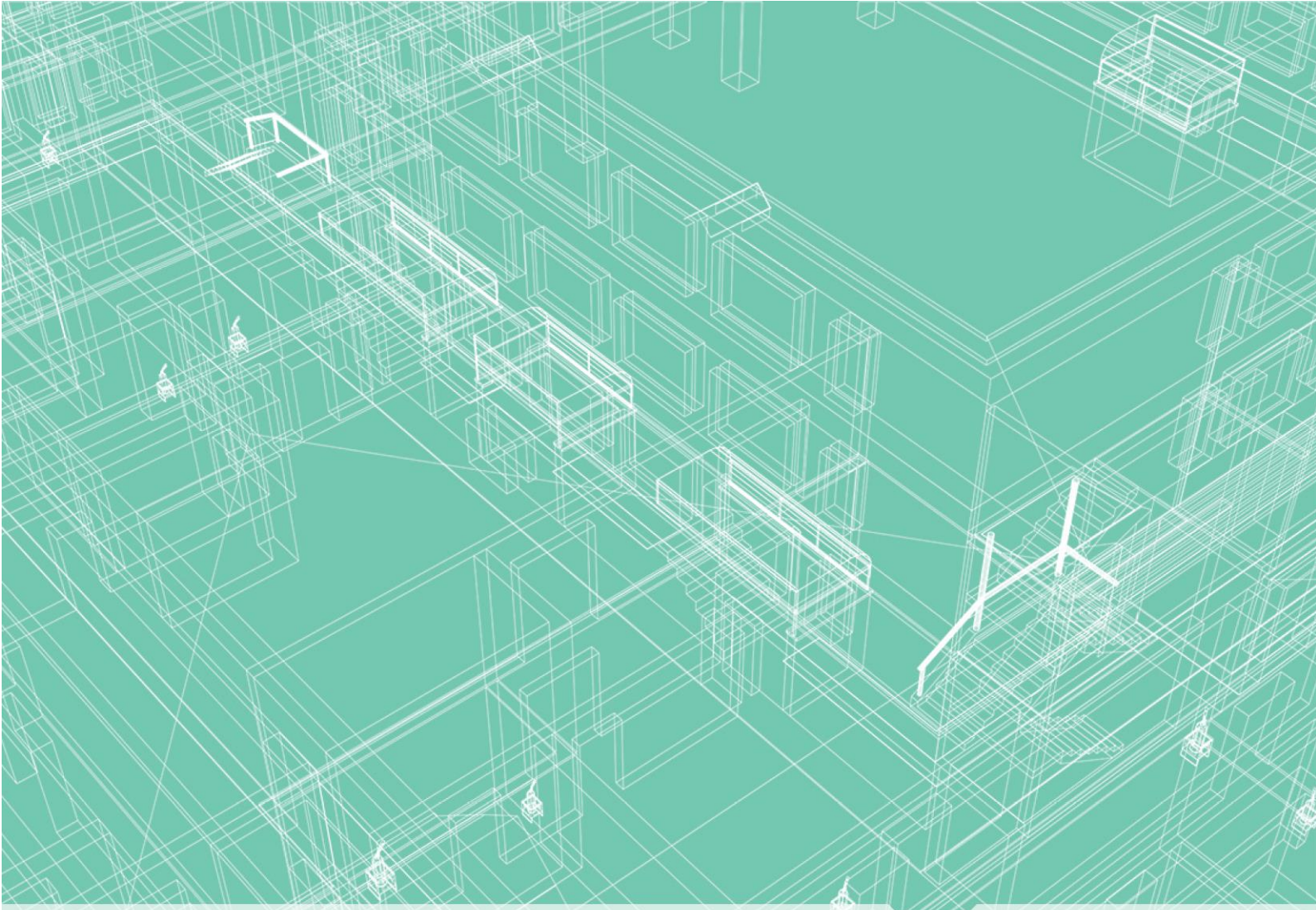

ESD SSDA REPORT

ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN (RIDBC) CENTRE OF EXCELLENCE MACQUARIE UNIVERSITY

ESD SERVICES

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EXECUTIVE SUMMARY

This report has been prepared by JHA to identify and summarise the Ecologically Sustainable Design (ESD) initiatives which have been considered in the design of the proposed new educational and office buildings for Royal Institute for Deaf and Blind Children (RIDBC) located within the Macquarie University precinct.

This report demonstrates compliance with the Secretary's Environmental Assessment Requirements (SEARs) that apply to the project and has been prepared to accompany a State Significant Development (SSD) application to the NSW Department of Planning and Environment. 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 is 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 with respect to impacts on the environment and on the health and well-being of students, staff, office workers and visitors whilst providing the best possible facilities for a constructive environment.

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

- Sufficient exposure to daylight
- Appropriate construction and glazing selection
- Energy-efficient air-conditioning systems with control strategy and thermal comfort tuning
- External horizontal shading devices
- Efficient water fixtures
- Sustainable materials

This report also documents how the principles of Ecologically Sustainable Design (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and on-going operation phases of the development.

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The RIDBC is Australia's largest non-government not-for-profit provider of therapy, education and cochlear implant services for children and adults with vision or hearing loss. Established in 1861 as a school with residential facilities, the RIDBC moved to North Rocks in 1961, where the main campus is still located. The RIDBC Mission is to provide quality and innovative services, to achieve the best outcomes for current and future generations of Australians with vision and/or hearing loss.

RIDBC provides a broad range of specialist services which include:

- Early Intervention;
- Allied Health & Therapy;
- Cochlear Implant Program;
- Schools (pre-school, primary to secondary programs);
- Research & Professional Education;
- School support; and
- Paediatric Audiology

The services provided are delivered by a broad group of professionals including: teachers, speech pathologists, occupational therapists, audiologists, orthoptists, psychologists, social workers, technology consultants, physiotherapists, Ear, Nose and Throat (ENT) surgeons and more.

As part of the RIDBC's 2016-2020 Strategic Intent it will relocate its school and clinical services activities from North Rocks to a purpose-built centre at Macquarie University (MQU). The new Centre of Excellence will further strengthen the relationship between MQU and the RIDBC, benefit the Australian Hearing Hub, and reinforce the cluster of research, audiology, and healthcare which already exists on the campus, which also includes the Cochlear Global headquarters.

The Centre of Excellence will serve a diverse range of employees, students, users and visitors who will visit the centre for diagnostic services, therapy and rehabilitation, research, education, and co-related services. The centre will provide an intricate design response to the needs of the users, in particular children and adults with vision and hearing loss and other cognitive impairments.

The proposed development generally seeks consent for the construction and operation of the new purpose-built 1-3 storey (including basement level) Centre of Excellence across two interconnected pavilions at the corner of Culloden and Gymnasium Road within the MQU Campus. The development includes:

- Pre-School and School accommodation for up to 80 pre-school children and up to 120 school children in a single storey pavilion addressing Culloden Road; and
- The main RIDBC building (accommodating approximately 260 staff) of up to three storeys, including basement level:
    - Public areas for staff and visitors;
    - RIDBC Renwick Centre classrooms (doubling also as conferencing facilities) and a business hub;
    - Medical Facility for various clinical services; and
    - RIDBC Renwick Centre resource centre; use between RIDBC Renwick Centre staff, clinicians and pre-school / primary school teaching staff.

1.2 SITE LOCATION

The subject site is located at Gymnasium Road, within the suburbs of Macquarie Park NSW 2109 and surrounded by residential developments and the University Campus.

Figure 1 – Aerial photo of site

1.3 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (SEARS)

The Secretary's Environmental Assessment Requirements (SEARs) for the development were issued on 6 May 2020 setting out the documentary and reporting requirements for the preparation of the EIS / DA. This report acknowledges the SEARs prepared by the Secretary which notes the followings in Section 8 of the document:

8. Ecologically Sustainable Development (ESD)

- *Detail how the ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the development.*
- *Include a framework for how the development will be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on a materiality assessment and include waste reduction design measures, future proofing, use of sustainable and low carbon materials, energy and water efficient design (including water sensitive urban design) and technology and use of renewable energy.*
- *Demonstrate how environmental design will be achieved in accordance with the GANSW Environmental Design in Schools Manual.*
- *Include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance.*
- *Include an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.*
- *Provide a statement regarding how the works are responsive to the CSIRO projected impacts of climate change. Specifically:*
    - *hotter days and more frequent heatwave events;*
    - *extended drought periods;*
    - *more extreme rainfall events;*
    - *gustier wind conditions; and*
    - *how these will inform material selection and social equity aspects (respite/shelter areas)."*

In accordance with the above SEARS requirements, the development will implement a holistic and integrated approach to Ecologically Sustainable Design (ESD), maximising passive opportunities with the selective application of modern technology where appropriate. Initiatives will be chosen with due regard to whole of lifecycle cost benefits to the school and office building.

The items listed above of the SEARS requirements are addressed in sections 2, 3, 4, 5, 6 and Appendix of this report.

1.4 PART 3A DEVELOPMENT REQUIREMENTS

The Modification of Minister's Approval under the Part 3A provisions for modifications (Section 75W) has included the requirement for Environmentally Sustainable Development

Schedule 3 (Environmentally Sustainable Development)

- Commercial development on the site shall be capable of achieving the following targets:
    - Buildings should achieve a minimum 4-star Green Star rating.
    - Buildings should achieve a minimum 4.5-star NABHERS rating.
    - Retail development will comply with any reasonable future rating tool provided by the Australian Greenhouse Rating Scheme.
- Each development involving external works is to provide measures to capture retain, and minimise litter, oil, sediment, nutrients, and pollutants prior to stormwater runoff discharge to the receiving creeks.
- Each development is to consider opportunities for water re-use to service non-potable uses such as irrigation for landscape areas and for toilet flushing, as relevant to the scope of the proposal.

The items listed above of the Part 3A development requirements are addressed in sections 2, 3, 4, 5, 6 and Appendix of this report.

2. PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The principles of Ecologically Sustainable Development as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 have been incorporated into the design and on-going operation phases of the development as follows:

2.1 THE PRECAUTIONARY PRINCIPLE

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

(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 with external high performance glazing and shading device, together with energy efficiency favoured passive design features to minimise severe or irreversible environmental damages.

2.2 INTER-GENERATIONAL EQUITY

Namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

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 student, employee capacity, upgraded teaching, learning, and working facilities. The project will contribute to a lively community environment and add architectural interest to the surrounding area.

2.3 CONSERVATION OF BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

Namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration

PROJECT RESPONSE:

For the project response of this principle, please refer to the "Request to Waive the Requirement of a Biodiversity Development Assessment Report" prepared by Lesryk.

2.4 IMPROVED VALUATION, PRICING AND INCENTIVE MECHANISMS

Namely, 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,
(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
(iii) Environmental goals, having been established, 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 benchmarked the project against the Green Star Design & As-Built v1.3 Rating System. 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 the materials with low embodied energy, will be preferred over others.

3. SUSTAINABLE DESIGN FRAMEWORK

3.1 FRAMEWORK

The sustainable design framework for this development aims to incorporate the best practice design initiatives and Ecologically Sustainable Development principles in new school building and office building to the development. The ESD initiatives and targets outlined within this framework have been compiled based on the following:

- National Construction Code (NCC) Section J
- Green Star Design and As-Built Submission Guidelines v1.3;
- GANSW Environmental Design in Schools Manual.

3.2 BUILDING ENVELOPE

Intelligent design and material selection ensure that thermal comfort is not entirely achieved by a mechanical means. Passive design initiatives such as performance glazing, shading and use of insulation will reduce demand on the mechanical air conditioning systems resulting in a reduction of energy consumption and greenhouse gas emissions.

3.2.1 Building Envelope Performance

The building fabric will be designed to meet or exceed the NCC 2019 Section J requirements for 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.

A preliminary assessment under the JV3 pathway to show compliance has been carried out during the schematic design stage of the project. The indicative results on insulation material quantity and glazing specifications demonstrating compliance with NCC 2019 Section J are provided below.

3.2.1.1 Building Fabric

The preliminary minimum performance requirements obtained under JV3 provision for the development (Class 5 and 9b) at the proposed location (Climate Zone 5) as per the NCC 2019 Section J - Energy Efficiency are:

Building Elements	Indicative NCC 2019 Requirements
Envelope Roof/Ceiling	Total R-Value of 4.1 (Downwards, Solar absorptance of the upper surface of a roof must be not more than 0.40)
External Envelope Walls	Total R-Value of 1.6
Internal Envelope Walls	Total R-Value of 1.6
Envelope Floors	Total R-Value of 2.2 (Downwards)

Note: The impact of thermal bridging must be considered within total R-value calculation under NCC2019.

This will necessitate the use of insulation in the walls, floor and roof for the building fabrics. 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 an 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.

3.2.1.2 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. 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 2019 Section J Energy Efficiency by means of JV3 pathway. A preliminary assessment to show compliance has been carried out during the schematic design stage of the project as demonstrated below:

Location – School Building	Window Assembly (Glass & Frame)		Description
	Total U-value	Total SHGC	
External Vertical Envelope Glazing	3.7	0.43	Double Glazed Neutral/Clear or the like

Location – Office Building	Window Assembly (Glass & Frame)		Description
	Total U-value	Total SHGC	
External Vertical Envelope Glazing	3.0	0.30	Double Glazed Performance or the like
Internal Vertical Envelope Glazing (Between basement carpark and basement conditioned areas)	3.0	0.30	Double Glazed Performance or the like
Skylights	3.3	0.24	Maximum Skylights Opening 36 m^2

3.3 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. Passive solar heating principle which aims to prevent solar heat gain in the summer and harvest it in the winter for free source of heating, and Passive cooling principle which prevents heat from entering the building during the summer months, are strategies which can conveniently take advantage of the site specific solar access for optimised indoor environmental quality and reduction of HVAC energy demand through use of tailored shadings.

The proposed buildings have been designed to make the best use of the sun by using external high performance horizontal and vertical shading screen devices to prevent the high summer sun from entering the building whilst allowing the low winter sun to enter the building for passive heating. The large portion of windows are also shaded by roof eaves and balconies/access paths to the floor above that will reduce the amount of incident summer solar radiation.

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. External views provide a connection to nature and the building and also help to create an environment encouraging constructive experience.

3.4 ENERGY EFFICIENCY

Each climate zone under the Building Code has different design and conditioning requirements to minimise energy use for heating and cooling. Good balance of heating and cooling reduction techniques are required to create an energy efficient development.

3.4.1 HEATING, COOLING AND VENTILATION SYSTEMS

The air-conditioning and ventilation systems shall be designed to comply or exceed the minimum requirements of NCC 2019 Section J5 as well as driven by NABERS design requirement.

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 carbon monoxide (CO) monitoring system, the car park exhaust fan will also be provided with a variable speed drive (VSD) to optimise energy efficiency. The basement storage room will be provided with an outside air ventilation system comprising of an inline fan ducted from a louvre located under the seating area.

The air conditioning system to the school building will be VRV/VRF (variable refrigerant volume/flow) Heat Recovery System, which can provide simultaneous operation of cooling and heating to each individual space. Each system will comprise of indoor fan coil units (wall-mounted, ceiling cassette or ceiling ducted). The air conditioning strategy for the office building will be high efficiency chiller/boiler on the centre of the solid roof serving two sides of the office building via numbers of air handling units. The control of 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 further assist with energy conservation of the building.

All bathroom, storage, and general exhaust are to be naturally ventilated where possible, with mechanical ventilation required where necessary and provided with time controls (time switches or run-on timers as appropriate).

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.

Further, a centralised control system will also be provided to monitor and control all mechanical services with the building. The system will allow building management to interrogate system usage, allow for programming of AC systems (for example time scheduling, and temperature settings), notification on maintenance requirements and system diagnostics. It is proposed to provide remote access to the centralised controller via the internet.

These initiatives will provide significant savings in energy use.

3.4.2 LIGHTING

Lighting will be designed to comply with or exceed the minimum requirements of NCC 2019 Section J6.

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 and be controlled via automatic control system with timer controls, PIR occupancy sensors and microwave occupancy sensors.

Lighting in each targeted area shall be provided with a daylight sensor to reduce light output or turn off lights when sufficient daylight is provided within the space. For large spaces, perimeter lightings shall be designated on a separate zone to make maximum use of the daylight.

3.4.3 CONTROLS

All lighting and HVAC installed shall be controlled by time switch or motion sensor for energy conservation. Closed spaces such as storage rooms and cleaner's cupboards are to also have a wall switch. Voltage control (dimming) should be provided where appropriate.

3.4.4 ELECTRICITY METERING

Electricity metering and sub-metering shall be specified in accordance with the Section J requirement to monitor and manage electricity consumption in the building.

3.4.5 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 emission. Appliances shall be selected within 1 star of the highest energy efficiency rating available on the market.

3.4.6 VERTICAL TRANSPORT

The use of lifts within the development will be discouraged by providing visually prominent staircases for all floors.

3.5 INDOOR AIR QUALITY (IAQ)

The quality of indoor air has a significant impact on our health and environment. Poor indoor air quality resulting in adverse health effect such as allergy, asthma, etc. The outdoor air ventilation rates shall be in accordance with AS 1668.2 for mechanically ventilated spaces. The ventilation system shall be designed to minimise the entry of outdoor pollutant as per ASHRAE Standard 62.1:2013.

3.6 WATER CONSERVATION

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

3.6.1 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	Minimum WELS Rating	Highest Available Rating (AS/NZS 6400-2016)
Showerhead rating	3 (>4.5, but <= 6L/min)	4
Sink tap rating	5	6
Toilet cistern rating	4	6
Urinals rating	4	6

3.7 SUSTAINABLE MATERIALS

3.7.1 LOW VOC / LOW FORMALDEHYDE MATERIALS

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

3.7.2 SUSTAINABLE PRODUCTS

A proportion of all materials used in the project will meet the transparency and sustainability requirements under one of the following initiatives:

- Reused Product;
- Recycled Content Products;
- Environmental Product Declarations;
- Third Party Certifications; or
- Stewardship Programs

A rate of at least 3% of Project Sustainability Value (PSV) over Project Contract Value (PCV) will be targeted, subject to project monitoring and calculation using Green Star Sustainable Products Calculator.

3.8 ECOLOGICAL CONSERVATION

The current school building design have been designed to bring nature and the buildings together by optimising the use of outdoor space with provision of sensible separation of uses, such as active play, quiet learning and gathering space, and flexible spaces of varying form and function for outdoor environmental learning, whilst ensuring connectivity throughout the site between main school area and oval.

3.9 WASTE

Waste collection and disposal plays an important role in the protection of the environment and the health of the population in the modern world. A waste management plan will be prepared to assess and monitor the waste management process during construction and demolition, as well as waste produced during occupation within the development. The waste management plan shall incorporate how to minimise the amount of waste generated, maximise the reuse, recycling and reprocessing construction waste materials and minimise the volume to materials disposed to landfill.

3.10 WATER SENSITIVE URBAN DESIGN

External area design will implement best practices of water sensitive urban design, including indigenous low water usage plants to increase stormwater retention, decrease total suspended solids and mitigate the urban heat island effect. The carbon sequestration of the plants will also combat climate change contributions.

4. GANSW ENVIRONMENTAL DESIGN IN SCHOOLS MANUAL

The GANSW Environmental Design in Schools Manual provides the guidance on new school developments and major upgrades in NSW and incorporates the scopes of State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017 (the Education SEPP).

With the assistance of the GANSW Design Guide, the project is to demonstrate the adoption of the following seven design quality principles outlining under Education SEPP and how school developments can apply design considerations and strategies to improve their learning spaces, education building, and school campus.

- Context, built form and landscape
- Sustainable, efficient and durable
- Accessible and inclusive
- Health and safety
- Amenity
- Whole of life, flexible and adaptive
- Aesthetics

The principles under GSNSW Environmental Design in Schools Manual only applies to the school building. The Design Verification Statement (DVS) addressing the development has been coupled with the above Education SEPP design quality principles is to be completed by the architect.

5. GREEN STAR RATING SCHEME COMPARISON

The project is not pursuing a formal Green Star rating through the certification procedures of the Green Building Council Australia (GBCA). However, the project team has benchmarked it against the Green Star Design & As-Built v1.3 Rating System.

For the purposes of benchmarking, a Green Star Scorecard and Green Star Nominated Area Markups have been prepared (attached as *Appendix A and Appendix B)*, which lists the sustainability initiatives targeted for the project. Below table summarises the outcomes of the Green Star benchmarking assessment. Points are calculated as per the official Green Star Design and As-Built v1.3 Scorecard.

Category	Total Points Targeted
Management	13
Indoor Environment Quality	10
Energy	8
Transport	5
Water	6
Materials	5
Land Use & Ecology	1
Emissions	4
Innovation	6
Total	58 points

6. IMPACTS OF CLIMATE CHANGE

For the design responses for the impact of climate change, please refer to Appendix D - Climate Adaptation Plan.

APPENDIX A: GREEN STAR SCORECARD

Green Star - Design & As Built Scorecard v1.3

Project: 200336 RIDBC Centre of Excellence

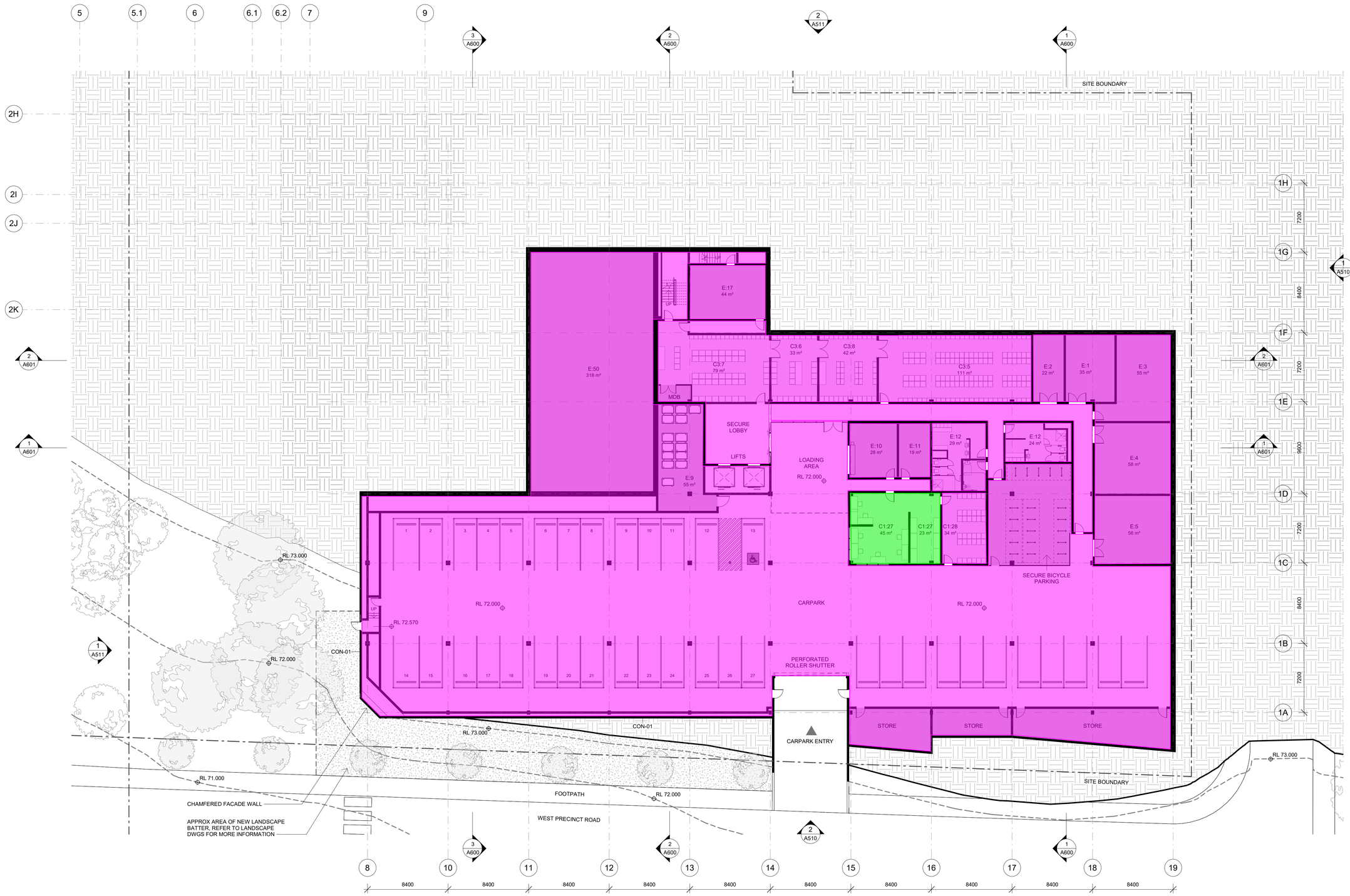
Targeted Rating: 5 Star - Australian Excellence. Min 60% of available points

Final Score	Total Score (without Innovation)	Points Available	Points Targeted (without Innovation)	Innovation
58	52	100	52	6

Category/Credit	Code	Credit Criteria	Points Available	Points Targeted	Responsibility
Management			14	13	
Green Star Accredited Professional	1.1	Accredited Professional	1	1	ESD Consultant
Commissioning and Tuning	2.0	Environmental Performance Targets	Complies (Mandatory)		All services consultants
	2.1	Services and Maintainability Review	1	1	
	2.2	Building Commissioning	1	1	
	2.3	Building Systems Tuning	1	1	
	2.4	Independent Commissioning Agent	1	-	
Adaptation and Resilience	3.1	Implementation of a Climate Adaptation Plan	2	2	All services consultants, Architect
Building Information	4.1	Building Information	1	1	Head Contractor
Commitment to Performance	5.1	Environmental Building Performance	1	1	Owner, Architect
	5.2	End of Life Waste Performance	1	1	
Metering and Monitoring	6.0	Metering	Complies (Mandatory)		Mechanical , Electrical & Hydraulic
	6.1	Monitoring Systems	1	1	
Responsible Building Practices	7.0	Enviromental Management Plan	Complies (Mandatory)		Head Contractor
	7.1	Formalised Enviromental Management System	1	1	
	7.2	High Quality Staff Support	1	1	
Operational Waste	8B	Prescriptive Pathway: Facilities	1	1	Architect
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	
Indoor Environment Quality			17	10	
Indoor Air Quality	9.1	Ventilation System Attributes	1	1	Mechanical
	9.2	Provision of Outdoor Air	2	-	Mechanical
	9.3	Exhaust or Elimination of Pollutants	1	1	Mechanical
Acoustic Comfort	10.1	Internal Noise Levels	1	1	Acoustic
	10.2	Reverberation	1	1	
	10.3	Acoustic Separation	1	-	
Lighting Comfort	11.0	Minimum Lighting Comfort	Complies (Mandatory)		Electrical
	11.1	General Illuminance and Glare Reduction	1	1	
	11.2	Surface Illuminance	1	-	
	11.3	Localised Lighting Control	1	-	
Visual Comfort	12.0	Glare Reduction	Complies (Mandatory)		Architect & ESD
	12.1	Daylight	2	1	
	12.2	Views	1	1	Architect
Indoor Pollutants	13.1	Paints, Adhesives, Sealants and Carpets	1	1	Architect & Services Consultants
	13.2	Engineered Wood Products	1	1	
Thermal Comfort	14.1	Thermal Comfort	1	1	Mechanical & ESD
	14.2	Advanced Thermal Comfort	1	-	
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	**Responsibility**
Energy			22	8	
Greenhouse Gas Emissions	15A.0	Conditional Requirement: Prescriptive Pathway	Complies (Mandatory)		ESD & Architects
	15A.1	Building Envelope	1	1	
	15A.2	Wall-glazing Construction and Retail Display Glazing	1	1	
	15A.3	Lighting	1	1	Electrical
	15A.4	Ventilation and Airconditioning	1	-	
	15A.5	Domestic Hot Water	1	1	Hydraulic
	15A.6	Transition Plan	1	1	Architect, Project Manager, Owner
	15A.7	Fuel Switching	1	1	
	15A.8	On-site Storage	1	-	
	15A.9	Vertical Transportation	1	1	VT
	15A.10	Off-site Renewables	5	-	
Peak Electricity Demand Reduction	16A	Prescriptive Pathway - On-site Energy Generation	1	1	Architect, Electrical, Owner
	16B	Modelled Performance Pathway - Reference Building	-	-	
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	**Responsibility**
Transport			10	5	
Sustainable Transport	17B.1	Access by Public Transport	3	2	Owner & Architect
	17B.2	Reduced Car Parking Provision	1	1	
	17B.3	Low Emission Vehicle Infrastructure	1	-	
	17B.4	Active Transport Facilities	1	1	Owner & Architect
	17B.5	Walkable Neighbourhoods	1	1	Owner & Architect
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	**Responsibility**
Water			12	6	
Potable Water	18B.1	Sanitary Fixture Efficiency	1	1	Architect, Hydraulic
	18B.2	Rainwater Reuse	1	1	Architect, Hydraulic
	18B.3	Heat Rejection	2	2	Mechanical, Architect
	18B.4	Landscape Irrigation	1	1	Architect, Hydraulic
	18B.5	Fire Protection System Test Water	1	1	Fire
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	**Responsibility**
Materials			14	5	
Life Cycle Assessment (LCA)	19A.1	Comparative Life Cycle Assessment	6	-	ESD, Architect, Head Contractor & Structural
	19A.2	Additional Life Cycle Impact Reporting	4	-	
Life Cycle Impacts	19B.1	Concrete	3	2	Head Contractor & Structural
	19B.2	Steel	1	1	
	19B.3	Building Reuse	4	-	
	19B.4	Structural Timber	4	-	
Responsible Building Materials	20.1	Structural and Reinforcing Steel	1	-	
	20.2	Timber Products	1	-	
	20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1	-	
Sustainable Products	21.1	Product Transparency and Sustainability	3	1	Architect, Owner
Construction and Demolition Waste	22.0	Reporting Accuracy	Complies (Mandatory)		Head contractor
	22A	Fixed Benchmark	1	1	
	22B	Percentage Benchmark			
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	**Responsibility**
Land Use & Ecology			6	1	
Ecological Value	23.0	Endangered, Threatened or Vulnerable Species	-		
	23.1	Ecological Value	3	-	
Sustainable Sites	24.0	Conditional Requirement	Complies (Mandatory)		
	24.1	Reuse of Land	1	-	
	24.2	Contamination and Hazardous Materials	1	-	
Heat Island Effect	25.0	Heat Island Effect Reduction	1	1	Architect & Landscape
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	**Responsibility**
Emissions			5	4	

Stormwater	26.1	Stormwater Peak Discharge	1	1	Civil & Hydraulic
	26.2	Stormwater Pollution Targets	1	1	Civil & Hydraulic
Light Pollution	27.0	Light Pollution to Neighbouring Bodies	Complies (Mandatory)		Electrical
	27.1	Light Pollution to Night Sky	1	1	
Microbial Control	28.0	Legionella Impacts from Cooling Systems	1	1	Mechanical
Refrigerant Impacts	29.0	Refrigerant Impacts	1	-	
Category/Credit	**Code**	**Credit Criteria**	**Points Available**	**Points Targeted**	**Responsibility**
Innovation			10	6	
Improving on Green Star Benchmarks	30C	Stormwater	2	1	Civil & Hydraulic
Innovation Challenge	30D	Financial Transparency	1	1	Project Manager
		Marketing Excellence	1	1	Architect, Project Manager, Owner
		Occupant Engagement	1	1	Architect, Project Manager, Owner
		Social Return on Investment	1	1	Architect, Project Manager, Owner
		Universal Design	1	1	Architect, Project Manager, Owner

APPENDIX B: GREEN STAR NOMINATED AREA MAKRUPS



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MARKUP / SKETCH

DOCUMENT No.: 200336
DOCUMENT TITLE: RIDBC Centre of Excellence - Prelim Green Star Nominated Areas Markups
DOCUMENT REV: DRAFT 3
DOCUMENT BY: G.T DATE: 27/10/2020

KEY

- PRIMARY SPACE
- SECONDARY SPACE
- TERTIARY SPACE

PRIMARY SPACE:
ALL AREAS WHERE A PERSON IS EXPECTED TO WORK, OR REMAIN FOR AN EXTENDED PERIOD OF TIME.

SECONDARY SPACE:
ALL AREAS USED TO SUPPORT THE PRINCIPAL ACTIVITY OF THE PRIMARY SPACE. THESE SPACES WILL BE REGULARLY OCCUPIED, HOWEVER, A SINGLE PERSON IS UNLIKELY TO REMAIN WITHIN FOR MORE THAN 2 HOURS.

TERTIARY SPACE:
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LANDSCAPE DRAWINGS FOR FURTHER INFORMATION.

0 2 4 6 8m 1:200

WMK Architecture
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Telephone 02 9299 0401
Facsimile 02 9299 0402
wmkarchitecture.com
ABN 25 082 956 929

Client
ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN

Project
ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN: CENTRE OF EXCELLENCE

GYMNASIUM & CULLODEN ROAD
MACQUARIE UNIVERSITY

Title
FLOOR PLAN - ZONE 1 - BASEMENT

Drawing No.	Issue
A110	2
Scale	**Drawing Size**
1 : 200	A1
Project No.	**Drawn By**
19181	MM

CAD Reference
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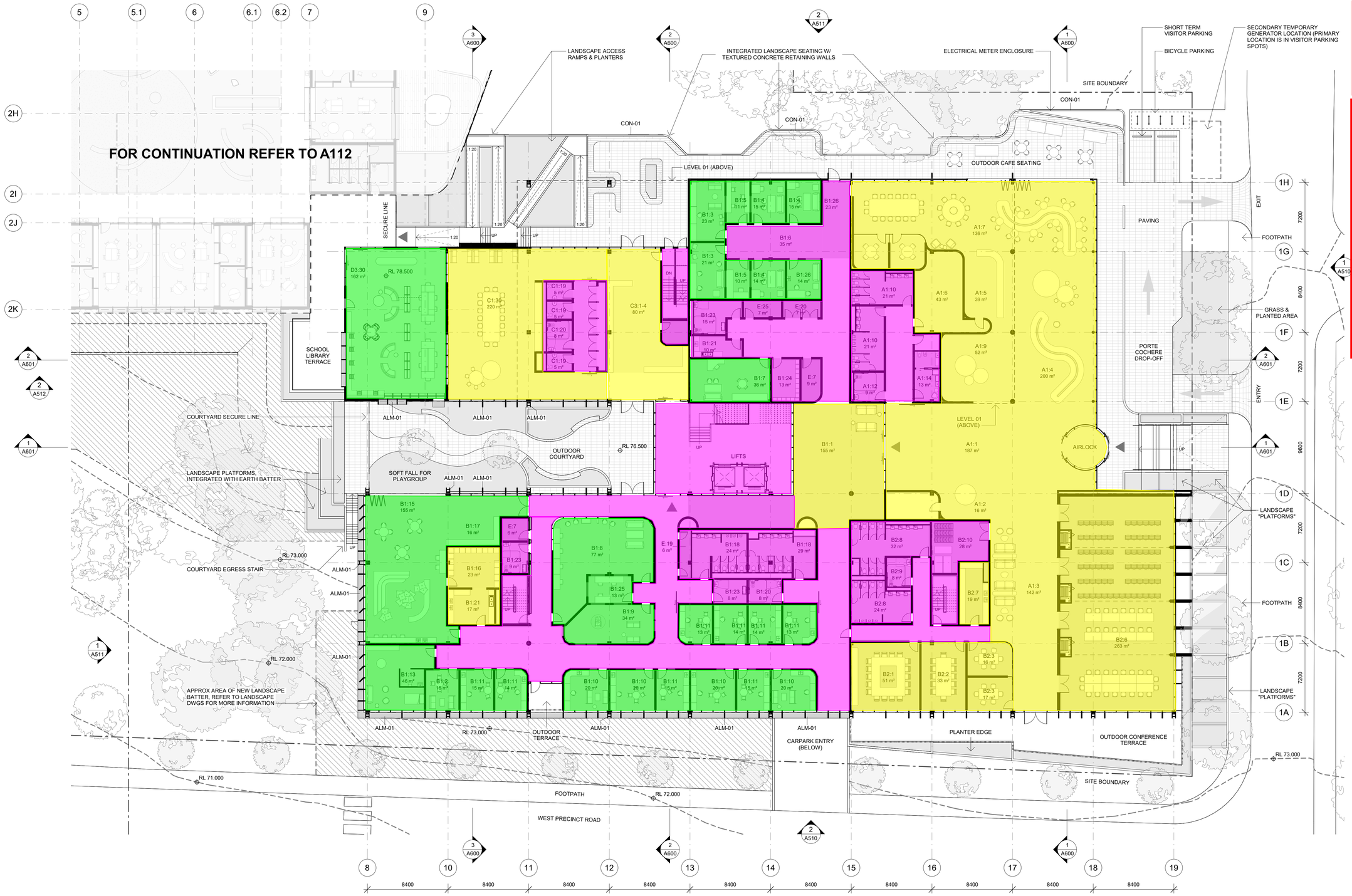

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GYMNASIUM & CULLODEN ROAD
MACQUARIE UNIVERSITY

Title
FLOOR PLAN - ZONE 1 - LOWER GROUND

Drawing No.	Issue
A111	2
Scale	**Drawing Size**
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Project No.	**Drawn By**
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Project
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GYMNASIUM & CULLODEN ROAD
MACQUARIE UNIVERSITY

Title
FLOOR PLAN - ZONE 1 - LEVEL 1

Drawing No.	Issue
A113	2
Scale	**Drawing Size**
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Project No.	**Drawn By**
19181	MM

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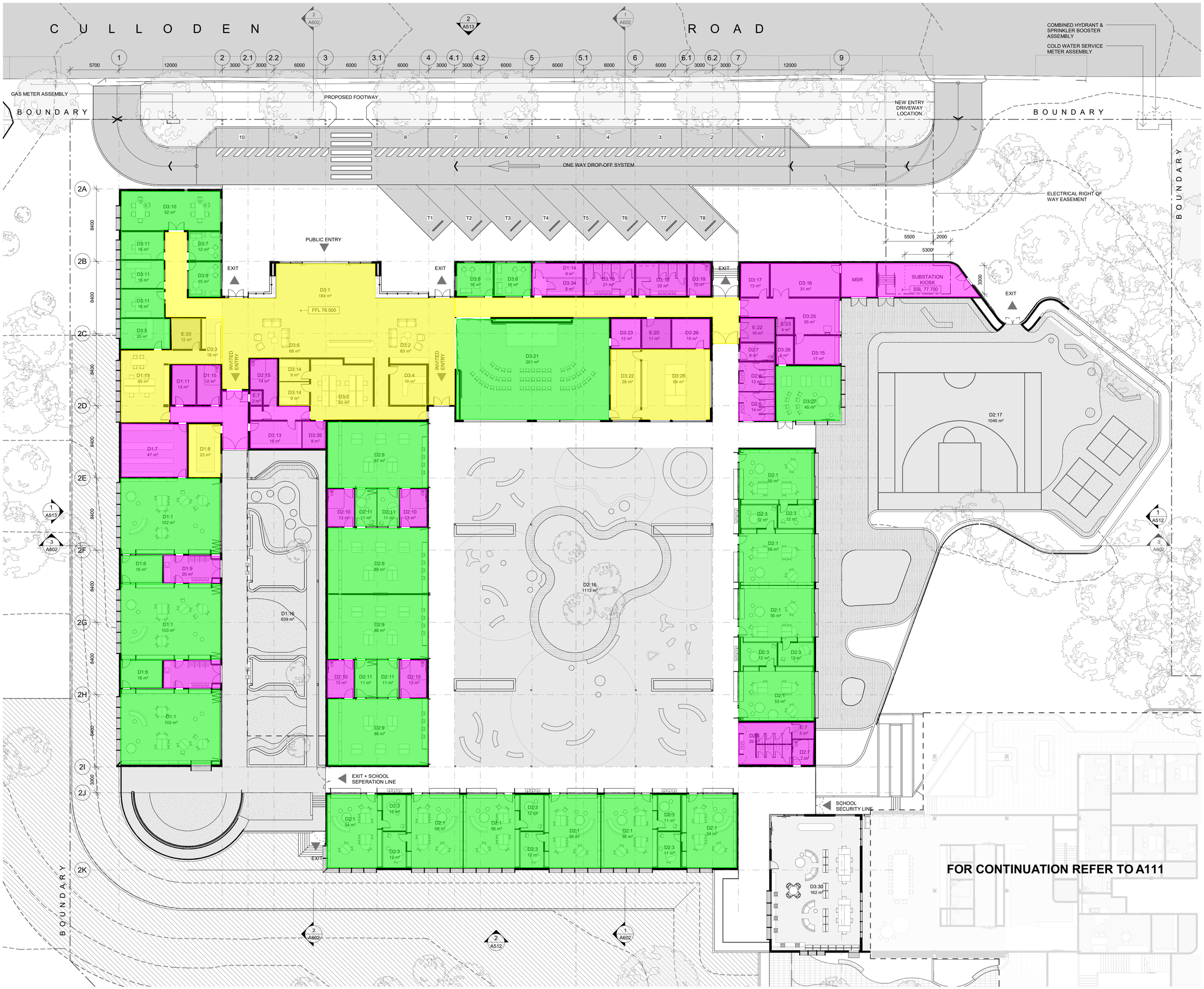

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DOCUMENT BY: G.T DATE: 27/10/2020

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Client
ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN

Project
ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN: CENTRE OF EXCELLENCE

GYMNASIUM & CULLODEN ROAD
MACQUARIE UNIVERSITY

Title
FLOOR PLAN - ZONE 2 - UPPER GROUND

Drawing No.	Issue
A112	3
Scale	**Drawing Size**
1 : 200	A1
Project No.	**Drawn By**
19181	SC

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APPENDIX C: NABERS CHECKLIST

JHA

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9 November 2020

MEMO

PROJECT NAME:	Royal Institute for Deaf and Blind Children (RIDBC) Centre of Excellence | Macquarie University
PROJECT NUMBER:	200336
ATTENTION:	Marcello Tuteri
FROM:	Lawrence Yu

RE: BEST ENDEAVOURS TO ACHIEVE A 4.5-STAR NABERS FOR THE BASE BUILDING

The intent of this memo is to confirm the design of the proposed Royal Institute for Deaf and Blind Children (RIDBC) Centre of Excellence meets its NABERS objective. In accordance with the client's ESD brief, the project is to endeavour to achieve a 4.5-star NABERS rating for the base building components.

A NABERS Base Building Rating is a benchmark of the energy efficiency of a building designed to help building owners and tenants understand their building's performance compared to other buildings.

NABERS Star Rating Benchmark

The thermal performance of the building design, the energy performance of the building services and an appropriate metering strategy are the key factors that will impact on a building's NABERS rating. Since the introduction of the NCC 2019 Section J Energy Efficiency requirements, all new buildings are designed to an equivalent NABERS rating of 4.0+ star.

The proposed RIDBC Centre of Excellence, in addition to complying with mandatory NCC requirements, has incorporated the following features to achieve greater energy efficiency:

- Further 10% improvement on NCC 2019 R-value requirement for the floors, walls and roofs;
- Further 10% improvement on NCC 2019 thermal requirement for vertical glazing;
- Further 15% improvement on NCC 2019 thermal requirement for skylights
- Further 10% improvement on NCC 2019 energy efficiency requirements for lighting;
- A domestic hot water system that is powered by renewable energy or heat pump;
- An onsite renewable photovoltaics system (up to 99kW).

Based on the above inclusions, it is predicted the proposed RIDBC Centre of Excellence will be capable of achieving an equivalent NABERS rating of 5.0 star or higher.

To help ensure the targeted NABERS rating will be achieved, a NABERS Checklist is attached below summarising all the included energy efficiency features as reference for the project team throughout design and construction.

Yours sincerely,

Lawrence Yu

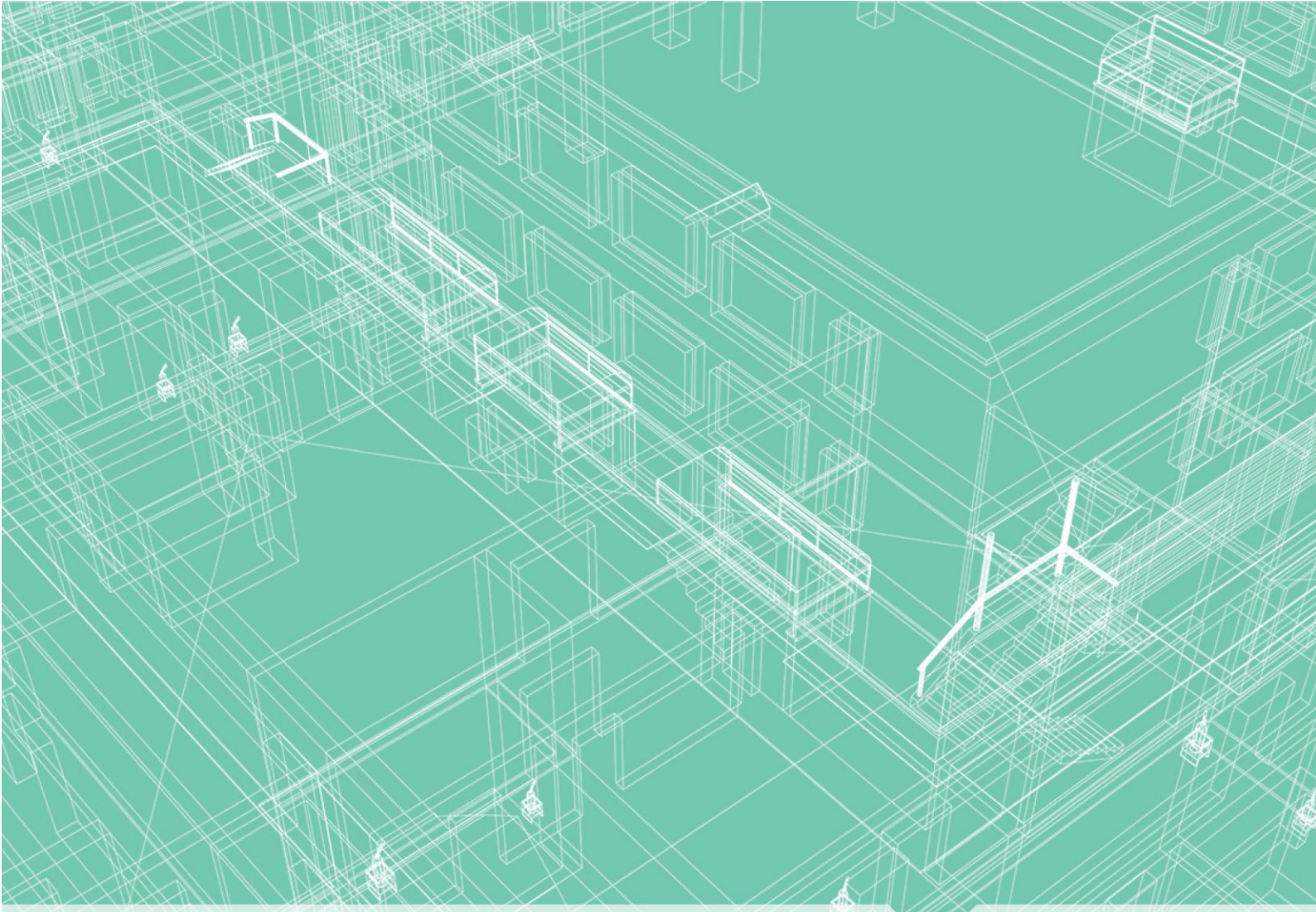
ESD Group Manager

NABERS CHECKLIST

Architectural	Included
<u>Shading</u> - Appropriate shading devices for glazing to reduce heat gain in summer, while allowing appropriate amount of natural daylight and solar gain in winter months.	☑ (in development)
<u>Glazing</u> - Appropriate window to wall ratio (ideally no more than 60%). - High performing glazing (with performance U-value and low solar heat gain co-efficient) throughout.	☑ (in development)
<u>Fabric Performance</u> - 10% improvement on floor, wall and roof insulation values over minimum Section J requirements. - Light coloured roofing. 0.05 improvement on maximum roof solar absorptance.	☑
Mechanical	
<u>Air Conditioning</u> - Chilled/heating water air handling and VAV system for the office building - Outdoor air economy cycle where appropriate - Ensure appropriate controls are employed to minimise energy consumption e.g. out of hours use or unoccupied spaces system shutdown. - Where areas are unoccupied consider potential to relax internal temperatures / design conditions.	☑
<u>Ventilation Systems</u> - CO2 sensors for high occupancy spaces; fans with variable speed drives to ramp up and down. - Consider high efficiency filters to reduce outside air rates. - Amenity exhaust systems to be interlocked with lighting PIR to deactivate when unoccupied. - Car parking areas (where natural ventilation cannot be utilised), carbon monoxide (CO) monitoring provided to control the ventilation system.	☑
<u>Controls</u> - Centralised controller to monitor and control all services (e.g. air conditioning, fans, external lighting, energy consumption etc.).	☑
<u>Metering</u> - Mechanical systems energy consumption to be sub-metered.	☑
Electrical	
<u>Lighting and Lighting Control</u> - High efficiency LED lighting to be used predominantly. - Ensure appropriate controls are employed to minimise energy consumption e.g. out of hours use or unoccupied spaces system shutdown. - PIR lighting control to amenities and back of house areas. - Consider daylight sensing to office areas.	☑

- External lighting control via photoelectric cell and/or time scheduling.	
<u>Energy Generation</u> - Maximise photovoltaic systems to match peak daytime electricity usage. Up to 99kW (target minimum 15% electrical energy consumption of the building).	☑ (system size TBC)
<u>Metering (for Base Building Rating)</u> - Energy consumed in the office building should be separately metered, including: • common-area lighting and power (for example lift lobbies, foyers, plant rooms and common-area toilets) • non-office tenancies (i.e. café) • lifts and escalators • air conditioning and ventilation, including: – base building services to meet normal requirements – centralised supplementary services provided for tenants (such as supplementary tenant condenser water loops) – supplementary services provided to ensure the premises are safe, lit and comfortable for office work, where there is no special tenant requirement • exterior lighting • exterior signage provided by the building owner for the benefit of office tenants • generator fuel where it serves central services • car park ventilation and lighting, where internal or external car parks within the legal boundaries of the site are provided for tenant use.	☑
Hydraulic	
<u>Hot Water Generation</u> - Heat pump or renewable powered domestic hot water system.	☑
Commissioning	
- All building services systems will require appropriate commissioning, ensuring systems are operating and controlled as required.	☑

APPENDIX D: CLIMATE ADAPTATION PLAN



CLIMATE ADAPTATION PLAN

ROYAL INSTITUTE FOR DEAF AND BLIND CHILDREN (RIDBC) CENTRE OF EXCELLENCE MACQUARIE UNIVERSITY

ESD SERVICES

JHA

JHASERVICES.COM

This report is prepared for the nominated recipient only and relates to the specific scope of work and agreement between JHA and the client (the recipient). It is not to be used or relied upon by any third party for any purpose.

DOCUMENT CONTROL SHEET

Project Number	200336
Project Name	RIDBC Centre of Excellence Macquarie University
Description	Climate Adaptation Plan
Key Contact	Lawrence Yu

Prepared By

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Author	Lawrence Yu
Checked	Gary Tang
Authorised	

Revision History

Issued To	Revision and Date								
WMK Architecture	REV	Draft	Rev A	Rev B					
	DATE	02/10/2020	06/10/2020	11/11/2020					
	REV								
	DATE								
	REV								
	DATE								

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EXECUTIVE SUMMARY

A Climate Adaptation Plan (CAP) report has been prepared for the proposed Royal Institute for Deaf and Blind Children (RIDBC) development located within the Macquarie University precinct.

This CAP addressed the following requirements:

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

The impacts of climate change were assessed across two time scales (2030 & 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	2030 Pre-adaptation	2030 Post-adaptation	2070 Pre-adaptation	2070 Post-adaptation
Low	2	4	1	3
Medium	4	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 risks by the proposed adaptation actions. The responses to high risks are summarised as follows:

1. Hotter and dryer conditions causing 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 practice to remove potential fuel source around the building once the building is in operation.
2. Hotter and dryer conditions resulting in higher frequency and/or duration of heatwaves resulting in 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 at least two risks items identified in the risk assessment being addressed by specific design responses.

1 INTRODUCTION

This Climate Adaptation Plan (CAP) report has been prepared for the proposed Royal Institute for Deaf and Blind Children (RIDBC) development located within the Macquarie University precinct.

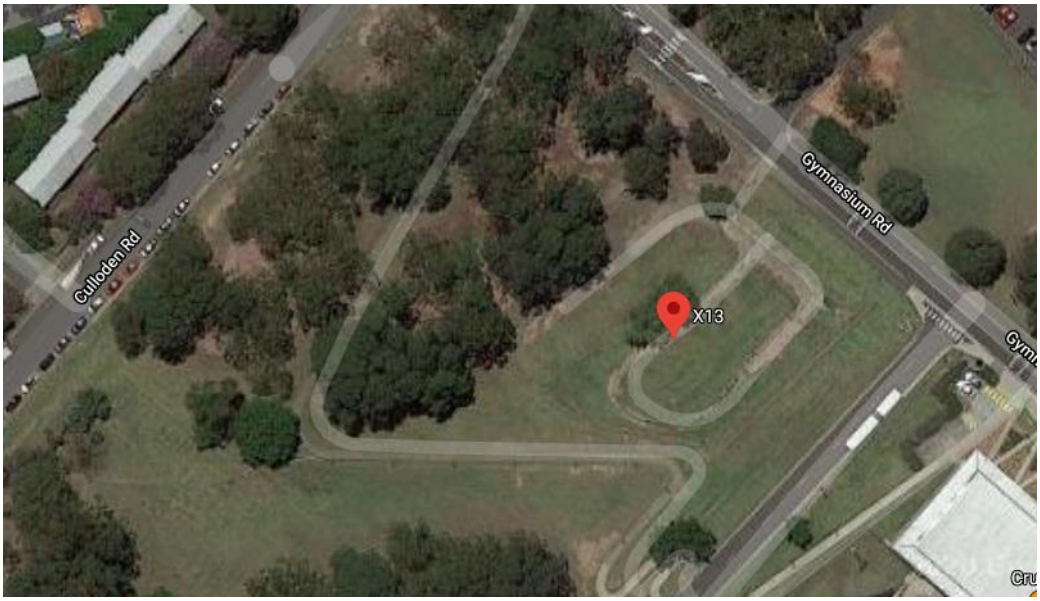
In accordance with Green Star – Design & As-Built Credit 3 "Adaptation and Resilience", the purpose of the CAP is to provide:

- 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 two time scale relevant to the project 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 standard (see Section 4)
- A list of actions and responsibilities for 'high' and 'extreme' risks identified (see Section 4)

Rendering of proposed development

1.1 PROJECT DESCRIPTION

The proposed development for the Royal Institute for Deaf and Blind Children (RIDBC) located within the Macquarie University precinct will result in the construction of a new one-storey educational building, a new two-storey office building and a basement carpark. The buildings will be a landmark development for the RIDBC that can be seen from both Culloden Road and Gymnasium Road.



Aerial 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 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
- NSW and ACT Regional Climate Modelling (NARCliM) climate change projections

1.3 STAKEHOLDERS CONSULTATION

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

Stakeholder	Role
RIDBC Andrew Brady	Client Representative
M Projects Marcello Tuteri & Antonio Galasso	Project Manager
WMK Architecture Igor Kochovski & Michaela Coe	Architect
Oculus Keith Stead	Landscape Architect
BG&E Patrick Ceballos & Paul Sancandi	Structure Consultant
LP Consulting Louis Panagopoulos	Civil Consultant
LCI Shi-En Lim & David Mitchell	Electrical Consultant
JHA Consulting Engineers Hadi Jalgha, Lawrence Yu & Gary Tang	Mechanical & ESD Consultant

2 PROJECT'S CLIMATIC CHARACTERISTICS

The proposed RIDBC development is located in NCC Climate Zone 5 (warm temperate) with warm humid summers and mild winters. This area has fairly evenly spread rainfall throughout the year, but is slightly more frequent during autumn. Winter is the driest time, with the least rainfall.

2.1 BASELINE CLIMATIC CONDITIONS

The baseline climatic conditions for RIDBC Macquarie University is taken from the Macquarie Park weather station, which is approx. 1.2 km away from the site location.

Weather station details:

- Site name: MACQUARIE PARK (WILLANDRA VILLAGE)
- Site number: 066156
- Latitude: 33.78 °S Longitude: 151.11 °E
- Elevation: 65 m
- Commenced: 1970
- Status: Open
- Last updated: 12 Sep 2020

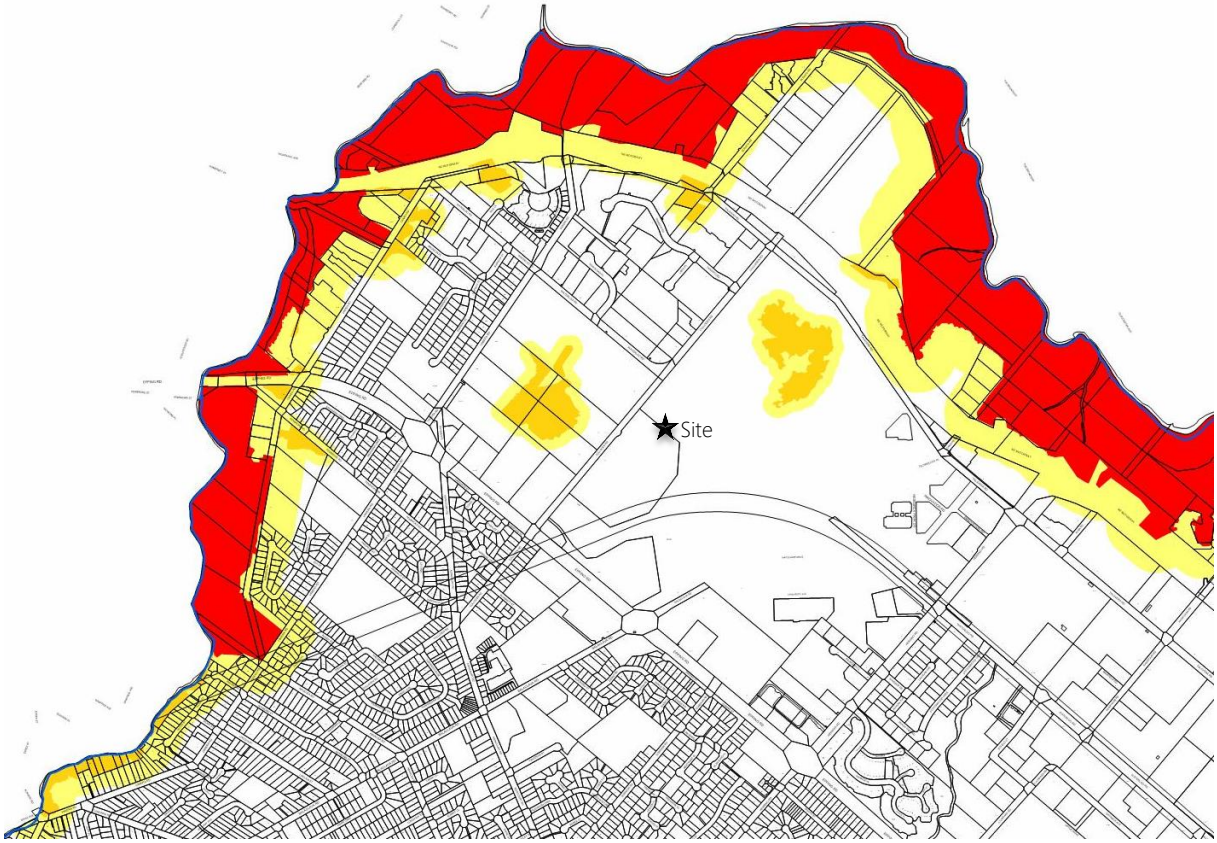
Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	An.
Maximum temperature													
Mean maximum temperature (Degrees C)	27.7	27.4	25.9	23.4	20.3	17.4	17.1	18.5	21.1	23.3	24.8	27.1	22.8
Highest temperature (Degrees C)	41.5	41.4	40.7	33.5	28.5	24.8	26.0	30.1	34.4	39.1	42.0	43.1	43.1
Mean number of days >= 35 Degrees C	1.9	1.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.0	6.7
Minimum temperature													
Mean minimum temperature (Degrees C)	16.9	16.9	15.2	12.0	9.2	6.5	4.9	5.7	7.8	10.8	13.0	15.6	11.2
Lowest temperature (°C)	8.5	8.9	6.1	2.5	0.3	-1.7	-3.5	-1.1	0.1	0.9	1.2	6.5	-3.5
Mean number of days <= 2 Degrees C	0.0	0.0	0.0	0.0	0.4	2.6	6.3	4.0	0.6	0.0	0.0	0.0	13.9
Rainfall													
Mean rainfall (mm)	119.3	144.2	137.8	106.6	77.9	119.3	55.6	59.7	59.6	85.8	89.6	83.1	1115.1
Highest rainfall (mm)	369.6	655.4	362.9	562.4	345.4	430.2	214.8	398.6	219.0	305.6	355.6	274.0	1951.4
Mean number of days of rain ≥ 25 mm	1.3	1.6	1.5	1.3	0.7	1.1	0.5	0.6	0.5	0.7	0.9	0.9	11.6
Solar & Cloudy Days													
Mean daily solar exposure (MJ/m2)	22.3	19.5	16.4	13.5	10.4	8.6	9.9	13.1	16.7	19.6	21.2	22.9	16.2
Mean number of cloudy days	11.3	12.7	12.9	7.8	9.9	11.1	6.3	6.3	7.4	11.8	11.5	11.2	120.2

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 focuses of this risk assessment.

Past climatic events that have impacted the site and/or the City of Ryde region are summarised below:

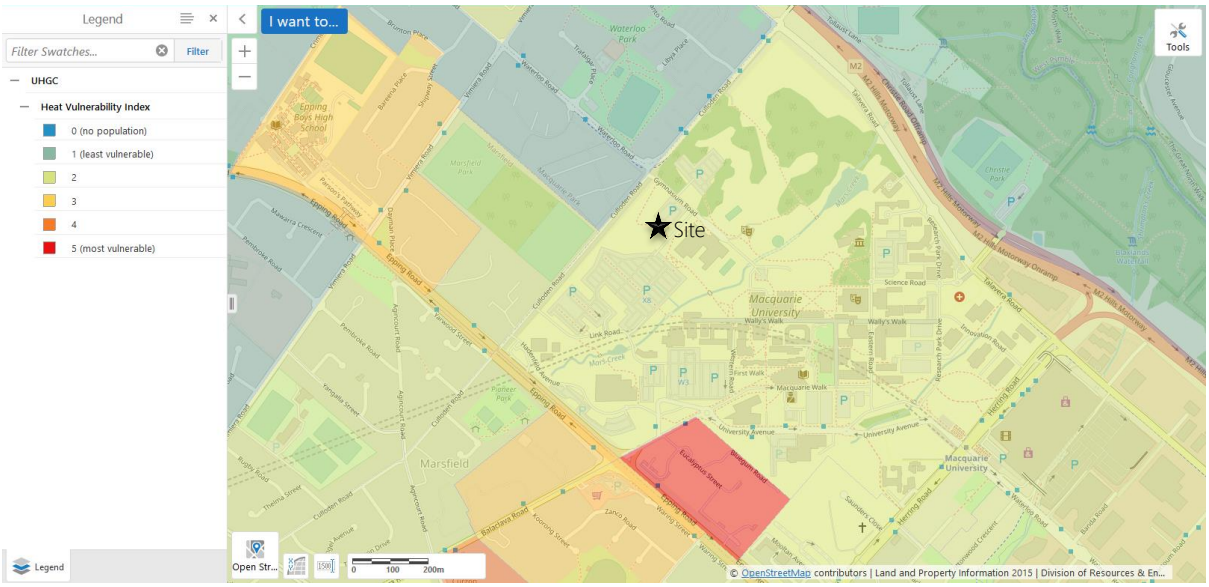
- Bushfire – In recent years there has been an increase in the number of high fire weather danger days, more severe fire weather and much longer fire seasons in NSW. The City of Ryde local government area has previously experienced major bushfire events, for example in 1994 in the Lane Cove River valley.
  Bush fire prone land (BFPL) is land that has been identified by local council which can support a bush fire or is subject to bush fire attack. The City of Ryde Council's Bush Fire Prone Land Map (below) [Source: https://www.ryde.nsw.gov.au/files/assets/public/development/bushfire-prone-land-map.pdf] shows the proposed development site is located near areas that can support a bush fire. The site may be subjected to ember attacks as large embers can travel as far as 700m ahead of a fire.



The City of Ryde Council's Bush Fire Prone Land Map

- 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 also shown that learning performance can be impacted by higher temperatures. Warm buildings may decrease interest and alertness, distracting students and teachers and other office workers. In hotter buildings, headaches and heat exhaustion symptoms may develop that can hinder academic performance. High temperatures may be accompanied by higher levels of humidity. Increased humidity can cause

drowsiness in both students and staffs. Studies have shown concentration performance is lower in humid, hot environments. The NSW Heat Vulnerability Index (HVI) dataset identifies the site currently as low/medium vulnerability to the adverse effects of urban heat. [Source: https://climatechange.environment.nsw.gov.au/Impacts-of-climate-change/Heat/Urban-heat]



Heat Vulnerability Index Map Viewer

- Storms/Gustier Wind – Thunderstorms are the most common type of storms 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 damage to property. Historically, this area has experienced low rainfall intensity for 60minute 1:100yr Storm. Predicted to receive 71.3 mm, or up to 459 mm over 3 days. [Source: Bureau of Meteorology]
- Floods/Extreme Rain – No known exposure to flood events. Simulation of probable maximum flood (PMF) carried out as part of "Flood Study Report - April 2010" indicates location is unlikely to be impact by largest flood that could possibly occur. [Source: https://www.ryde.nsw.gov.au/Business-and-Development/Planning-Controls/Other-Planning-Considerations/Flood-Prone-Areas/Macquarie-Park-Catchment]

Simulation of PMF Flood

- 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]

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 causing increase in the frequency and/or severity of bushfire and heatwave events.
2. Warmer temperatures and increased moisture in the atmosphere causing increase in severity of extreme storm/wind events (by providing more fuel to increase the wind speeds of storms).

3 CLIMATE CHANGE SCENARIOS AND IMPACTS

3.1 REGIONAL OVERVIEW

The subject site is located within the East Coast South sub-cluster.

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.

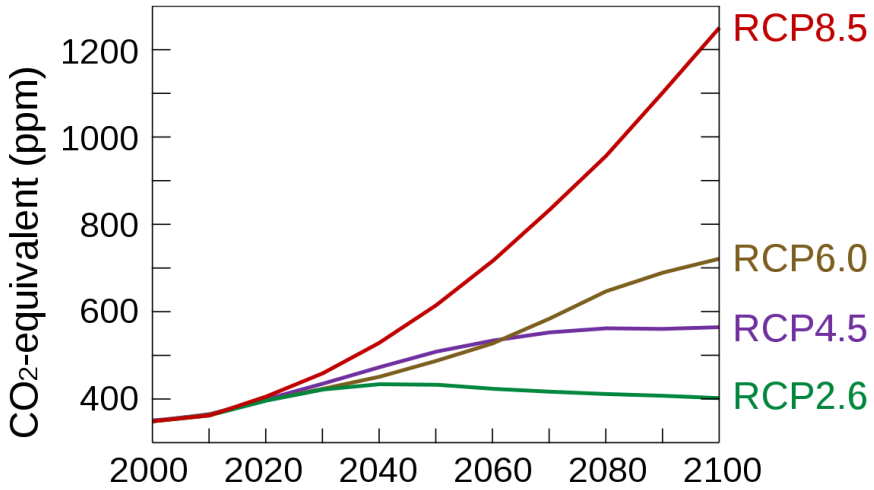
The sub-cluster area has a predominantly sub-tropical climate, with regional variations such as some temperate influences in the south.

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.
- 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 height of extreme sea-level events will also increase (very high confidence).
- A harsher fire-weather climate in the future (high confidence).
- On 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 projection, 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, RCP2.6, where the numbers of each RCP refer to the amount of radiative forcing produced by greenhouse gases in 2100.



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 continued increase in fossil fuel use. It is the 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 is achieved by 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 were considered to determine the appropriate projection time scale. Based on components design life of a hospital building, the time series that is selected to understand the future climate impacts across the project's life are 2030 and 2070.

3.4 CLIMATE VARIABLES OF INTEREST

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

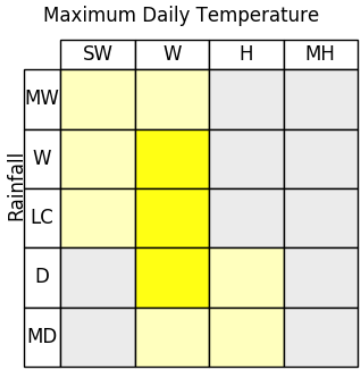
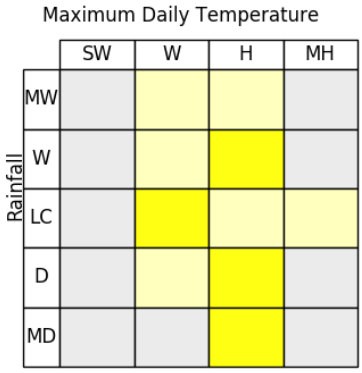
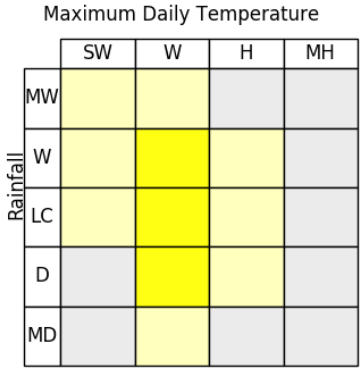
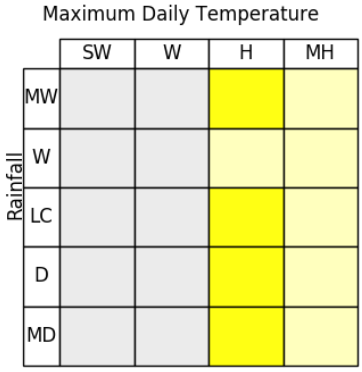
Events	Key Cases
Bushfires & Heatwaves	"Best Case": Climate Future with the least increase in maximum summer daily temperature and the least decrease (or most increase) in rainfall (shorthand: "coolest and wettest") "Worst Case": Climate Future with the greatest increase in maximum summer daily temperature and the greatest decrease (or least increase) in rainfall (shorthand: "hottest and driest")
Storms/Winds	"Best Case": Climate Future with the least increase in maximum summer daily temperature and the greatest decrease (or least increase) in rainfall (shorthand: "coolest and driest") "Worst Case": Climate Future with the greatest increase in maximum summer daily temperature and the least decrease (or most increase) in rainfall (shorthand: "hottest and wettest")

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 table below. All climate future matrices are sourced from CSIRO and Bureau of Meteorology, Climate Change in Australia website - www.climatechangeinaustralia.gov.au, cited 15/09/2020.

Consensus	Proportion of models
Not projected	No models
Very Low	< 10%
Low	10% - 33%
Moderate	33% - 66%
High	66% - 90%
Very High	> 90%

Colour legend of climate future projection consensus levels

East Coast Climate Futures		Year	
		Summer 2030	Summer 2070
Emissions Scenarios	RCP 4.5		
	RCP 8.5		
Keys		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	Rainfall (December to February) 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

3.5.1 PROJECTED CLIMATE SCENARIOS FOR BUSHFIRES & HEATWAVES

Case	2030 Climate Future		2070 Climate Future	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
"Best" Coolest and wettest	Slightly warmer and much wetter (Consensus: Very low)	Slightly warmer and much wetter (Consensus: Very low)	Warmer and much wetter (Consensus: Very low)	Hotter and much wetter (Consensus: Low)
"Worst" Hottest and driest	Hotter and much drier (Consensus: Very low)	Hotter and drier (Consensus: Very low)	Hotter and much drier (Consensus: Low)	Much hotter and much drier (Consensus: Very low)
"Maximum consensus"	Warmer and drier to wetter (Consensus: Moderate)	Warmer and drier to wetter (Consensus: Moderate)	Hotter and drier to much drier (Consensus: Moderate)	Hotter and little change to much drier (Consensus: Moderate)

On balance, the projected climate scenarios indicate a summer that will be warmer in the near future and becoming hotter and drier later. In these projected scenarios, the risks of bushfire and heatwaves will be increased.

3.5.2 PROJECTED CLIMATE SCENARIOS FOR STORMS/WINDS

Case	2030 Climate Future		2070 Climate Future	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
"Best" Coolest and driest	Slightly warmer and little change in rainfall (Consensus: Very low)	Slightly warmer and little change in rainfall (Consensus: Very low)	Warmer and drier (Consensus: Very low)	Hotter and much drier (Consensus: Low)
"Worst" Hottest and wettest	Hotter and much wetter (Consensus: Very low)	Hotter and wetter (Consensus: Very low)	Hotter and much wetter (Consensus: Low)	Much hotter and much wetter (Consensus: Very Low)
"Maximum consensus"	Warmer and drier to wetter (Consensus: Moderate)	Warmer and drier to wetter (Consensus: Moderate)	Hotter and drier to much drier (Consensus: Moderate)	Hotter and little change to much drier (Consensus: Moderate)

The projected climate scenarios indicate a summer that will be warmer in the near future and becoming hotter later. There is no strong consensus whether it will become wetter or drier in the near future but hotter temperature may impact on the severity of storm and wind events.

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
			2030			2070				2030			2070			
			C	L	Rating	C	L	Rating		C	L	Rating	C	L	Rating	
Hotter and dryer conditions resulting in higher frequency and/or severity of bushfire events	On balance, the projected climate scenarios indicate a summer that will be warmer in the near future and becoming hotter and drier later. In these projected scenarios, the risks of bushfire will be increased.	DIRECT: Increased bushfires risk due to warmer to hotter conditions may cause direct damage to the facilities.	Major	Unlikely	Medium	Major	Possible	High	Investigate locations of vulnerability, 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 evacuation plan in case of fire threatening building, with particular attention paid to the special needs of the students.	Major	Rare	Low	Major	Unlikely	Medium	The risk and impact of bushfire on the building will be reduced if good management practice are implemented. A properly considered evacuation plan will minimise the risks to occupants of the building.
		DIIRECT: 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 building is well sealed to minimise risks of smoke infiltration. Put in place smoke hazard management strategies. Consider providing mechanical outside air system with high quality filters that can remove smoke particulates from the air.	Minor	Unlikely	Low	Minor	Unlikely	Low	The risk and impact of smoke on occupants will be reduced if good management practice are implemented.
		INDIRECT: Increased bushfires risk may damage power infrastructure, disrupting operation of facility.	Moderate	Possible	Medium	Moderate	Possible	Medium	Provide backup power supply. Ensure critical data and information can be accessed offline.	Minor	Possible	Medium	Minor	Possible	Medium	Backup 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 degree Celsius)	On balance, the projected climate scenarios indicate a summer that will be warmer in the near future and becoming hotter and drier later. In these projected scenarios, the risks of heatwaves will be increased.	DIRECT: Extreme heat will increase demand on HVAC system and may impact the ability of HVAC system to maintain 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 thermal insulation. Provide light coloured roofs to reduce heat gains via the roof and help mitigate 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 capacity of units in line with change in climatic conditions. Provide dedicated "Cool outdoor areas" where students and teachers can take shelter during extreme hot days when the power fails should be explored by the design team. This cool area should utilise passive design principals 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 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 their end of their service life will help ensure 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 temperature to 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 increase relevant to the components 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 their end of their service life will help ensure system will be capable of handling more extreme temperatures in the far future.

Hotter and wetter conditions increasing severity of extreme storm/wind events (by providing more fuel to increase the wind speeds of storms)	The projected climate scenarios indicate a summer that will be warmer in the near future and becoming hotter later. There is no strong consensus whether it will become wetter or drier in the near future but hotter temperature may impact on the severity of storm and wind events.	DIRECT: Stronger wind and rain events may damage the building and cause disruption of service and power failure.	Minor	Unlikely	Low	Minor	Unlikely	Low	Additional adaptation measures is not warranted at this stage as there is no clear indication storm/wind events will be increased as a result of climate change.	Minor	Unlikely	Low	Minor	Unlikely	Low	NA

4.2 RESPONSES TO HIGH AND EXTREME RISKS

The risk assessment identified two high risks for the proposed development by 2070 (zero high risks by 2030). No extreme risks were identified. The responses to high risks are summarised as follows:

1. Hotter and dryer conditions causing 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 practice to remove potential fuel source around the building once the building is in operation.
2. Hotter and dryer conditions resulting in higher frequency and/or duration of heatwaves resulting in 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 risks items identified in the risk assessment are addressed by specific design responses.

Risk rating	2030 Pre-adaptation	2030 Post-adaptation	2070 Pre-adaptation	2070 Post-adaptation
Low	2	4	1	3
Medium	4	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 Royal Institute for Deaf and Blind Children (RIDBC) development located within the Macquarie University precinct.

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 identified in Section 4.

The impacts of climate change were assessed across two time scales (2030 & 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 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

Rating	SUCCESS CRITERIA				
	Public safety	Local economy & growth	Community & lifestyle	Environment & sustainability	Public administration
Catastrophic	Large numbers of serious injuries or loss of lives	Regional decline leading to widespread business failure, loss of employment and hardship	The region would be seen as very unattractive, moribund and unable to support its community	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage	Public administration would fall into decay and cease to be effective
Major	Isolated instances of serious injuries or loss of lives	Regional stagnation such that businesses are unable to thrive and employment does not keep pace with population growth	Severe and widespread decline in services and quality of life within the community	Severe loss of environmental amenity and a danger of continuing environmental damage	Public administration would struggle to remain effective and would be seen to be in danger of failing completely
Moderate	Small numbers of injuries	Significant general reduction in economic performance relative to current forecasts	General appreciable decline in services	Isolated but significant instances of environmental damage that might be reversed with intensive efforts	Public administration would be under severe pressure on several fronts
Minor	Serious near misses or minor injuries	Individually significant but isolated areas of reduction in economic performance relative to current forecasts	Isolated but noticeable examples of decline in services	Minor instances of environmental damage that could be reversed	Isolated instances of public administration being under severe pressure
Insignificant	Appearance of a threat but no actual harm	Minor shortfall relative to current forecasts	There would be minor areas in which the region was unable to maintain its current services	No environmental damage	There would be minor instances of public administration being under more than usual stress but it could be managed

LIKELIHOOD CRITERIA

Rating	Recurrent risks	Single events
Almost certain	Could occur several times per year	More likely than not – Probability greater than 50%.
Likely	May arise about once per year	As likely as not – 50/50 chance.
Possible	May arise once in ten years	Less likely than not but still appreciable – Probability less than 50% but still quite high.
Unlikely	May arise once in ten years to 25 years	Unlikely but not negligible – Probability low but noticeably greater than zero.
Rare	Unlikely during the next 25 years	Negligible – Probability very small, close to zero.

RISK PRIORITY LEVELS

	Consequences				
Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	Medium
Rare	Low	Low	Low	Low	Medium

The interpretation of the priority levels is usually as follows:

- Extreme risks demand urgent attention at the most senior level and cannot be simply accepted as a part of routine operations without executive sanction.
- High risks are the most severe that can be accepted as a part of routine operations without executive sanction but they will be the responsibility of the most senior operational management and reported upon at the executive level.
- Medium risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for action, maintained under review and reported upon at senior management level.
- Low risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe.