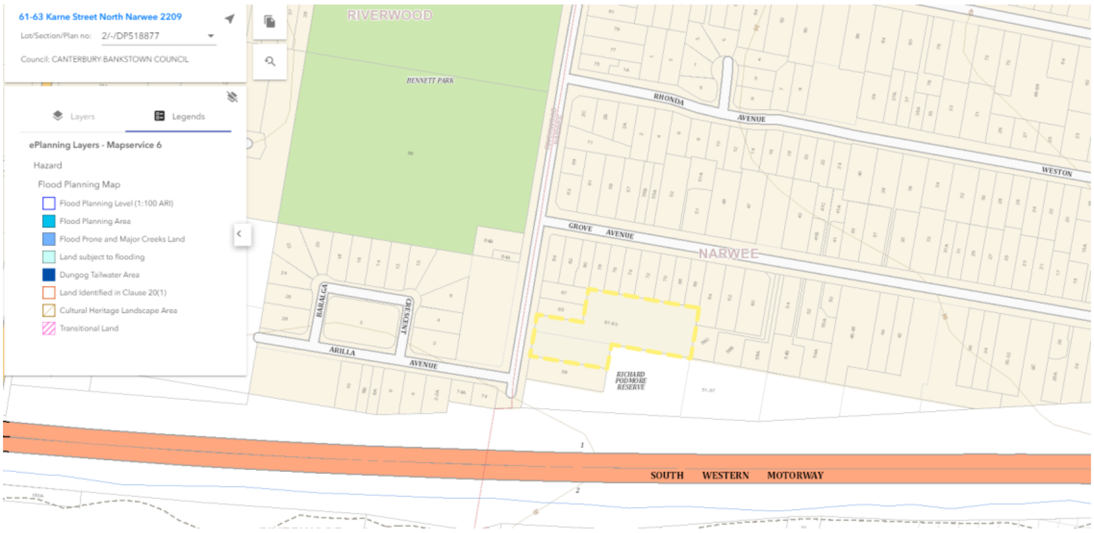


Figure 4: Flood Map - NSW Planning Portal;
[Source: https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address]

2.3 PROJECT-SPECIFIC RISK STATEMENTS

Based on the project's baseline climatic characteristics and past extreme events, the following project-specific climate risk statements are formulated:

1. Hotter and dryer conditions cause an increase in the frequency and/or severity of bushfire and heatwaves events.
2. Higher maximum temperatures and more humid conditions cause an increase in frequency and/or duration of extreme heat days (over 35 °C) and heatwave events.

3 CLIMATE CHANGE SCENARIOS AND IMPACTS

3.1 REGIONAL OVERVIEW

The subject site is located within the East Coast South sub-cluster as defined by the CSIRO and the Australian Government.

Figure 5: East Coast South Sub-cluster

The East Coast south sub-cluster comprises Natural Resource Management (NRM) regions in the central part of the eastern seaboard of Australia. The area encompasses important headwater catchments for a high proportion of Australia's population.

The sub-cluster area has a predominantly sub-tropical climate, with regional variations such as some temperate influences in the south.

Key projection messages for this sub-cluster:

- Average 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.
- Temperatures have increased over the past century, with the rate of warming higher since 1960. The mean temperature increased between 1910 and 2013 by around 0.8°C. The recent decades have been the warmest on record for both daily minimum and daily maximum temperatures in the cluster.
- For the near future (2050), the annual average warming across all emissions scenarios is projected to be around 0.5 to 1.3°C above the climate of 1986 – 2005.
- By late in the century (2090), for a high emission scenario (RCP8.5) and projected range of warming is 2.9 to 4.6°C. Under an intermediate scenario (RCP4.5) the projected warming is 1.3 to 2.5°C.
- Decreases in winter rainfall are projected with medium confidence. Other changes are possible but unclear.
- Increased intensity of extreme rainfall events is projected, with high confidence.

- Mean sea level will continue to rise and the height of extreme sea-level events will also increase (very high confidence).
- A harsher fire-weather climate in the future (high confidence).
- On an annual and decadal basis, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years and for rainfall.

3.2 REPRESENTATIVE CONCENTRATION PATHWAY

In order to source relevant climate projections, appropriate Representative Concentration Pathway (RCPs) based on the latest Intergovernmental Panel on Climate Change (IPCC) report are chosen. The RCPs provide plausible climate futures that may eventuate over the coming years. There are four pathways: RCP8.5, RCP6, RCP4.5, and RCP2.6, where the numbers of each RCP refer to the amount of radiative forcing produced by greenhouse gases in 2100.

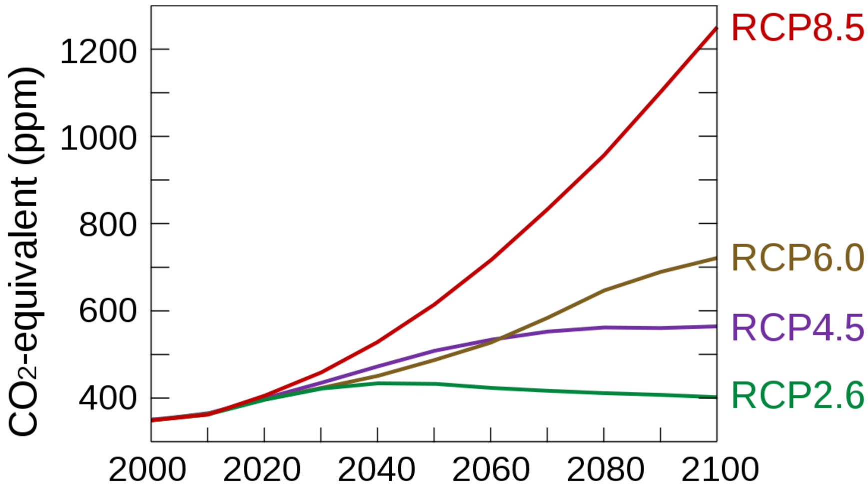


Figure 6: IPCC Representative Concentration Pathway

The RCP 8.5 scenario has been selected as one future climate projection for this assessment as it is the most conservative pathway and because current emissions are tracking close to RCP 8.5. RCP 8.5 reflects a future with less curbing of emissions and a continued increase in fossil fuel use. It is generally taken as the basis for worst-case climate change scenarios.

The RCP 4.5 is chosen to represent a stabilisation pathway in which lower emissions are achieved by the application of some mitigation strategies and technologies. RCP 4.5 reflects a future where emissions peak around 2040, and the CO_2 concentration reaches 540 ppm by 2100.

3.3 PROJECTION TIME SCALE

The lifespan of the project components was considered to determine the appropriate projection time scale. Based on the components design life of a school building, the time series that is selected to understand the future climate impacts across the project's life are 2050 and 2070.

3.4 CLIMATE VARIABLES OF INTEREST

Based on the project's characteristics, the climate variables of interest for this site are:

Events	Variables	Key Cases
Bushfires	Mean surface temperature and rainfall (Summer)	"Best Case": Climate Future with the least increase in mean surface temperature and the least decrease (or most increase) in rainfall (shorthand: "coolest and wettest") "Worst Case": Climate Future with the greatest increase in mean surface temperature and the greatest decrease (or least increase) in rainfall (shorthand: "hottest and driest")
Heatwaves	Maximum daily temperature and humidity (Annual)	"Best Case": Climate Future with the least increase in maximum daily temperature and the least increase (or most decrease) in humidity (shorthand: "coolest and least humid") "Worst Case": Climate Future with the greatest increase in maximum daily temperature and the greatest increase (or least decrease) in humidity (shorthand: "hottest and most humid")

3.5 CLIMATE FUTURE PROJECTIONS

The series of climate futures matrices representing the combination of time periods and greenhouse gas scenarios and classified by the combined changes of the climate variables identified above are provided in the table below. All climate future matrices are sourced from CSIRO and Bureau of Meteorology, Climate Change in Australia website - www.climatechangeinaustralia.gov.au, cited 09/08/2022.

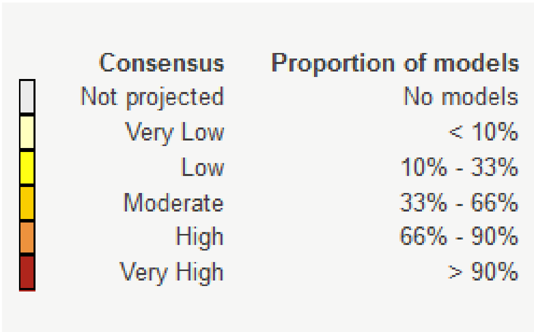
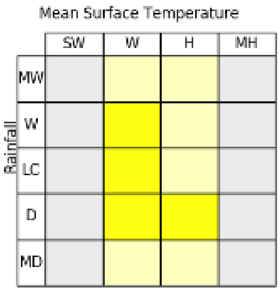
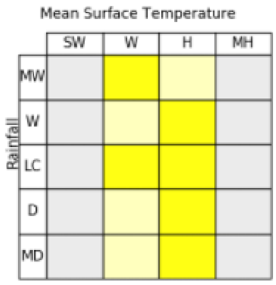
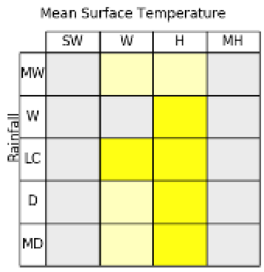
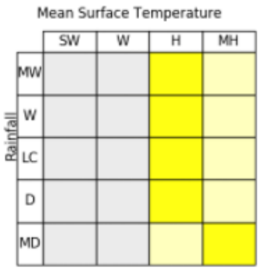


Figure 7: Colour Legend of climate future projection consensus levels

3.5.1 SUMMER MEAN SURFACE TEMPERATURE AND RAINFALL (FOR BUSHFIRES)

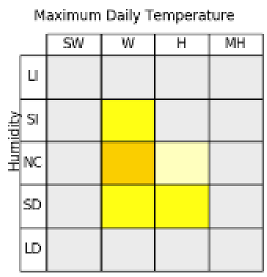
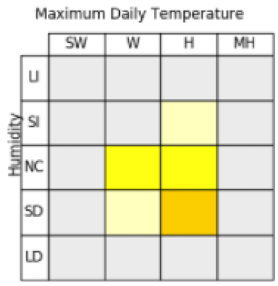
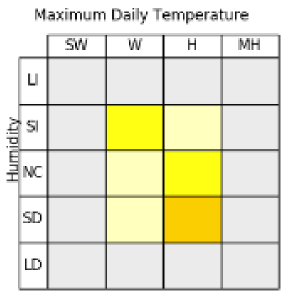
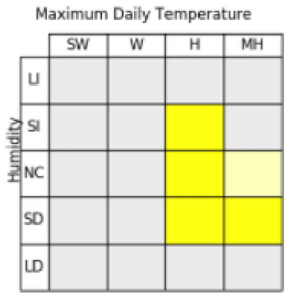
<table>
<tr><th colspan="2" rowspan="2">East Coast Climate Futures</th><th colspan="2">Year</th></tr>
<tr><th>2050</th><th>2070</th></tr>
<tr><td rowspan="2">Emissions Scenarios</td><td>RCP 4.5</td><td>
</td><td>
</td></tr>
<tr><td>RCP 8.5</td><td>
</td><td>
</td></tr>
<tr><td colspan="2">Keys</td><td>Summer Mean Surface Temperature
SW Slightly Warmer < 0.50
W Warmer 0.50 to 1.50
H Hotter 1.50 to 3.00
MH Much Hotter > 3.00</td><td>Summer Rainfall
MW Much Wetter > 15.00
W Wetter 5.00 to 15.00
LC Little Change -5.00 to 5.00
D Drier -15.00 to -5.00
MD Much Drier < -15.00</td></tr>
</table>

3.5.2 PROJECTED CLIMATE SCENARIOS FOR BUSHFIRES

Case	2050 Climate Future		2070 Climate Future	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
"Best" Coolest and wettest	Warmer and much wetter (Consensus: Very low)	Warmer and much wetter (Consensus: Very Low)	Warmer and much wetter (Consensus: Low)	Hotter and much wetter (Consensus: Low)
"Worst" Hottest and driest	Hotter and much drier (Consensus: Very low)	Hotter and much drier (Consensus: Low)	Hotter and much drier (Consensus: Low)	Much hotter and much drier (Consensus: Low)
"Maximum consensus"	Warmer and wetter to drier, Hotter and Drier (Consensus: Low)	Warmer and Little change, Hotter and wetter to much drier (Consensus: Low)	Warmer and much wetter, Warmer and little change, Hotter and wetter to much drier (Consensus: Low)	Hotter and much wetter to drier, Much hotter and much drier (Consensus: Low)

The projected climate scenarios indicate a summer that will be warmer and hotter in the near future. There is no strong consensus whether rainfall will become wetter or drier in the near future but the hotter temperature may impact the risks of bushfire events.

3.5.3 ANNUAL MAXIMUM DAILY TEMPERATURE AND HUMIDITY (FOR HEATWAVES)

East Coast Climate Futures		Year	
		2050	2070
Emissions Scenarios	RCP 4.5		
Emissions Scenarios	RCP 8.5		
Keys		Annual Maximum Daily Temperature SW Slightly Warmer < 0.50 W Warmer 0.50 to 1.50 H Hotter 1.50 to 3.00 MH Much Hotter > 3.00	Annual Humidity LI Large Increase > 10.00 SI Small Increase 1.00 to 10.00 NC No Change -1.00 to 1.00 SD Small Decrease -10.00 to -1.00 LD Large Decrease < -10.00

3.5.4 PROJECTED CLIMATE SCENARIOS FOR HEATWAVES

Case	2050 Climate Future		2070 Climate Future	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
"Best" Coolest and wettest	Warmer and small increase (Consensus: Low)	Warmer and small increase (Consensus: Low)	Hotter and small increase, warmer and no change (Consensus: Very low and low)	Hotter and small increase (Consensus: Low)
"Worst" Hottest and driest	Hotter and small decrease (Consensus: Low)	Hotter and small decrease (Consensus: Moderate)	Hotter and small decrease (Consensus: Moderate)	Much hotter and small decrease (Consensus: Low)
"Maximum consensus"	Warmer and no change (Consensus: Moderate)	Hotter and small decrease (Consensus: Moderate)	Hotter and small decrease (Consensus: Moderate)	Hotter and small increase to small decrease, Much hotter and small decrease (Consensus: Low)

The projected climate scenarios indicate the max daily temperature that will be hotter and warmer in the near future and the humidity has no change or small decrease. In these projected scenarios, the risk of heat waves will be increased.

4 CLIMATE RISK ASSESSMENT

The qualitative descriptions used in the risk assessment to categorise risks as low, medium, high and extreme depending on the likelihood and consequence are in accordance with the AGO's Climate Change Risks and Impacts: A Guide for Government and Business. Details of the qualitative descriptions are provided in Appendix A.

4.1 RISK ASSESSMENT TABLE

Climate Variables and Risks	Climate Projections	Potential Climate Impacts	Pre-adaptation Actions						Proposed Adaptation Actions	Post-adaptation Actions						Summary of how measures reduce risk
			2050			2070				2050			2070			
			C	L	Rating	C	L	Rating		C	L	Rating	C	L	Rating	
Hotter and dryer conditions result in higher frequency and/or severity of bushfire and heatwave events.	The projected climate scenarios indicate a summer that will be warmer and hotter in the near future. There is no strong consensus whether rainfall will become wetter or drier in the near future but the hotter temperature may impact the risks of bushfire events.	DIRECT: Increased bushfires risk due to warmer to hotter conditions may cause direct damage to the facilities.	Major	Rare	Low	Major	possible	High	Investigate locations of vulnerability, and remove potential fuel sources surrounding the building such as removing dead vegetation as part of ongoing landscaping/maintenance works. Use of non-combustible construction materials as per regulation. Put in place an evacuation plan in case of a fire-threatening building.	Major	Rare	Low	Major	Unlikely	Medium	The risk and impact of bushfires on the building will be reduced if good management practices are implemented. A properly considered evacuation plan will minimise the risks to occupants of the building.
		DIRECT: Increased bushfires risk due to warmer to hotter conditions may increase exposure to smoke and particulate for staff and visitors, impacting health.	Minor	Possible	Medium	Minor	Possible	Medium	Ensure the building is well sealed to minimise risks of smoke infiltration. Consider pressurised staircase and put in place smoke hazard management strategies.	Minor	Unlikely	Low	Minor	Unlikely	Low	The risk and impact of smoke on occupants will be reduced if good management practices are implemented.
		INDIRECT: Increased bushfires risk may damage power infrastructure, disrupting the operation of the facility.	Moderate	Possible	Medium	Moderate	Possible	Medium	Backup generator to provide power to safety-critical services. On-site renewable energy to reduce the maximum demand from the grid. Ensure critical data and information can be accessed offline.	Minor	Possible	Medium	Minor	Possible	Medium	The alternative power supply and ability to access information offline will facilitate the ongoing operation of the facility.

Hotter and dryer conditions resulting in higher frequency and/or duration of heatwaves/ extreme heat-days (over 35 degrees Celsius)	The projected climate scenarios indicate the max daily temperature that will be hotter and warmer in the near future and the humidity has no change or small decrease. In these projected scenarios, the risk of heat waves will be increased.	DIRECT: Extreme heat will increase demand for the HVAC system and may impact the ability of the HVAC system to maintain the thermal comfort of occupants due to capacity constraints.	Moderate	Possible	Medium	Moderate	Likely	High	Incorporate passive thermal design principles in the design and construction of the building such as appropriate levels of shading devices and thermal insulation. Provide light-coloured roofs to reduce heat gains via the roof and help mitigate the urban heat island effect. Provide additional photovoltaic panels to provide renewable electricity to help offset the additional HVAC electricity demand. When replacing HVAC units at the end of service life, consider upsizing the capacity of units in line with the change in climatic conditions. Providing dedicated "Cool outdoor areas" where students and teachers can take shelter during extremely hot days when the power fails should be explored by the design team. This cool area should utilise passive design principles to moderate temperature during extreme days. Secondly, this cool area should consider ways to harness the cooling power of water to provide additional cooling. For example, provide shaded outdoor areas with drinking fountains as cool shelters during an extreme heat event.	Moderate	Possible	Medium	Moderate	Possible	Medium	The incorporation of passive thermal design principles will help mitigate extreme heat risks in the near future. Appropriate upgrade of HVAC equipment at the end of their service life will help ensure the system will be capable of handling more extreme temperatures in the far future.
		DIRECT: Extreme heat may impact the operation of electrical equipment and infrastructures due to temperature exceeding design limits.	Minor	Unlikely	Low	Minor	Possible	Medium	In the near future, current temperature ratings for electrical equipment should be able to cope with projected temperature increases relevant to the component's design life. In the far future, equipment should be gradually upgraded as required to cope with more extreme conditions.	Minor	Unlikely	Low	Minor	Unlikely	Low	Appropriate upgrade of electrical equipment at the end of their service life will help ensure the system will be capable of handling more extreme temperatures in the far future.

4.2 RESPONSES TO HIGH AND EXTREME RISKS

The risk assessment identified three high risks for the proposed development by 2070 (zero-high risks by 2050). No extreme risks were identified. The responses to high risks are summarised as follows:

1. Higher average surface temperature and less rainfall conditions cause an increase in the frequency and/or severity of bushfire events directly damaging the building. This risk is mitigated by ensuring non-combustible building elements are used in the fabric of the building and by implementing good management practices to remove potential fuel sources around the building once the building is in operation.
2. Higher maximum daily temperature and lower humidity conditions result in higher frequency and/or duration of heatwaves resulting in an insufficient capacity of the HVAC system to maintain thermal comfort. This risk is mitigated by the incorporation of passive thermal principles such as appropriate external shades and thermal insulation and by upgrading the capacity of the HVAC system once the current system has reached the end of its service life.

4.3 RISKS SUMMARY

The table below shows all risk items identified as 'high' or 'extreme' are addressed by specific design responses and at least two risk items identified in the risk assessment are addressed by specific design responses.

Risk rating	2050 Pre-adaptation	2050 Post-adaptation	2070 Pre-adaptation	2070 Post-adaptation
Low	2	3	0	2
Medium	3	2	3	3
High	0	0	2	0
Extreme	0	0	0	0

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5 CONCLUSION

A Climate Adaptation Plan (CAP) report has been prepared for the proposed development of Narwee Parklands Care Community located at 59-67 Karne St N, Narwee, NSW 2209.

In particular, this CAP specifically addressed:

- The details of stakeholder consultation that was undertaken during plan preparation in Section 1.3;
- The project's characteristics in Section 2;
- The assessment of climate change scenarios and impacts on the project in see Section 3;
- The potential direct and indirect climate change impacts in Section 4;
- The potential risks for the project and people in Section 4; and
- The actions to reduce 'high' and 'extreme' risks are identified in Section 4.

The impacts of climate change were assessed across two-time scales (2050 & 2070) and two Representative Concentration Pathways (RCP4.5 & RCP 8.5). Climate Futures matrices were used to determine the key climate projections based on multiple climate variables for this risk assessment. The key climate projections were used to inform the climate risk assessment.

The results of the climate risk assessment identified two high risks items pre-adaptation. These high risks were mitigated to medium and low risks by the proposed adaptation actions.

APPENDIX A – RISK ASSESSMENT FRAMEWORK

The following risk assessment framework is used to determine consequence and likelihood ratings. Based on these ratings, the risk rating has been determined.

Consequence Criteria

Consequence descriptor	Adaptive capacity (see Note 1)	Infrastructure, service	Social/cultural	Governance	Financial (see Note 2)	Environmental (see Note 3)	Economy (see Note 4)
Insignificant	No change to the adaptive capacity	No infrastructure damage, little change to service	No adverse human health effects	No changes to management required	Little financial loss or increase in operating expenses	No adverse effects on natural environment	No effects on the broader economy
Minor	Minor decrease to the adaptive capacity of the asset. Capacity easily restored	Localized infrastructure service disruption No permanent damage. Some minor restoration work required Early renewal of infrastructure by 10–20% Need for new/modified ancillary equipment	Short-term disruption to employees, customers or neighbours Slight adverse human health effects or general amenity issues	General concern raised by regulators requiring response action	Additional operational costs Financial loss small, <10%	Minimal effects on the natural environment	Minor effect on the broader economy due to disruption of service provided by the asset
Moderate	Some change in adaptive capacity. Renewal or repair may need new design to improve adaptive capacity	Limited infrastructure damage and loss of service Damage recoverable by maintenance and minor repair Early renewal of infrastructure by 20–50%	Frequent disruptions to employees, customers or neighbours. Adverse human health effects	Investigation by regulators Changes to management actions required	Moderate financial loss 10–50%	Some damage to the environment, including local ecosystems. Some remedial action may be required	High impact on the local economy, with some effect on the wider economy
Major	Major loss in adaptive capacity. Renewal or repair would need new design to improve adaptive capacity	Extensive infrastructure damage requiring major repair Major loss of infrastructure service Early renewal of infrastructure by 50–90%	Permanent physical injuries and fatalities may occur Severe disruptions to employees, customers or neighbours	Notices issued by regulators for corrective actions Changes required in management. Senior management responsibility questionable	Major financial loss 50–90%	Significant effect on the environment and local ecosystems. Remedial action likely to be required	Serious effect on the local economy spreading to the wider economy
Catastrophic	Capacity destroyed, redesign required when repairing or renewing asset	Significant permanent damage and/or complete loss of the infrastructure and the infrastructure service Loss of infrastructure support and translocation of service to other sites Early renewal of infrastructure by >90%	Severe adverse human health effects, leading to multiple events of total disability or fatalities Total disruptions to employees, customers or neighbours Emergency response at a major level	Major policy shifts Change to legislative requirements Full change of management control	Extreme financial loss >90%	Very significant loss to the environment. May include localized loss of species, habitats or ecosystems Extensive remedial action essential to prevent further degradation. Restoration likely to be required	Major effect on the local, regional and state economies

(continued)

NOTES:

1 Adaptive capacity relates to the ability of the infrastructure element and/or organization to adapt/change/cope with change in the climate change variable.

2 Financial loss will be relative to the infrastructure element being considered (i.e. a single building, coastal town, rail system). Dollar values need to include replacement cost for the infrastructure item and financial loss/costs relating to the loss of the service provided by the infrastructure item.

3 While the term 'environment' can include both man-made and natural systems, in this Standard 'environment' is limited to the natural environment outside the asset being considered.

4 Economy refers to the local economy (e.g. town or region), the state economy, or the economy of Australia as a whole. Significance of this measure will depend on the asset being considered.

Likelihood Criteria

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

Risk Priority Levels

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	L	M	H	E	E
Likely	L	M	M	H	E
Moderate	L	L	M	H	E
Unlikely	L	L	M	M	H
Very unlikely	L	L	L	M	M

LEGEND:
E = Extreme risk, requiring immediate action.
H = High risk issue requiring detailed research and planning at senior management level.
M = Moderate risk issue requiring change to design standards and maintenance of assets.
L = Low risk issue requiring action through routine maintenance of assets.

APPENDIX B – CLIMATE RISK INTERVENTIONS REGISTER

PROJECT	Narwee Parklands Care Community
PROJECT #	220317
REVISION	A
AUTHOR	Tarun Sebastian Thottungal

Climate Risks	Climate Projection	Climate Impact	Proposed Adaptation Actions	Responsible Parties	Responsible Parties Comments/Confirmations
Bushfire Hotter and dryer conditions result in higher frequency and/or severity of bushfire events	The projected climate scenarios indicate that summer will be warmer and hotter in the near future. There is no strong consensus whether rainfall will become wetter or drier in the near future but the hotter temperature may impact the risks of bushfire events.	Increased bushfires risk due to warmer to hotter conditions may cause direct damage to the facilities.	Investigate locations of vulnerability, and remove potential fuel sources surrounding the building such as removing dead vegetation as part of ongoing landscaping/maintenance works. Use of non-combustible construction materials as per regulation. Put in place an evacuation plan in case of a fire-threatening building.	Architect Landscape	
		Increased bushfires risk due to warmer to hotter conditions may increase exposure to smoke and particulate for staff and visitors, impacting health.	Ensure the building is well sealed to minimise risks of smoke infiltration.	Services Consultant	
		Increased bushfires risk may damage power infrastructure, disrupting the operation of the facility.	Backup generator to provide power to safety-critical services. On-site renewable energy to reduce the maximum demand from the grid. Ensure critical data and information can be accessed offline.	Services Consultant Opal Healthcare	
Heatwave Hotter and dryer conditions resulting in higher frequency and/or duration of heatwaves/ extreme heat-days (over 35 degrees Celsius)	The projected climate scenarios indicate the max daily temperature that will be hotter and warmer in the near future and the humidity has no change or small decrease. In these projected scenarios, the risk of heat waves will be increased.	Extreme heat will increase demand for the HVAC system and may impact the ability of the HVAC system to maintain the thermal comfort of occupants due to capacity constraints.	Incorporate passive thermal design principles in the design and construction of the building such as appropriate levels of shading devices and thermal insulation. Provide additional photovoltaic panels to provide renewable electricity to help offset the additional HVAC electricity demand. When replacing HVAC units at the end of service life, consider upsizing the capacity of units in line with the change in climatic conditions. Providing dedicated “Cool outdoor areas” where residents and staff can take shelter during extremely hot days when the power fails should be explored by the design team. This cool area should utilise passive design principles to moderate temperature during extreme days. Secondly, this cool area should consider ways to harness the cooling power of water to provide additional cooling. For example, provide shaded outdoor areas with drinking fountains as cool shelters during an extreme heat event.	ESD Architect Landscaping Services Consultant	
		Extreme heat may impact the operation of electrical equipment and infrastructures due to temperature exceeding design limits.	In the near future, current temperature ratings for electrical equipment should be able to cope with projected temperature increases relevant to the component's design life. In the far future, equipment should be gradually upgraded as required to cope with more extreme conditions.	Opal Healthcare Services Consultant	