ARUP

ISPT

Julius Avenue Data Centre

SSDA ESD Report

Reference: JADC-ARP-RP-ED-000001

V6 | December 2025

Job number 306239-00

Arup Australia Pty Ltd | ABN 76 625 912 665

Arup Australia Pty Ltd
Level 5
151 Clarence Street
Sydney
NSW, 2000
Australia
arup.com

ARUP

Document Verification

Project title	Julius Avenue Data Centre
Document title	SSDA ESD Report
Job number	306239-00
Document ref	JADC-ARP-RP-ED-000001
File reference	ESD-01

Revision	**Date**				
		Filename	ESD-01 SSDA Report - Julius Avenue Data Centre- DRAFT01.docx		
DRAFT 01	24 April 2025	**Description**	Draft Issue		
			Prepared by	**Checked by**	**Approved by**
		Name	SG	CS	CS
V2	16 May 2025	**Filename**	ESD-01 SSDA Report - Julius Avenue Data Centre V2.docx		
		Description	Updated issue to address Logic comments		
			Prepared by	**Checked by**	**Approved by**
		Name	SG	AR	CS
V3	23 May 2025	**Filename**	ESD-01 SSDA Report - Julius Avenue Data Centre V3.docx		
		Description	Updated with GHG Assessment and Mitigation Plan		
			Prepared by	**Checked by**	**Approved by**
		Name	SG	AR	CS
V4	17 June 2025	**Filename**	ESD-01 SSDA Report - Julius Avenue Data Centre V4.docx		
		Description	Minor updates to address DPHI test of adequacy comments		
			Prepared by	**Checked by**	**Approved by**
		Name	SG	NN	CS
V5	28 Nov 2025	**Filename**	ESD-01 SSDA Report - Julius Avenue Data Centre V5.docx		
		Description	Update for SSDA resubmission		
			Prepared by	**Checked by**	**Approved by**
		Name	MC	AR/NN	CS
V6	10 Dec 2025	**Filename**	ESD-01 SSDA Report - Julius Avenue Data Centre V6.docx		
		Description	Update for SSDA resubmission		
			Prepared by	**Checked by**	**Approved by**
		Name	MC	MC	CS

Issue Document Verification with Document ☐

Contents

Executive Summary

This Ecologically Sustainable Development Report has been prepared by Arup to support the application for SSD-80018208, Julius Avenue Data Centre by ISPT. The project is located at 6-8 Julius Avenue, Macquarie Park, within the City of Ryde local government area.

The report summarises the development's approach to addressing the ecologically sustainable development (ESD) requirements documented in the Secretary's Environmental Assessment Requirements (SEARs) issued on 20 February 2025. The project is subject to the industry specific SEARs for Data Storage Centres.

Documented in this report are how the design team has addressed the EP&A ESD Principles, and specific details regarding the project's design response to:

- Reduction of greenhouse gas emissions and approach to net zero emissions,
- Reduction of water use intensity,
- Resilience,
- Industry recognised sustainability performance and
- Measurement of embodied emissions.

Comparing with the previous proposal SSD-80018208 submitted on 24/06/204, the updated scheme:

- Reduces total GHG emissions by approximately 27% through a lower IT load and total annual energy use reduction of 413,736 MWh
- Significantly reduces the strain on local water infrastructure through use of waterless heat rejection, saving approximately 1.3 million kilolitres of water per year compared with the previous proposal; and

Also addressed by the report are opportunities that the design team will investigate through design finalisation:

- Circular economy,
- Industry recognised rating, and
- Maximising the reduction in embodied emissions.

A GHG emissions assessment and mitigation plan is in the appendix of this document.

The report concludes that the development addresses the requirements of the SEARs and shows good opportunities for exceeding these with further opportunities to be explored through design finalisation.

1. Introduction

This Ecologically Sustainable Development Report has been prepared by Arup on behalf of ISPT to accompany a State Significant Development Application (SSDA) for a data centre development.

1.1 The Site

The Site is identified as 6-8 Julius Avenue, North Ryde, legally described as Lot 89 in Deposited Plan 1082131 (the Site). The Site is irregular in shape and is located on the south-eastern side of Julius Avenue, North Ryde.

The Site has a primary frontage of approximately 100m to Julius Avenue and has a partial rear frontage to Richardson Place (cul-de-sac) at the north-eastern corner. The Site has an area of approximately 2.863ha.

The Site is currently vacant. The north-western part of the Site was excavated and cleared of vegetation in 2009 as part of Modified Determination No. 1395/1999 previously approved on the Site.

The Site is zoned E3 Productivity Support pursuant to *Ryde Local Environmental Plan 2014* (RLEP 2014) and is located within the City of Ryde Local Government Area (LGA) which is approximately 15km north-west of the Sydney CBD.

Existing attributes of the Site and surrounding context are noted as follows:

- The Site is generally surrounded to the north-east, north-west, and south-west by commercial uses and E3 Productivity Support zoned land.
- Approximately 150m to the west of the Site is MU1 mixed Use zoned land which contemplates residential development to a height of 95m.
- The Site directly adjoins the Lane Cove National Park to the east and south-east which contains a walking track known as The Great North Walk and a fire trail.
- The Lane Cove River is located approximately 100m to the east of the Site.
- The Site directly adjoins the Ryde City Council Administrative Centre to the east.
- Approximately 500m to the west of the Site is the North Ryde Metro Station.

The nearest residential development is located approximately 300m to the south-east of the Site on the eastern side of Lane Cove River in Lane Cove North, and 300m to the south-west of the Site on the southern side of Epping Road in North Ryde.

An aerial view of the Site is provided in **Figure 1** below.

Figure 1 Aerial view of the Site (Source: Nearmap, 2024)

1.2 Proposed Development

The Proposal involves the construction and operation of a data centre and associated infrastructure and amenities, identified as the Julius Avenue Data Centre, comprising the following scope of works:

- Site preparation works, including tree removal;
- Earthworks and additional site retaining;
- Infrastructure comprising civil works and utilities servicing;
- Construction of a data centre including the following:
  - Ground level loading dock, services plantrooms and car parking for 38 cars, including 2 accessible;
  - 8 data halls across four (4) storeys with an IT load of 76 MW and a maximum power consumption of 120 MW, plus rooftop plant;
  - Three (3) storey office/front of house building;
  - Five (5) storey enclosed generator gantry to rear of data centre.
  - New Ausgrid 132 kilovolt (KV) Sub-Transmission Switching Station (STSS);
- A new pedestrian through-site link from Julius Avenue to Richardson Place; and
- Complementary landscaping and offset planting.

The Proposal includes works as identified in **Table 1** below.

Table 1 Development Particulars

Component	Documentation
Site Area	28,630 m^2
Primary Land Use	Data Centre (16,647 m^2 GFA)
Ancillary Land Uses	Office premises (868 m^2 GFA)
Gross Floor Area	16,457 m^2
Floor Space Ratio	0.58:1
IT Load	76 MW
Maximum Power Consumption	120 MW
Building Height	40m
Car Parking	38 car parking spaces (including 2 accessible)
Landscaping/trees	Total landscaping and tree removal to be confirmed.
Back-Up Generators	48 x 3MW diesel back-up generators (data centre) + 1 x 1MW back-up generator (office)
Dangerous Goods	955kL diesel storage capacity (Data Centre = 12 x 75kL bulk tanks + 48 x 1kL day tanks + Office = 1 x 6kL tank + 1kL day tank)
Estimated Jobs	Total estimated jobs (construction and operation) to be confirmed.

1.3 SEARs Requirements

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 20 February 2025 issued for the SSDA (SSD-80018208). Specifically, this report has been prepared to respond to the Ecologically Sustainable Development SEARs issued below.

Table 2 SEARs Requirements - Ecologically Sustainable Development

Issue and Assessment Requirements	Response
8. Ecologically Sustainable Development	
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.	Refer Section 2.3 Specific commentary provided for each of the principles of ESD with examples of initiatives to be included in the development.
Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	Refer Section 3.2 Options for assessment of the development against relevant industry standards.
Demonstrate how the development minimises greenhouse gas emission (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	Refer Section 3.1, and Appendix Initiatives provided in these sections address the specific requirements noted here for energy efficiency, water efficiency, WSUD and materials. The Appendix contains the GHG Assessment and Mitigation Plan developed in accordance with the NSW EPA Guide for Large Emitters.
If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies:	Refer Section 3.1

Issue and Assessment Requirements	Response
Demonstrate how the development has been designed to enable the general sustainability provisions, as defined by Chapter 3.2(1)	In addition to the requirements addressed in the previous item above, this section also address renewable energy generation, metering and monitoring of energy use as required by the SEPP.
SEPP: Provide a NABERS Embodied Emissions Material Form to disclose amount of embodied emissions attributable to the development in accordance with section 35B of the EP&A Regulation.	Refer NABERS Embodied Emissions Materials form submitted separate to this report.
SEPP: Provide a Net Zero Statement for the office component of the development.	The Sustainable Buildings SEPP requires a Net Zero Statement to be prepared for State Significant Developments and Large Commercial Developments (office with net lettable area (NLA) greater than 1,000m^2). Given the proposed office component is less than 1,000m^2 and will be ancillary and subservient to the primary use of the site as a data centre, a Net Zero Statement is not required.

2. Ecologically Sustainable Development

2.1 Definition

Ecologically sustainable development (ESD) requirements to be addressed by this SSD report are derived from the definition documented in Section 193 of the Environmental Planning and Assessment Regulation 2021, under the Environmental Planning and Assessment Act 1979.

Namely, these are the principles of ecologically sustainable development:

1. The precautionary principle,
2. Inter-generational equality,
3. Conservation of biological diversity and ecological integrity, and
4. Improved valuation, pricing and incentive mechanisms.

2.2 Methodology

The principles of ecologically sustainable development have been used as an overarching guide to develop the ESD strategy for the project. The key elements of this development proposal in respect to Section 193 are resource consumption and carbon emissions. Specifically, the ESD strategy for the development addresses the following key areas:

- Greenhouse Gas Emissions
- Energy
- Water
- Material Resources
- Waste

Each of these areas identifies design initiatives that have been incorporated or are under consideration that have the potential to reduce the environmental impact of the proposed data centre. It should be noted the building is in the Development Application stage, therefore further consideration of sustainability initiatives will be applied throughout design development. The ESD principles specific to Section 193 are detailed in this Section, for further detail please refer to the design initiatives detailed in the body of the report.

2.3 Principles of ESD

2.3.1 The Precautionary Principle

The precautionary principle is defined as follows:

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.

(3) In applying the precautionary principle, public and private decisions should be guided by -

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

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

The proposed development has the potential to consume significant amounts of energy and water. A range of measures have been considered to reduce the environmental impact of the proposal.

Energy consumption will be minimised through optimisation of mechanical systems including: higher operating temperature set points, an energy management system and high efficiency equipment. The

proposed development will be designed to achieve a 4.5-star NABERS Energy for Data Centre Infrastructure rating. As described in Section 3.3 of this ESD Report, the net lettable area of the office component is below the threshold to enable reporting, and therefore a NABERS Energy or Water rating is not applicable.

Water consumption will be minimised through a range of measures including multi-layered metering strategies, rainwater harvesting, and deploying high-efficiency equipment to achieve a balance between energy consumption and water consumption. In addition, a specific water consumption target for the proposed development has been set to drive the water efficiency of the design, outlined in section 3.1.2.

Other relevant initiatives and information is covered in the Environmental Impact Statement (EIS) and Biodiversity Development Assessment Report (BDAR), submitted separate to this report.

2.3.2 Intergenerational Equity

The principle of intergenerational equity is defined as follows:

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.

Data centres are critical infrastructure, that not only provide employment-generating opportunities within the Information, Communication and Technology (ICT) sector, but also support the operation of business to business and business to consumer services. The storage of cloud and electronic data is a fundamental for both business and consumer transactions. By supporting productivity and helping to drive business activity that underpins current and future economic growth, the proposed development will positively impact future generations.

In addition, the proposed development will seek to minimise greenhouse gas emissions through operational energy efficiency measures and on-site renewables. Reducing the upfront embodied carbon footprint of the proposed development will also minimise the potential detrimental impact to future generations.

Other relevant initiatives include reducing waste to landfill through construction and demolition as well as operationally, which is covered in the Waste and Recycling Management Plan submitted separate to this report. Climate change resilience and Connection with Country design principles are embedded in responses to the Macquarie Park Design Guide.

2.3.3 Conservation of biological diversity and ecological integrity

The principle of the conservation of biological diversity is defined as follows:

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.

The resultant direct, indirect, and cumulative ecological impacts of the proposal are being carefully considered. Through the development of an Environment Impact Statement, recommendations and mitigation measures will be developed in order to address the principle of biological diversity and ecological integrity. These are addressed in the EIS and BDAR, submitted separate to this report.

2.3.4 Improved valuation, pricing and incentive mechanisms

The principle of improved valuation, pricing and incentive mechanisms is defined as follows:

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 -

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

(b) 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

c) 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.

Tenant electricity consumption will be the main driver of carbon emissions for the facility. Electricity consumption from the tenant activities at the facility will be under the direct operational and financial control of the tenant. The proponent will support tenants who choose to self-procure renewables to offset their emissions in the facility.

The proponent will work with utility providers, energy retailers and renewable project developers to offer the data centre tenants innovative and commercially attractive renewable electricity supply options. At the same time, the proponent will support tenants who choose to self-procure renewables to offset their Scope 2 emissions in the facility. The proponent will support this outcome by providing granular breakdowns of energy consumption and associated emissions.

3. Assessment and Mitigation of Impacts

The following sections describe in detail the assessment of potential impacts and specific mitigation measures to respond to the SEARs objectives.

3.1 ESD Design Initiatives (Mitigation Measures)

To address the SEARs and Sustainable Buildings SEPP targets, the project will develop a comprehensive ESD strategy. The following areas are the focus of the design team:

- Energy and Greenhouse Gas Emissions – Incorporate energy efficient designs and technological strategies to reduce energy use, greenhouse gas emissions, and peak demand for electricity.
- Water – reduce consumption of potable water, by installing water efficient systems and water sensitive urban design features.
- Material Resources and Waste – Optimise the use of resources while minimising waste throughout the whole life cycle of the building. Reduce material embodied impacts through structurally optimal design and dematerialisation, low carbon building materials and recycled content.

This section outlines the ESD initiatives that are either being implemented into the design or are earmarked for further consideration.

3.1.1 Energy and Greenhouse Gas Emissions

This section describes the measures incorporated and being considered in the development's design to minimise the proposal's energy use and operational greenhouse gas emissions, in line with the Government's goal of net zero emissions by 2050 as noted in the SEARs.

The proponent seeks to design, build, and operate the data centre to be capable of achieving a 4.5-star NABERS Energy for data centres (Infrastructure) rating using waterless heat rejection. The target annual average Power Use Effectiveness (PUE) is 1.39 (note that this is different to the peak PUE). This metric is used to determine the energy efficiency of data centres, lower numbers indicate better efficiency. Studies indicate that the global average PUE for data centres decreased from 2.5 when it was first introduced in 2007 to 1.59 in 2020.[1] The combined compute and HVAC energy is the largest operational carbon impact, and small improvements in this results in large absolute savings.

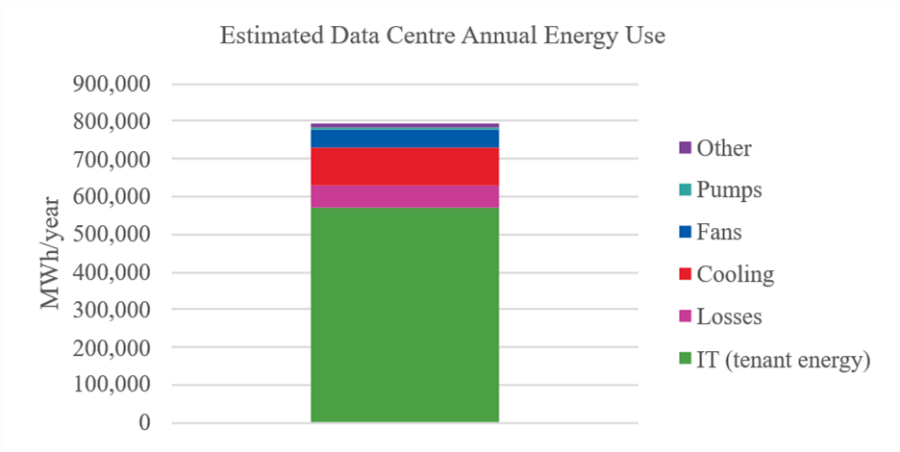
High-level calculations and benchmarking indicate that the target annual average PUE is achievable based on the following key assumptions:

- Data centre IT load 76.8 MW, running 24/7 (8760 hours per year) with 85% load diversity average
- Chiller selection with part load efficiency NPLV.IP ~9.23 (note full load COP ~3.05)
- Losses from UPS 4%, transformers 2%, and cable and boards 2%
- Office energy use is estimated to be 161 MWh/year based on floor area less that 1000m^2 and equivalent operation to 5 Star NABERS Energy rating – note this is insignificant compared to the data centre

A summary of the estimated energy use breakdown is provided in the following graph.

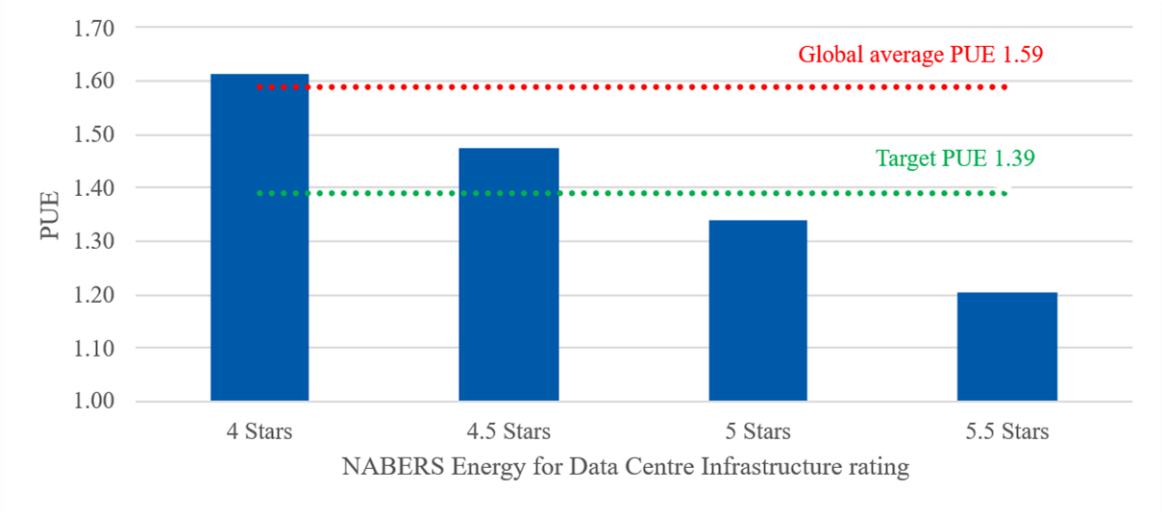
It is noted that that the energy use estimate has been developed based on previous benchmarking and modelling data as best reflects the design at this point in time. Changes to assumptions such as load diversity (will depend on customer usage, assumptions to be confirmed with future operator), UPS and transformer redundancy and performance for losses, HVAC systems and operational profiles will affect annual operational energy and end use breakdown.

[1] Brocklehurst, Fiona. "International review of energy efficiency in Data Centres for IEA EBC Building Energy Codes Working Group" March 2022



*'Other' category includes office, lighting, lifts, small power, domestic hot/cold water and other small loads)

PUE 1.39 compared to 1.59 would save approximately **97,215 MWh** per year (assuming 85% load average), as shown below against the NABERS star ratings.



Potential strategies currently being investigated for to reduce energy, emissions, and peak demand include:

- Envelope design using insulation, high performance selective glazing and external shading on appropriate elevations to achieve Section J envelope minimum compliance, balanced with allowing daylight into office spaces to reduce the reliance on artificial lighting.
- Near-zero GWP refrigerant specification for all chillers
- Efficient LED lighting with motion sensing throughout.
- Solar photovoltaic generation maximised for available rooftop areas and in excess of code requirements.
- Provision of EV charging stations.
- Metering and monitoring of energy consumption.
- High albedo materials to reduce Heat Island Effect, including high 'Solar Reflectance Index' cladding materials and paving.

A GHG emissions assessment and mitigation plan is provided in the Appendix of this document.

3.1.2 Water

This section describes the measures incorporated and being considered in the development's design to minimise the potable water consumption and water sensitive urban design as noted in the SEARs.

Water Use Effectiveness (WUE) rating is used to determine the water efficiency of data centres, a lower number indicates improved efficiency. The global average WUE for data centres is 1.8.[2] This project is estimated to have a WUE rating of ~0.01 through use of waterless heat rejection systems (air-cooled chillers, no cooling towers).

WUE 0.01 compared to WUE 1.8 would save approximately 1,000,000 kilolitres of water per year (assuming 85% load average). The supporting office area is less than 1000m^2 floor area and is estimated to use approximately 1.041 kL/m^2.year, less than 0.5% of the total water use of a data centre with WUE 1.8.

Potential strategies currently under investigation to reduce water use associated with the facility include:

- Use of native and indigenous planting with low water requirements.
- Rainwater collection, for cooling tower water top-up and irrigation.
- Recirculation and capture of at least 80% of fire system testing water.
- Efficient fixtures and fittings with high WELS ratings.
- Stormwater design avoids drainage and spreads downhill to support national park flora.

3.1.3 Material Resources and Waste

This section describes the measures incorporated or being considered in the development's design to optimise the use of resources while minimising waste.

Potential strategies currently under investigation include:

- Structural optimisation considering dematerialisation.
- Consideration of low carbon materials including high supplementary cementitious material concrete (Boral Envisia proposed to be used), steel produced with arc furnace and renewable energy, low carbon aluminium framing for glazing systems.
- Cradle-to-gate life cycle assessment of embodied carbon and other materials impacts.
- Development of a construction and demolition waste management plan, detailing all major waste streams generated, including disposal and diversion rates.
- Provision of on-site separation of waste streams to maximise diversion from landfill.

[2] https://www.sunbirddcim.com/glossary/water-usage-effectiveness-wue#:~:text=The%20average%20data%20center%20has,hour%20consumed%20by%20IT%20equipment.

3.2 Industry Recognised Sustainability and Environmental Performance

Investigations have been made to confirm if applicable industry rating tools for the development which respond to the SEARs requirement meet or exceed the relevant industry recognised building sustainability and environmental performance standards.

The project is also subject to the Macquarie Park Design Guide. A consistency assessment has been undertaken to identify where the design initiatives align with the Design Guide, covered in a separate document. The Design Guide covers the following Sustainability aspects:

- Climate Risk and Resilience
- Greenhouse Gas Emissions and Energy
- Circular Economy, Materials and Waste Management
- Water Quality, Flooding and Stormwater
- Canopy Coverage and Biodiversity
- Smart Places

The project is being developed for occupation by future tenants who are at this stage unidentified. In line with industry standard practice, it is proposed that any applicable rating tools are coordinated with the future tenant. At this stage, the design has been progressed to ensure capability of rating once a tenant has been identified.

The commercial component of the development, namely the Class 5 office space, currently has net lettable area less than 1,000m^2 therefore is not subject to the requirements of SEPP Schedule 3 Standards for energy and water use for large commercial development (i.e. NABERS Energy and Water ratings not applicable).

4. Conclusion

The ESD strategy is being developed to align with the SEARs requirements and Sustainable Building SEPP requirements for the 6-8 Julius Road Data Centre development. These strategies will be realised through focused ESD initiatives involving building design that considers optimised energy generation, reduced greenhouse gas emissions and potable water use, optimised resource use and minimisation of waste throughout the whole lifecycle of the building.

The mitigation measures listed in Section 3 act to reduce the impacts of the proposal, particularly with regards to energy and water consumption. While savings of measures included in the design have been noted, other measures have been earmarked for further consideration where the savings will be further progressed through detailed design. As a result, it is not possible at this stage to give a definitive answer to the total savings achieved. Despite this, mitigations which have been included in the design have achieved significant savings across energy and water. Below provides a summary of the key savings.

- Energy use – Designing to an annual average PUE of 1.39 compared to an industry average of 1.59 results in a 34% energy use saving across the data hall infrastructure, and 13% overall saving when considering the IT load. Energy and greenhouse gas emissions targets are embedded within the NABERS Energy rating tool, and proposed development will be designed to achieve a 4.5-star NABERS Energy for Data Centre Infrastructure rating.
- Water use – Waterless heat rejection will enable the development to achieve a WUE close to 0.01, which is an enormous saving when compared to the industry standard of 1.8. This will save approximately a million kilolitres of water annually compared to an industry standard data centre and greatly reduce the burden on local water infrastructure.

The mitigation measures in Section 3 also act to impact or influence the ESD principles. The ESD principles that are particularly influenced by the above measures include:

- Intergenerational equity – By reducing environmental impacts and the consumption of resources due to the proposal, the measures help towards ensuring the health and productivity of the environment is maintained for the benefit of future generations.
- The precautionary principle – By reducing environmental impacts and resource consumption, the measures serve to avoid, wherever practicable, serious or irreversible damage to the environment.

A GHG emissions assessment and mitigation plan is in the appendix of this document.

Appendix – GHG Assessment and Mitigation Plan

See on following pages.

ARUP

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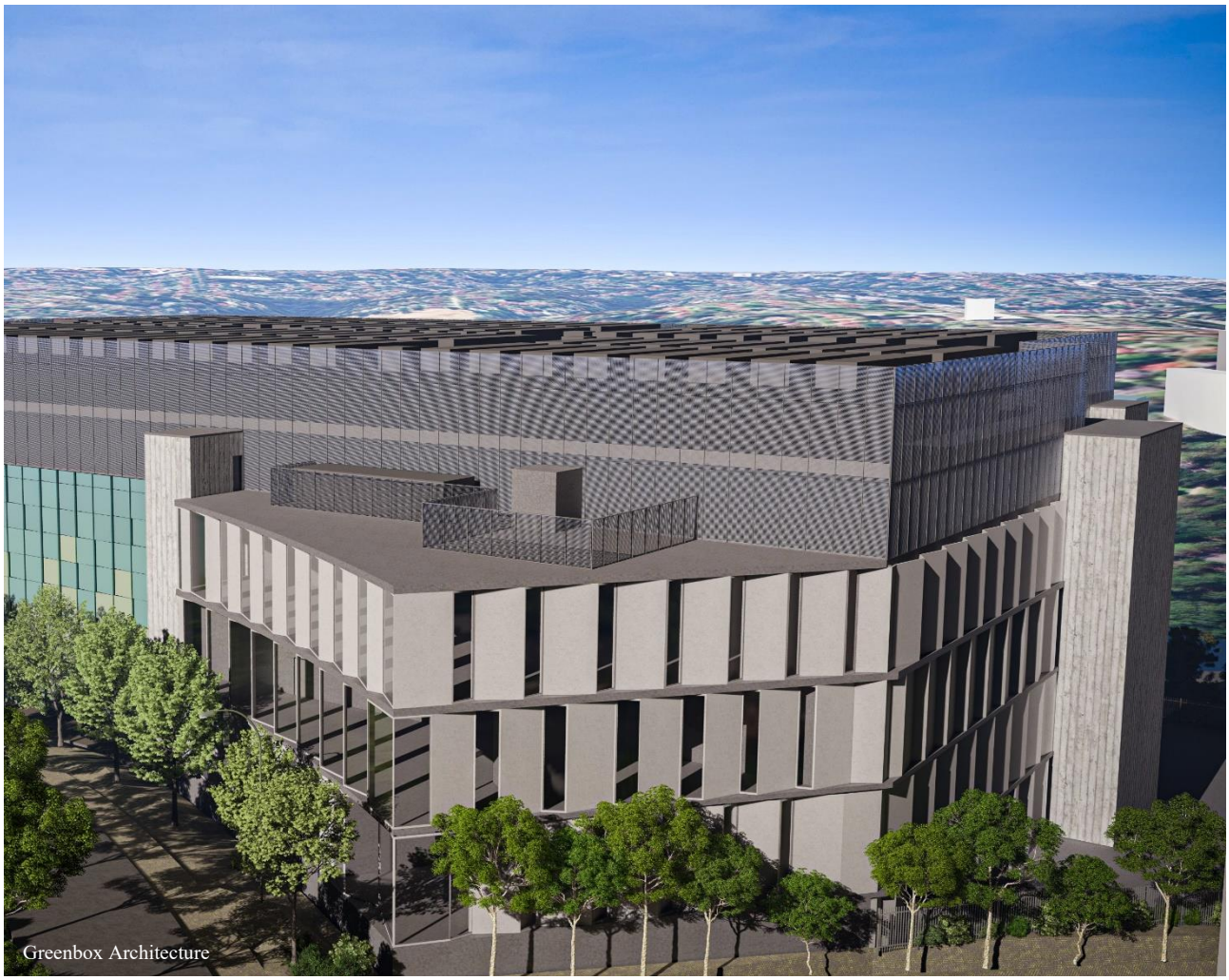
Julius Avenue Data Centre

SSDA Greenhouse Gas Emissions Assessment and Mitigation Plan

Reference: JADC-ARP-RP-ED-000002

V3 | 10 December 2025



Job number 306239-00

Arup Australia Pty Ltd | ABN 76 625 912 665

Arup Australia Pty Ltd
Level 5
151 Clarence Street
Sydney
NSW, 2000
Australia
arup.com

ARUP

Document Verification

Project title	Julius Avenue Data Centre
Document title	SSDA Greenhouse Gas Emissions Assessment and Mitigation Plan
Job number	306239-00
Document ref	JADC-ARP-RP-ED-000002
File reference	ESD-02

Revision	**Date**				
V1	23 May 2025	**Filename**	ESD-02 GHG Report - Julius Avenue Data Centre V1		
		Description	Initial Issue		
			Prepared by	**Checked by**	**Approved by**
		Name	DP	SG/AR	CS
V2	28 Nov 2025	**Filename**	ESD-02 GHG Report - Julius Avenue Data Centre V2		
		Description	Update for SSDA resubmission		
			Prepared by	**Checked by**	**Approved by**
		Name	MC	AR/NN	CS
V3	10 Dec 2025	**Filename**	ESD-03 GHG Report - Julius Avenue Data Centre V3		
		Description	Update for SSDA resubmission		
			Prepared by	**Prepared by**	**Prepared by**
		Name	MC	MC	CS

Issue Document Verification with Document ☑

Contents

Tables

Figures

Executive Summary

Purpose of the report

This GHG Assessment has been prepared by Arup on behalf of the Proponent to accompany a detailed State Significant Development Application (SSDA) for the data centre development at 6-8 Julius Avenue (SSD-80018208). This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project and to address the requirements in NSW EPA Guide for Large Emitters.

This report identifies the main sources of greenhouse gas emissions (GHGs) across the Proposal's construction, operation, and decommissioning phases. It presents annual and total Scope 1, 2, and 3 emissions, outlines the mitigation measures adopted, and demonstrates the Proposal's alignment with government net-zero policies and targets for 2050.

GHG emissions estimate

The GHG emissions estimate for the project is outlined in Table 1 below.

Table 1. Scope 1, 2 and 3 GHG emissions estimates for the Proposal across its lifecycle.

Scope	Stage	Emission source	Total Emissions (t CO2-e)	% of GHG emissions
1	A5	• Fuel and electricity consumption from on-site construction and installation activities	2,640	1.2%
	B1	• Refrigerant leakage • Diesel used in standby generator testing	28,277	12.8%
Total Scope 1			**30,917**	**13.9%**
2	B6	• Electricity (base building)	161,096	72.7%
Total Scope 2			**161,096**	**72.7%**
3	A1-A3	• Embodied emissions released during the manufacture of materials used in construction	26,244	11.8%
	A4	• Fuel use for construction materials transport to site during construction	1,839	0.8%
	B2-B3	• Maintenance of materials across lifespan of the Proposal*	0	0%
	B4	• Replacement of materials across lifespan of the Proposal	1,536	0.7%
	B7	• Water supply and wastewater discharged	44	0.0%
	C1-C4	• Deconstruction and demolition activities, transport and processing of demolition waste*	0	0%
Total Scope 3			**29,633**	**13.4%**
Proposal's total GHG emissions (i.e. Scope 1,2 and 3)			**221,677**	**100%**

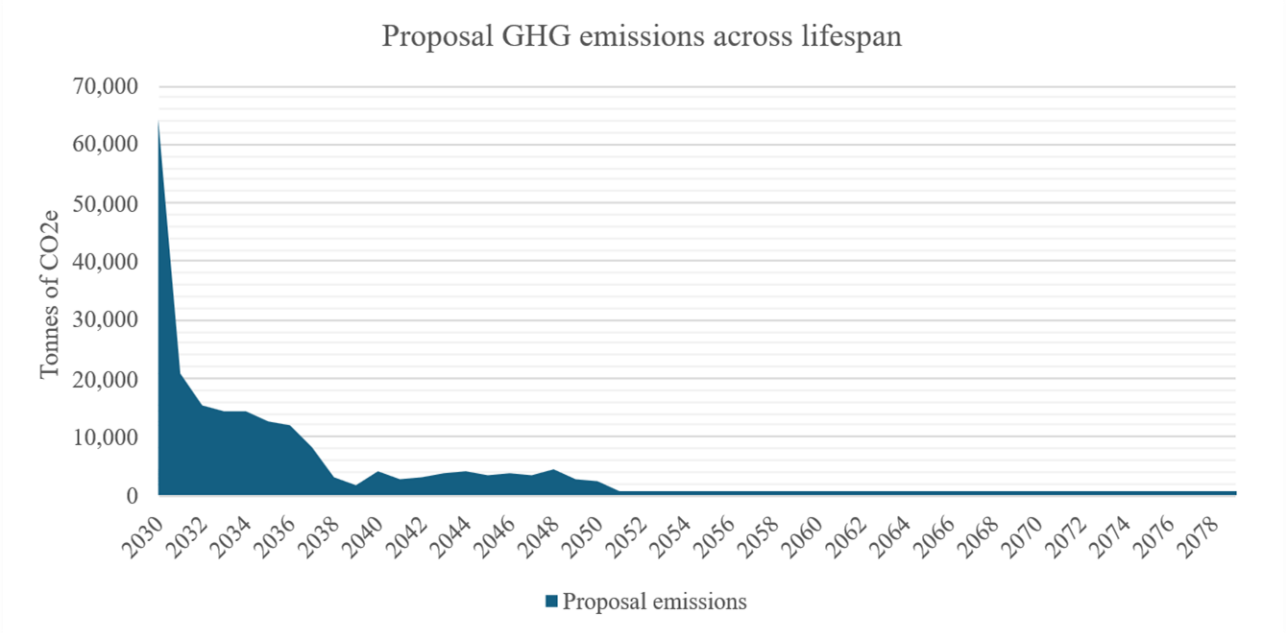
* Maintenance and replacement activities occurring in 2050 and beyond have been assumed to have zero emissions impact, in line with NSW's net zero targets. For the Proposal, major equipment and finishes replacement occurs after 20 years.

Key insights of the above emissions estimate are as follows:

- Scope 1 emissions only account for a small proportion of the total footprint. However, beyond 2050 these will remain as residual emissions to be offset unless emissions-free technology becomes available.
- Scope 2 emissions make up the majority of emissions due to significant electricity consumption during operations, from cooling of equipment and electrical losses etc. Emissions dramatically reduce from 2030 due to grid decarbonisation projections from the AEMO ISP – this can be seen in Figure 1 below – and can be further reduced with procurement of renewable energy.
- Scope 3 emissions only account for 8% of the Proposal's total footprint. However, since they occur upfront and before 2050, consideration has been given to low-carbon materials and materials rationalisation trough design optimisation, where feasible.

Across its lifecycle, the Proposal is expected to contribute **0.05%** and **0.24%** to current National and State's GHG inventories, respectively.

Figure 1. Proposal's annual GHG emissions over a 50-year period



Measures to reduce emissions

The Proponent recognises the importance of establishing net zero targets and notes that this is an ongoing, multi-stakeholder process that occurs at the corporate level. The proposed facility will include multiple GHG mitigation measures to address its scope 1, 2 and 3 emissions, to align with the NSW Net Zero Plan.

These mitigation measures will aim to reduce GHG emissions immediately, through smart design and construction, lean operation, as well as forward thinking strategies to ensure that the facility has a clear path to decarbonisation. The facility will be designed to be flexible and adaptable, acknowledging the rapidly changing technological advances in the industry, ensuring that future technologies can be retrospectively applied.

Table 2 summarises the initiatives proposed for implementation and those currently under investigation.

Table 2. Initiatives for implementation and under investigation.

Scope	Implemented initiatives
1	• Refrigerants with low GWP • Refrigerants leakage prevention • HVO compatible generators
2	• Energy reduction through waterside economiser to reduce chiller, higher operating temperatures, and high-efficiency equipment • Submetering • On-site solar PV • Customer driven renewable energy contracts
3	• Reduction of potable water though multi-layered metering strategies, rainwater harvesting, and high-efficiency equipment.

Other key additional initiatives being investigated include renewable energy procurement, structural design optimisation, low carbon material specifications, water recycling and reuse.

1. Introduction

This Greenhouse Gas (GHG) Assessment and Mitigation Plan ('the GHG Assessment') has been prepared to accompany a detailed SSDA for 6-8 Julius Road Data Centre development ('the Proposal') (SSD-80018208). In accordance with the NSW EPA Guide for Large Emitters, the Proposal is classified as a 'new development' and emissions are accounted for under the 'project-only' scenario.

The following sections will outline the proposed Greenhouse Gas emission (GHG) sources and lifecycle inventory, implemented and under consideration mitigation measures, and demonstrate alignment with NSW's net zero policies and targets.

This report will also outline the GHG goals of the project, with regard to scope 1, 2 and 3 emissions over the building life cycle, in addition to outlining the performance monitoring and reporting schedule, as per the NSW EPA Guide for Large Emitters requirements.

1.1 The Site

The Site is identified as 6-8 Julius Avenue, North Ryde, legally described as Lot 89 in Deposited Plan 1082131 (the Site). The Site is irregular in shape and is located on the south-eastern side of Julius Avenue, North Ryde.

The Site has a primary frontage of approximately 100m to Julius Avenue and has a partial rear frontage to Richardson Place (cul-de-sac) at the north-eastern corner. The Site has an area of approximately 2.863ha.

The Site is currently vacant. The north-western part of the Site was excavated and cleared of vegetation in 2009 as part of Modified Determination No. 1395/1999 previously approved on the Site.

The Site is zoned E3 Productivity Support pursuant to *Ryde Local Environmental Plan 2014* (RLEP 2014) and is located within the City of Ryde Local Government Area (LGA) which is approximately 15km north-west of the Sydney CBD.

Existing attributes of the Site and surrounding context are noted as follows:

- The Site is generally surrounded to the north-east, north-west, and south-west by commercial uses and E3 Productivity Support zoned land.
- Approximately 150m to the west of the Site is MU1 mixed Use zoned land which contemplates residential development to a height of 95m.
- The Site directly adjoins the Lane Cove National Park to the east and south-east which contains a walking track known as The Great North Walk and a fire trail.
- The Lane Cove River is located approximately 100m to the east of the Site.
- The Site directly adjoins the Ryde City Council Administrative Centre to the east.
- Approximately 500m to the west of the Site is the North Ryde Metro Station.

The nearest residential development is located approximately 300m to the south-east of the Site on the eastern side of Lane Cove River in Lane Cove North, and 300m to the south-west of the Site on the southern side of Epping Road in North Ryde.

An aerial view of the Site is provided in **Figure 2** below.

Figure 2 Aerial view of the Site (Source: Nearmap, 2024)

1.2 Proposed Development

The Proposal involves the construction and operation of a data centre and associated infrastructure and amenities, identified as the Julius Avenue Data Centre, comprising the following scope of works:

- Site preparation works, including tree removal;
- Earthworks and additional site retaining;
- Infrastructure comprising civil works and utilities servicing;
- Construction of a data centre including the following:
  - Ground level loading dock, services plantrooms and car parking for 38 cars, including 2 accessible;
  - 8 data halls across four (4) storeys with an IT load of 76 MW and a maximum power consumption of 120 MW, plus rooftop plant;
  - Three (3) storey office/front of house building;
  - Five (5) storey enclosed generator gantry to rear of data centre.
  - New Ausgrid 132 kilovolt (KV) Sub-Transmission Switching Station (STSS);
- A new pedestrian through-site link from Julius Avenue to Richardson Place; and
- Complementary landscaping and offset planting.

The Proposal includes works as identified in **Table 3** below.

Table 3 Development Particulars

Component	Documentation
Site Area	28,630sqm
Primary Land Use	Data Centre (16,647 m^2 GFA)
Ancillary Land Uses	Office premises (868 m^2 GFA)
Gross Floor Area	16,457 m^2
Floor Space Ratio	0.58:1
IT Load	76 MW
Maximum Power Consumption	120 MW
Building Height	40m
Car Parking	38 car parking spaces (including 2 accessible)
Landscaping/trees	Total landscaping and tree removal to be confirmed.
Back-Up Generators	48 x 3MW diesel back-up generators (data centre) + 1 x 1MW back-up generator (office)
Dangerous Goods	955kL diesel storage capacity (Data Centre = 12 x 75kL bulk tanks + 48 x 1kL day tanks + Office = 1 x 6kL tank + 1kL day tank)
Estimated Jobs	Total estimated jobs (construction and operation) to be confirmed.

1.3 SEARs Requirements

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 20 February 2025 issued for the SSDA (SSD-80018208). Specifically, this report has been prepared to respond to the Ecologically Sustainable Development SEARs issued below.

Table 4 SEARs Requirements - Ecologically Sustainable Development

Issue and Assessment Requirements	Response
8. Ecologically Sustainable Development	
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.	Refer to main body report ESD-01 Section 2.3 Specific commentary provided for each of the principles of ESD with examples of initiatives to be included in the development.
Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	Refer to main body report ESD-01 Section 3.2 Options for assessment of the development against relevant industry standards.
Demonstrate how the development minimises greenhouse gas emission (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	Refer to main body report ESD-01 Section 3.1, and this Appendix Initiatives provided in these sections address the specific requirements noted here for energy efficiency, water efficiency, WSUD and materials. This Appendix contains the GHG Assessment and Mitigation Plan developed in accordance with the NSW EPA Guide for Large Emitters.
If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies:	Refer to main body report ESD-01 Section 3.1

Issue and Assessment Requirements	Response
Demonstrate how the development has been designed to enable the general sustainability provisions, as defined by Chapter 3.2(1)	In addition to the requirements addressed in the previous item above, this section also address renewable energy generation, metering and monitoring of energy use as required by the SEPP.
SEPP: Provide a NABERS Embodied Emissions Material Form to disclose amount of embodied emissions attributable to the development in accordance with section 35B of the EP&A Regulation.	Refer NABERS Embodied Emissions Materials form submitted separate to this report.
SEPP: Provide a Net Zero Statement for the office component of the development.	The Sustainable Buildings SEPP requires a Net Zero Statement to be prepared for State Significant Developments and Large Commercial Developments (office with net lettable area (NLA) greater than 1,000m^2). Given the proposed office component is less than 1,000m^2 and will be ancillary and subservient to the primary use of the site as a data centre, a Net Zero Statement is not required.

2. Legislative and policy context

This report has been developed in the context of legislative drivers in NSW in which the Proposal is located. An overview of key policy and its relevance to the GHG mitigation report has been outlined in Table 5 below.

Table 5. Outline of the relevant policy and legislation as per Appendix C (Section 2) of the Guide for Large Emitters

Document	Description	Relevance to the GHG mitigation assessment
Climate Change (Net Zero Future) Act 2023 (NSW)	Legislates a comprehensive approach to achieving net zero emissions by 2050, including setting interim targets, establishing guiding principles, and creating an independent Net Zero Commission to monitor progress	Sets legally binding targets for reducing greenhouse gas emissions, including interim targets for 2030 and 2035, and the ultimate goal of net zero emissions by 2050. It provides a framework for monitoring and reporting progress.
Net Zero Plan Stage 1: 2020-2030	Outlines the state's strategy to reduce greenhouse gas emissions by 47-52% below 2005 levels by 2030, while fostering economic growth and job creation, as part of its broader goal to achieve net zero emissions by 2050	Outlines specific strategies and initiatives to reduce emissions by 47-52% below 2005 levels by 2030.
Protection of the Environment Administration Act 1991	Establishes the Environment Protection Authority (EPA) in New South Wales, outlining its responsibilities, powers, and management structure to oversee and enforce environmental protection laws	This Act establishes the Environment Protection Authority (EPA), which is responsible for enforcing environmental laws and regulations. The EPA oversee the enforcement of the Guide for Large Emitters in which this report responds to.
Protection of the Environment Operations Act 1997	Primary legislation for environmental protection in New South Wales, aiming to safeguard and enhance the environment and human health through integrated pollution control and sustainable development practices	Provides the primary legal framework for pollution control and environmental protection in NSW. It includes provisions for monitoring and managing emissions from various sources.

This GHG assessment has been prepared in accordance with Appendix C of the NSW Guide for Large Emitters and addresses the requirements of the NSW Climate Change Act 2023. The following table outlines how the Proposal responds to each of the guiding principles set out under the Act.

Table 6. Section 8 requirements of the Climate Change Act (2023) and alignment with the proposed development.

Guiding Principle	Detail	How it has been addressed
Urgency, Necessity and Early Action	A critical need to act to address climate change, which is a serious threat to the social, economic and environmental wellbeing of New South Wales. Action to address climate change should be taken as early as possible to minimise the cost and adverse impacts of climate change.	Many of the mitigations outlined in the report below will be implemented into design and provide evident GHG reductions from day-1 of building operation.
Fiscal Responsibility and Sustainable Growth	Action to address climate change should be taken in a way that is fiscally responsible, and promotes sustainable economic growth, and considers the economic risks of delaying action to address climate change, and considers the impact on rural, regional, and remote communities in New South Wales.	The mitigations proposed are commercially viable, have been balanced with the operational integrity of the proposed facility, and seek to reduce GHG emissions in a way that addresses climate change with the necessary urgency, whilst still ensuring the promotion of sustainable economic growth.
Ecologically Sustainable Development	Action to address climate change should be consistent with the right to a clean, healthy and sustainable environment. Action to address climate change should be consistent with the principles of ecologically	The proposed facility is designed to operate as an all-electric development, excluding nominal generator testing required solely for emergency backup purposes. As such, it is not expected to have a material impact on local air quality.

Guiding Principle	Detail	How it has been addressed
	sustainable development described in the Protection of the Environment Administration Act 1991, section 6.	
Consultation	Action to address climate change should involve appropriate consultation with affected persons, communities and stakeholders.	The proposed facility has been and continues to go through stakeholder engagement processes with Council, NSW Government, and the EPA through the SSDA process to ensure a satisfactory outcome. The facility will adopt industry best practice techniques and technologies to ensure that the need to address climate change is appropriately met. This development will have a positive impact on the local industry, fostering the opportunity for high-skilled labour opportunities, in addition to wider employment benefits such as site security. The development will also help meet the demands of a digital transition in NSW, supporting the rapid growth of a digital economy in the region.
Alignment with NSW Government ambitions	The Government of New South Wales is responsible for urgently developing and implementing strategies, policies and programs to address climate change, and ensuring the Government of New South Wales pursues best practice in addressing climate change.	The New South Wales Government has set targets for Net Zero by 2050, with 50% and 70% reductions over a 2005 baseline required by 2030 and 2035 respectively. The Proponent is committed to aligned with these targets, and has robust mitigation measures and a offsetting strategy in place. The majority of GHG emissions associated with the Proposal arise from tenant electricity consumption during operation. The Proponent is committed to enabling renewable electricity procurement for tenants, which is expected to result in an immediate and material reduction in emissions. In addition, the Proponent will explore adaptable or fossil-free backup systems as they become available in the market and procure them, where commercially viable. The reduction of Scope 3 emissions poses the biggest challenge regarding emission reduction, given that much of these emissions are produced in the supply chain and out of the building owner's control. Nonetheless, the Proposal is considering several low-carbon materials and dematerialisation strategies, which will reduce associated Scope 3 emissions, demonstrating a willingness to tackle this challenge head-on and make meaningful reductions in that area.
Biodiversity	The need to reduce the risk climate change poses to the survival of all species. Action to address climate change should consider the impact on local flora and fauna.	This Proposal has been designed to have minimal impacts on local flora and fauna. Relevant strategies are further described in the Environmental Impact Statement (EIS) and Biodiversity Development Assessment Report (BDAR),

3. GHG emissions assessment

3.1 Assessment boundary

The assessment boundary of the Proposal accounts for GHG emissions across project stages as detailed below. Stages expected to generate negligible GHG emissions have been excluded from the boundary, with justification outlined below.

Table 7. GHG boundary for the Proposal

Project stage	GHG Boundary	Timeframe	Description
1. Construction	Included	Construction programme is yet to be confirmed	Covers site preparation, building construction, installation of electrical, mechanical, and IT infrastructure. Embodied carbon from materials and on-site fuel use are the primary sources of emissions.
2. Operation	Included	2030 - 2079	Involves day-to-day running of the data centre, including electricity use for IT load and cooling systems, refrigerant leakage, and diesel generator testing. This stage is expected to contribute the majority of emissions.
3. Decommissioning	Included	2080 - onwards	Encompasses removal of equipment, infrastructure, and systems at the end of the facility's operational life.

3.1.1 Emissions scope

This assessment categorises the Proposal's greenhouse gas (GHG) emissions in accordance with the Greenhouse Gas (GHG) Protocol, a widely recognised framework developed by the GHG Protocol Initiative—a multi-stakeholder partnership convened by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Emissions are classified as follows:

- **Scope 1** – Direct GHG emissions from sources owned or controlled by the Proponent within the site boundary (e.g., emissions from on-site plant and equipment).
- **Scope 2** – Indirect GHG emissions from the generation of purchased energy consumed by the Proponent (e.g., electricity used in landlord-controlled areas).
- **Scope 3** – All other indirect GHG emissions not included in Scope 2 that occur across the Proponent's value chain (e.g., emissions from embodied materials, waste, transport, and tenant-controlled activities).

The GHG Protocol's scope classification framework is universally applicable; however, the allocation of emissions between scopes (i.e. direct vs indirect) may vary between entities depending on the degree of ownership or operational control over a particular asset or activity. This nuance is particularly relevant for colocation providers, such as the Proponent, where incoming tenants retain control over their allocated IT equipment, including rack power consumption and localised cooling requirements.

Accordingly, tenant electricity demand, estimated at 72% of facility's electricity consumption, has been excluded from the Proponent's GHG emissions boundary. This approach is consistent with the GHG Protocol's operational control method, under which tenants that lease or license space within the Proponent's data centres are considered to have control over their own rack power. As a result, while electricity consumption is classified as Scope 2 for the tenant, it is reported as Scope 3 by the Proponent. For clarity, tenant electricity has therefore been excluded from this assessment.

3.2 Emissions scenarios

In accordance with the EPA Guide for Large Emitters requirements for new developments, this assessment calculates GHG emissions under the 'Project-only' scenario, as described below.

'Project-only' scenario: This scenario comprises the Proposal and associated GHG emissions sources as outlined in 1.2 Proposed Development and 3.3 Emissions sources. Mitigation measures have been incorporated and are expected to support the Proposal in achieving the target Power Usage Effectiveness (PUE) value of 1.39 and low Water Usage Effectiveness of ~0.01, (see ESD-01).

3.3 Emissions sources

The table below summarises the emission categories and sources identified for the construction and operation stages of the Proposal. Lifecycle modules, as defined in Embodied Carbon Measurement for Infrastructure Technical Guidance ('the Technical Guidance'), have been added in brackets for clarity.

Table 8. Emissions sources identified for the Proposal

Scope	Emission categories	Emission sources
Scope 1	Liquid fuel	• Fuel use for on-site stationary plant and equipment during construction (A5 - construction) • Fuel use for diesel generator testing during operation (B1 – use)
	Refrigerant	• Leakage of refrigerants during operation (B1 – use)
Scope 2	Electricity	• Grid electricity for stationary plant and equipment during construction (A5 - construction) • Grid electricity during operation (base building) (B6 – operational energy)
Scope 3	Materials	• Embodied emissions released during the manufacture of materials used during construction (A1-A3 product) • Replacement and maintenance of materials across lifespan of asset (B2-B5 repair, maintenance and refurbishment)
	Fuel	• Fuel use for construction materials transport to site during construction (A4 – transport) • Fuel use dismantling and demolishing the building at the end-of-life (C1 – demolition) • Fuel use for transporting demolishes materials to waste facilities (C2 – transport EoL)
	Waste	• End-of-life treatment of demolished materials such as sorting and crushing (C3 waste processing) • Final treatment of demolished materials such as landfill or incineration (C4 Disposal)
	Water	• Water use for utilities (toilets, urinals, taps, showers, fire testing, heat rejection and irrigation) during and cooling systems during operation (B7 – operational water)

Table 9. Lifecycle modules as per RICS Whole Life Carbon Assessment for the Built Environment (2nd Edition)

Stage Name	Stage Description
A1–A3: Product Stage	Includes raw material supply (A1), transport to manufacturing (A2), and manufacturing (A3) of construction products. These represent upfront embodied carbon.
A4: Transport to Site	Covers emissions from transporting construction products from the factory to the construction site.
A5: Construction/Installation Process	Accounts for emissions from on-site construction activities and wastage during installation.
B1: Use	Emissions or impacts during the building's use phase (e.g. operation of materials or components), although often negligible for most construction products.
B2: Maintenance	Emissions from maintenance activities, such as cleaning, painting, or surface treatments.
B3: Repair	Covers emissions related to repairing components after damage or wear.
B4: Replacement	Emissions from replacing building components or systems during the building's life.
B5: Refurbishment	Emissions from planned or significant updates to components or systems during the asset's life.
B6: Operational Energy Use	Emissions from energy used in the operation of the building (regulated and unregulated energy).
B7: Operational Water Use	Emissions from water supply and treatment for building operations.
C1: Deconstruction and Demolition	Emissions from dismantling or demolishing the building at the end of life.
C2: Transport (End of Life)	Transport of building materials and components to waste processing or disposal facilities.
C3: Waste Processing	Emissions from processing waste before final disposal or recycling.
C4: Disposal	Emissions from the final disposal of building materials (e.g., landfilling or incineration).

3.4 Assessment methodology

The assessment methodology consisted of the following steps:

1. Defining emission boundary and sources: the emission boundary was defined identifying GHG emission sources that are relevant to the assessment.
2. Quantifying emission sources: The quantity of each relevant emission source was estimated in its relevant units, utilising proposal-specific data and information where possible or available, supplemented where necessary with asset-level carbon intensity benchmarks from previous projects and those published in the Technical Guidance.
3. Calculating emissions: Once the emission sources had been estimated in their relevant units, these were then converted to CO_2-equivalent units using known emission factors and industry recognised calculation methods to estimate the GHG emissions from the identified sources.

Proposal of mitigation measures: Proposed mitigation measures to reduce GHG emissions for significant GHG emission sources

3.5 Quantifying GHG emission sources

3.5.1 Data hierarchy

The data hierarchy adopted to quantify GHG emissions is summarised as follows:

1. Actual data – resource use quantities estimated for the Proposal.
2. Estimated quantities – resource use quantities estimated from design of the Proposal (quantity surveyor estimates) or from existing comparable data centres.
3. Early asset details (linked to sub-asset or element specific carbon intensity benchmarks) – project scope information broken down to the sub-asset element of the Proposal, for example, m^3 of concrete.
4. Material/capital spend (asset level carbon intensity benchmarks) – project scope information at the asset level (material spend for the Proposal).

Where possible, actual resource use quantities have been prioritised. However, as the Proposal is in the early design stage (planning), therefore estimated quantities, asset-level carbon intensity benchmarks and a number of assumptions have been used.

3.5.2 Emission factor types and hierarchy

For the GHG calculations, the following emission factor types and hierarchy was adopted from the Technical Guidance:

Table 10. Emissions factors and sources utilised in this assessment.

Emission factor database	Emission source	Lifecycle module
Australian National Greenhouse Account Factors (NGAF) 2024	Diesel, refrigerants	B1 - Use
2024 Integrated System Plan for the National Electricity Market - AEMO	Electricity Grid decarbonisation	B6 – Operational energy
Annual Environmental Performance Report 2024 – Sydney Water	Water supply and treatment emission	B7 – Operational water
Australian Life Cycle Inventory Database (AusLCI) emission factors	Construction materials Construction activities Materials transport to site End-of-life treatment of demolished materials such as landfill or incineration	A1-A3 – Product A4 – Transport A5 – Construction B2-B5 Repair & maintenance C - Disposal D - Recovery

3.5.3 Asset-level carbon benchmarks

Asset-level carbon benchmarks have been utilised to estimate GHG emissions associated with the Proposal as this stage of planning.

Benchmark values have been scaled to the Proposal's design and activity data to estimate associated emissions per source. Benchmark characteristics are described below.

Data Centre 1

- Detailed LCA results of a 6MW data centre project with GFA 12,369m2 located in Australia using material bill of quantities from the quantity surveyor and design documentation

Data Centre - Embodied Carbon Measurement for Infrastructure Technical Guidance

- Asset-level carbon intensity benchmarks for Data Centre building typology provided by Infrastructure Australia. These have low accuracy and are most suitable at early stages in the project life cycle when little project information is available.

Table 11. Asset-level benchmarks from previous projects and Embodied Carbon Measurement for Infrastructure Technical guidance

Benchmark	A1-A3	A4	A5	B2B3	B4	C1	C2	C3	C4	Unit
Data Centre 1	1084	76	82	2	623	9	68	0.1	65	kgCO2e/ m2
Data Centre – Technical Guidance	432	23.7	109	NA	NA	NA	NA	NA	NA	kgCO2e/ m2

3.5.4 Input data and assumptions

At this stage of planning, most of the data used for this assessment is available only on a high-level and/or generic basis at this stage, with assumptions and scaling on benchmark values made where needed.

The construction works are expected to include the following activities:

- Demolition.
- Excavation and site preparation.
- Construction and building works.
- Public domain works.

At the time of writing operations are assumed to commence in Q1 2030.

3.6 Summary of calculation methods and emissions

This section details the calculation methods and emission factors that were used to convert the baseline quantity of emission sources in tonnes of CO_2-equivalent ($tCO_{2\text{-}e}$). A summary of the approach taken is provided for each scope and emission source.

3.6.1 Scope 1

3.6.1.1 Fuel and electricity use (A5 – Construction and Installation Processes)

The following method was used to calculate the Scope 1 emissions from the combustion of diesel and electricity use associated with on-site construction and installation activities:

$$\text{GHG emissions (tCO2-e)} = ((\text{Benchmark} \times \text{GFA})/1000)$$

Where:

Benchmark is the *Data Centre – Technical Guidance* A5 emissions ($kgCO_2e/m^2$) (see Table 11)

GFA is the Proposal's GFA

3.6.1.2 Fuel use (B1 - Use)

The following method was used to calculate the Scope 1 emissions from the combustion of diesel (stationary energy) during the testing of the emergency generators:

$$\text{GHG emissions } (tCO_{2\text{-e}}) = ((Q \times ECF)/1000) \times (EF_{GHG})$$

Where:

Q is the quantity of fuel (kL).

ECF is the relevant energy content factor (GJ/kL).

EF_{GHG} is the total GHG emission factor, taking into account the carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emission factors, expressed in CO_2 equivalent ($tCO_{2\text{-e}}/GJ$).

Table 12. Fuel emission factors (Scope 1)

Fuel type	Energy content factor (GJ/kL)	Emission factor ($tCO_{2\text{-e}}$ /GJ)	Source
Diesel (Stationary energy purposes)	38.6	70.2	Table 8, NGA Factors 2024

For standby generators to be ready to operate should an unexpected interruption to mains power occur, a regular maintenance schedule is required. The testing regime from a similar past project outlined has been adapted based on the test running times developed for the Proposal. A total of 15,533 minutes (264.4 hours) of generator run time where diesel fuel is used has been estimated, equating to 132.2 hours of total testing time based on two generators tested simultaneously.

Table 13. Generators in Proposal

Generator	Rated Power (MW)	Quantity
Data hall generator	3	48
Office generator	1	1

Table 14. Proposed standby generator testing schedule

Test	Runtime (Minutes)	Cooldown (excl from runtime)	No of Gens	Tests annually	Total Run Times (Minutes)	Description
Monthly	27	10	48	12	3,888	Tested under 100% load
Total			**15,553**			**264.4 hours**

The diesel usage rate for emergency generator testing has been calculated based on typical industry-standard performance data and insights from past projects, assuming a diesel density of 0.85 kg/L. The value provided in Table 15 below are consistent with industry averages

Table 15. Diesel usage rate

Generator load	Rated power (kW)	Diesel consumption rate (g/kWh)	Diesel consumption rate (L/hr)
100%	3308	205	798
75%	2480	200	584
50%	1653	215	418
25%	827	233	227
55%	-	-	450

3.6.1.3 Refrigerants (B1 – Use)

The following method was used to calculate the Scope 1 emissions from the use of refrigerants, as sourced from product specific information and the NGA Factors:

$$\text{GHG emissions } (tCO_{2\text{-}e}) = Q \times GWP/1000 \times LR$$

Where:

Q is the quantity of refrigerant (kg).

GWP is the global warming potential of refrigerants used ($kgCO_{2\text{-}e}$/kg refrigerant) as per the equipment specification.

LR is the annual leakage rate.

Table 17 outlines the GWP and leakage rate of the refrigerant used in the Scope 1 assessment.

Table 16. Chiller and refrigerant charge in Proposal

Unit	Capacity (kW)	Refrigerant charge (kg)	Quantity
Data Dall Chiller	1200	340	96

Table 17 – Refrigerant emission factors (Scope 1)

GWP (AR5)	Source	Annual leakage rate	Source
1	https://ww2.arb.ca.gov/resources/documents/high-gwp-refrigerants	4%	CIBSE TM65: Embodied Carbon in Building Services (2021)

3.6.2 Scope 2

3.6.2.1 Grid Electricity (B6 – Operational energy)

The following method was used to calculate the Scope 2 GHG emissions from the consumption of electricity:

$$\text{GHG emissions } (tCO_{2\text{-}e}) = (Q \times EF^{1}) + (Q \times EF^{2})$$

Where:

Q is the quantity of purchased grid electricity (MWh).

EF^1 is the emission factor for NSW electricity generation (Scope 2) ($tCO_{2\text{-}e}$/MWh).

EF^2 is the emission factor for NSW electricity distribution losses (Scope 3) ($tCO_{2\text{-}e}$/MWh).

The emissions intensity of grid-supplied electricity (Scope 2) is directly influenced by the mix of generation technologies within the National Electricity Market (NEM), with a greater reliance on fossil fuels resulting in higher emissions per megawatt-hour (MWh). As the NEM continues to transition toward low- and zero-emission technologies, emission factors are expected to decline correspondingly.

AEMO's 2024 Integrated System Plan (ISP) outlines a rapid decarbonisation pathway under the 'Step Change' scenario, which anticipates significant policy action and investment in renewable energy. This scenario projects that renewable energy will account for more than 80% of electricity supplied to the NEM by 2030, supporting Australia's commitment to achieving net zero emissions by 2050. This trajectory indicates a substantial decline in Scope 2 emissions intensity over the coming decades.

The proposed facility is expected to be fully operational by Q1 2030 and has a design life extending approximately 50 years, to around 2080. Scope 2 emissions calculations for the operational phase have been based on the emission intensity projections under the Step Change scenario. In line with the NSW Government's Net Zero Plan and national targets, grid electricity emissions reduce to zero by 2050.

For Scope 3 emissions associated with upstream electricity distribution losses, emissions factors from the National Greenhouse Accounts Factors (NGAF) have been applied. These factors have been adjusted using the same decarbonisation trajectory as the Step Change scenario, ensuring consistency in the treatment of projected reductions across both Scope 2 and Scope 3 emissions related to electricity consumption.

Table 18. Electricity generation and distribution losses emissions factors for NSW

Year	Electricity generation Scope 2 ($kgCO2\text{-}_e$/kWh)	Distribution loses Scope 3 ($kgCO2\text{-}_e$/kWh)
2030	0.11	0.015
2031	0.07	0.008
2032	0.05	0.005
2033	0.05	0.004
2034	0.05	0.004
2035	0.04	0.004
2036	0.04	0.003
2037	0.03	0.003
2038	0.01	0.002
2039	0.00	0.000
2040	0.01	0.000
2041	0.01	0.001
2042	0.01	0.001
2043	0.01	0.001
2044	0.01	0.001
2045	0.01	0.001
2046	0.01	0.001
2047	0.01	0.001
2048	0.02	0.001
2049	0.01	0.001
2050	0.01	0.001

Sources:

- AEMO 2024 Integrated System Plan (Step Change scenario projections)
- National Greenhouse Accounts Factors 2024 (Electricity distribution losses, Scope 3 factors)

3.6.3 Scope 3

3.6.3.1 Materials (A1 – A3 Product)

The following method was used to calculate the Scope 3 emissions from manufacturing of construction materials.

GHG emissions (tCO2-e) = ((Benchmark x GFA)/1000)

Where:

Benchmark is the *Data Centre 1* A1 – A3 emissions (kgCO2e/m2) (see Table 11)

GFA is the Proposal's GFA

3.6.3.2 Materials (B2-B5 repair, maintenance and refurbishment)

The following method was used to calculate the Scope 3 emissions from maintenance and refurbishment of materials within the Proposals 50-year lifespan.

GHG emissions (tCO2-e) = ((Benchmark x GFA)/1000)

Where:

Benchmark is the *Data Centre 1* B2-B5 emissions (kgCO2e/m2) (see Table 11)

GFA is the Proposal's GFA

3.6.3.3 Fuel (A4 Transport)

The following method was used to calculate the Scope 3 emissions from fuel use to transport materials to the Proposal's site.

GHG emissions (tCO2-e) = ((Benchmark x GFA)/1000)

Where:

Benchmark is the *Data Centre 1* A4 emissions (kgCO2e/m2) (see Table 11)

GFA is the Proposal's GFA

3.6.3.4 Decommission and demolition waste (C1 – C4 End of Life)

The following method was used to calculate the Scope 3 emissions from demolition activities and transport and processing of demolition waste at the Proposal's end-of-life)

GHG emissions (tCO2-e) = ((Benchmark x GFA)/1000)

Where:

Benchmark is the *Data Centre 1* C1-C4 emissions (kgCO2e/m2) (see Table 11)

GFA is the Proposal's GFA

3.6.3.5 Water and wastewater emissions (B7 – Operational water)

$$\text{GHG emissions } (tCO_{2\text{-}e}) = ((Q^1 \times EF^1) + (Q^2 \times EF^2))/1000$$

Where:

Q^1 is the quantity of potable water supplied to the facility (kL)

Q2 is the quantity of wastewater discharged from the facility (kL)

EF1 is the emission factor for potable water supply in NSW (Scope 3) ($kgCO_2$-e/kL).

EF2 is the emission factor for wastewater treatment in NSW (Scope 3) ($kgCO_2$-e/kL).

The emissions associated with potable water supply and wastewater treatment are categorised as Scope 3 and result from the upstream energy use required to treat, pump, and distribute water, as well as process wastewater. These emissions are quantified using intensity factors published in the *Sydney Water Annual Environmental Performance Report 2024*, which provides the latest regional estimates of greenhouse gas emissions per kilolitre (kL) of water supplied and wastewater processed.

Water demand and sewer blowdown volumes for the proposed facility have been estimated based target Water Usage Effectiveness (WUE) of 1.55 for the facility and project information, on and are expressed in kL/year.

In recognition of broader decarbonisation trends across infrastructure and utility sectors, the emission factors applied have been projected to decline in line with the AEMO *2024 Integrated System Plan (ISP)* Step Change scenario. This reflects the anticipated reduction in upstream electricity emissions associated with water utility operations, consistent with national net zero commitments. Emission factors are assumed to reach zero by 2050 in accordance with the NSW net zero target.

Table 19. Annual potable water supply and wastewater discharge of the Proposal

Water Stream	Quantity	Unit
Potable Water Consumption	7,242	kL/year
Wastewater Discharge	5,794	kL/year

Table 20. Water supply and wastewater discharge emissions factors

Year	Potable water supply ($kgCO2\text{-}_e$/kL)	Wastewater treatment ($kgCO2\text{-}_e$/kL)
2030	0.34	0.07
2031	0.22	0.04
2032	0.17	0.03
2033	0.17	0.03
2034	0.16	0.03
2035	0.14	0.03
2036	0.13	0.03
2037	0.08	0.02
2038	0.02	0.00
2039	0.01	0.00
2040	0.03	0.00
2041	0.03	0.01
2042	0.03	0.01
2043	0.04	0.01
2044	0.04	0.01
2045	0.03	0.01
2046	0.04	0.01
2047	0.03	0.01

Year	Potable water supply (kgCO2-e/kL)	Wastewater treatment (kgCO2-e/kL)
2048	0.05	0.01
2049	0.02	0.00
2050	0.02	0.00

Sources:

- Sydney Water Annual Environmental Performance Report 2024
- AEMO 2024 Integrated System Plan (Step Change scenario projections)

4. GHG Mitigation measures

The proponent recognises the importance of aligning with NSW Net Zero Plan, which has set ambitions to tackle climate change through the setting of GHG reduction targets of 50%, 70% and Net Zero by 2030, 2035 and 2050 respectively.

To support alignment with net zero targets, the proposed facility will incorporate a range of GHG mitigation measures across Scope 1, 2, and 3 emissions. These measures are intended to deliver immediate emissions reductions through smart design in both construction and operation, while also embedding forward-looking strategies to enable a clear pathway to long-term decarbonisation. The facility will be designed to be flexible and adaptable, acknowledging the rapidly changing technological advances in the industry, ensuring that future technologies can be retrospectively applied.

In the following section, implemented initiatives and initiatives under investigation are discussed.

4.1 Measures to address scope 1 emissions

4.1.1 Low-Global Warming Potential (GWP) refrigerants

The proposed development has considered the GWP of any refrigerant type as part of the specification for chillers on site. Low-GWP refrigerants have a much lower potential to contribute to global warming compared to traditional refrigerants, and therefore the specification of a low-GWP chiller refrigerant positively contributes to the reduction of the facilities Scope 1 emissions.

4.1.2 Leak detection

As technology advances and systems optimise, the likelihood of refrigerant leakage decreases. For example, a general assumption for annual refrigerant leakage is <4%. The specification of low-GWP refrigerants, as outlined above, also helps to mitigate this impact as low-GWP refrigerants, when leaked, have a significantly lower impact on global warming compared to high-GWP refrigerants.

Despite this, refrigerant leakage is a common issue that data centre operators face, and it negatively impacts their Scope 1 emission reporting. Considering this, the proposed facility will utilise industry best practice technology in the form of built-in leak detection systems for applicable units, ensuring that systems are monitored continuously and the prevention of excessive leakage of all GWP systems is maintained.

4.1.3 Fossil fuel-free backup generators

The proposed development will install generators capable of running on HVO (Hydrotreated Vegetable Oil), a renewable and lower-emission fuel alternative to diesel. It is noted that the potential to procure HVO may be limited by the supply chain and availability in market.

4.2 Measures to address scope 2 emissions

4.2.1 Energy reduction and equipment optimisations

Energy consumption will be minimised through efficient design and optimisation of mechanical systems including higher operating temperature set points, an energy management system and high efficiency equipment.

The data centre design has a targeted PUE of 1.39, which performs comparably better than the industry standard PUE of 1.59. Designing to this PUE, over the industry average, results in roughly 97,215 MWh per year annual savings in energy use.

This PUE is consistent with a 4.5-star NABERS Energy for data centres (Infrastructure) rating. A 4.5-star rating typically reflects a Power Usage Effectiveness (PUE) of approximately 1.48 or lower, indicating a high standard of energy efficiency. In comparison, a 4-star rating generally corresponds to a PUE of around 1.61. The higher rating demonstrates improved infrastructure performance and reduced operational energy intensity, contributing to lower Scope 2 emissions.

4.2.2 Submetering

To support optimised operational performance and reduce Scope 2 emissions, the facility will incorporate extensive sub-metering. This system will enable detailed monitoring of energy consumption across key systems, facilitating the identification of inefficiencies and opportunities for improvement. Insights gained through sub-metering will support ongoing efforts to optimise cooling performance, reduce overall energy use, and minimise associated Scope 2 emissions.

4.2.3 Customer driven renewable energy contracts

Tenant electricity consumption will be the main driver of carbon emissions for the facility. Based on current design, this is estimated at 78%. Therefore, the Proponent will support tenants who choose to self-procure renewables to offset their emissions in the facility.

The proponent will work with utility providers, energy retailers and renewable project developers to offer the data centre tenants innovative and commercially attractive renewable electricity supply options. At the same time, the Proponent will support tenants who choose to self-procure renewables to offset their Scope 2 emissions in the facility. The Proponent will support this outcome by providing granular breakdowns of energy consumption and associated emissions.

4.2.4 Initiatives under investigation

Potential strategies to minimise Scope 2 emissions currently under investigation include:

- High performing envelope that reduces HVAC energy and reliance on artificial lighting.
- On-site solar photovoltaic (PV) systems, with the generated renewable energy primarily directed toward meeting the operational energy demand of the office areas.
- Efficient LED lighting with motion sensing throughout
- Materials with high SRI to reduce Heat Island Effect
- Renewable energy Power Purchase Agreement (PPA) for base building

4.3 Measures to address scope 3 emissions

4.3.1 Water use reduction

Water consumption will be minimised through a range of measures including multi-layered metering strategies, rainwater harvesting, and deploying high-efficiency equipment to achieve a balance between energy consumption and water consumption.

Fully air-cooled HVAC plant will be used to greatly reduce water use on the project, with an expected Water Use Effectiveness (WUE) rating for the facility of ~0.01. This metric is used to determine the water efficiency of data centres, a lower number indicates improved efficiency. The global average WUE for data centres is 1.8. A 0.01 WUE compared to 1.8 would save approximately 1,000,000 kilolitres of water per year (assuming 85% load average).

4.3.2 Initiatives under investigation

Potential strategies to minimise Scope 3 emissions currently under investigation include:

- Use of native and indigenous plants with low water requirements
- Recirculation and capture of at least 80% of fire system testing water
- Efficient fixtures and fitting with high WELS rating
- Structural optimisation (dematerialisation), ;ow-carbon concrete and steel specification
- Construction and demolition waste management plan
- Provision of EV charging stations

5. Summary of GHG emissions

Table 21 provides a summary of the total Scope 1, 2 and 3 emissions of the Proposal across its lifespan. The Proposal has a total of 0.58 $MtCO_2e$. Figure 3 below shows the Proposal's total annual emissions (i.e., scope 1, 2 and 3 combined) across its lifespan. Figure 4 below shows the proportional impact of each lifecycle stage relative to the Proposal's total emissions for that year. Following the projected decarbonisation of the electricity grid by 2050, generator testing and refrigerant leakage constitute the predominant sources of residual emissions.

Table 21. Summary of Scope 1, 2 and 3 emissions for the Proposal

Scope	Stage	Emission source	Total Emissions (t CO2-e)	% of GHG emissions
1	A5	• Fuel and electricity consumption from on-site construction and installation activities	2,640	1.2%
	B1	• Refrigerant leakage • Diesel used in standby generator testing	28,277	12.8%
Total Scope 1			**30,917**	**13.9%**
2	B6	• Electricity (base building)	161,096	72.7%
Total Scope 2			**161,096**	**72.7%**
3	A1-A3	• Embodied emissions released during the manufacture of materials used in construction	26,244	11.8%
	A4	• Fuel use for construction materials transport to site during construction	1,839	0.8%
	B2-B3	• Maintenance of materials across lifespan of the Proposal*	0	0%
	B4	• Replacement of materials across lifespan of the Proposal	1,536	0.7%
	B7	• Water supply and wastewater discharged	44	0.0%
	C1-C4	• Deconstruction and demolition activities, transport and processing of demolition waste*	0	0%
Total Scope 3			**29,633**	**13.4%**
Proposal's total GHG emissions (i.e. Scope 1,2 and 3)			**221,677**	**100%**

* Maintenance and replacement activities occurring in 2050 and beyond have been assumed to have zero emissions impact, in line with NSW's net zero targets. For the Proposal, major equipment and finishes replacement occurs after 20 years.

Figure 3. Proposal's annual GHG emissions over a 50-year period

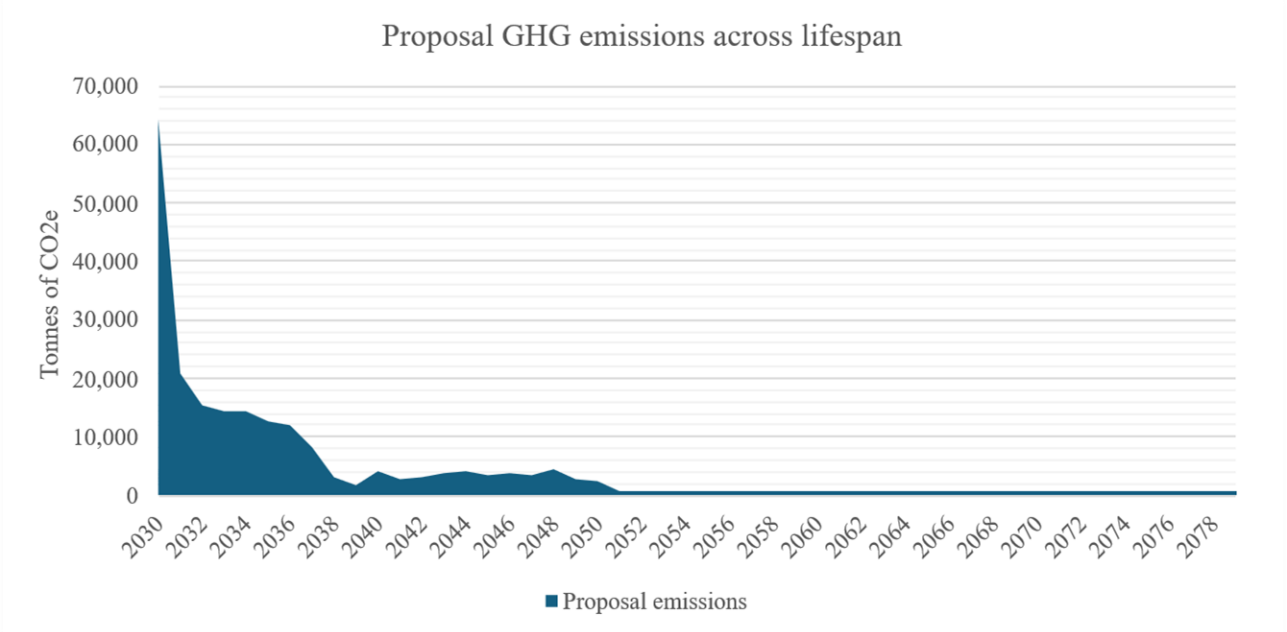
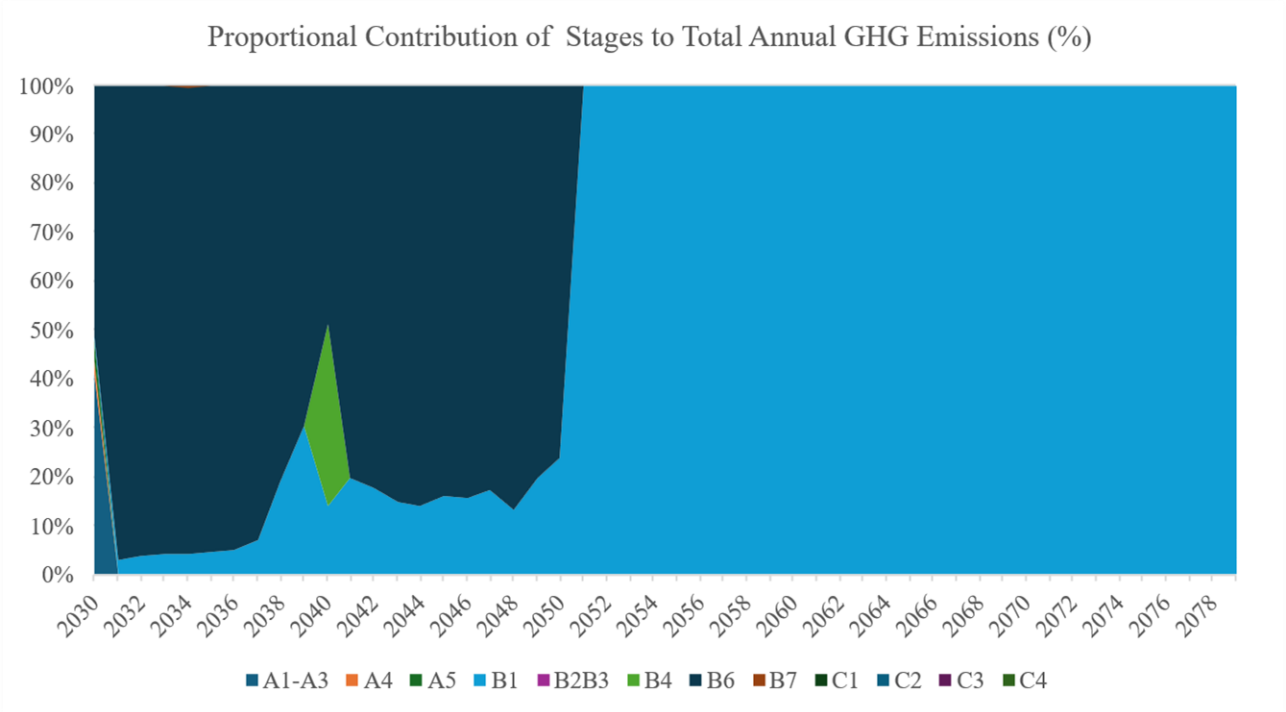


Figure 4. Proportional contribution of each lifecycle stage to annual GHG emissions for the Proposal



5.1 Comparison against Australian and NSW GHG emissions

The comparison of the Proposal's GHG emissions against the Australian and NSW GHG emissions is shown in Table 22. Comparison of Proposal's GHG emissions against that of NSW and Australia. The Proposal's total GHG emissions of 0.222 Mt CO_2**-e** is **0.05% and 0.24%** respectively of national (ending June 2024) and state (ending June 2022) GHG emissions.

Table 22. Comparison of Proposal's GHG emissions against that of NSW and Australia

GHG emissions	Total GHG emissions (MtCO2-e)	Proposal's percentage of national and state emissions	Source
National (ending June 2024)	440.6	0.05%	Department of Climate Change, Energy, the Environment and Water
NSW (ending June 2022)	94	0.24%	National Greenhouse Accounts

6. Goals setting

The Proponent recognises the importance of establishing net zero targets and notes that this is an ongoing, multi-stakeholder process that occurs at the corporate level. This process requires continued engagement with facility tenants to clarify and allocate emissions responsibilities

NSW have taken action to tackle climate change through legislated 2030, 2035 and 2050 targets that set a clear path to achieving Net Zero emissions.

Through a Net Zero Commission, the state will assess proposed developments on their alignment and support with the following ambitions:

- 50% GHG emission reduction by 2030 compared to 2005 levels
- 70% GHG emission reduction by 2035 compared to 2005 levels
- Interim targets to be prescribed in 2040 and 2045 based on progress against the aforementioned targets
- State Net Zero status by 2050

In addition to these Net Zero targets, the State is looking to further economic growth, supporting initiatives in the fields of Energy, Electric Vehicles, Hydrogen, Technology and the Built Environment.

The proposed facility acts as a critical service for meeting NSW's ambitions for economic growth, digitalisation, and the energy transition, while also demonstrating that this can be achieved through high sustainability performance and efficient resource use.

The Scope 1 emissions for the proposed facility account for ~14% of the total Proposal's emissions.

Prior to any potential offset, the proposed facility will aim to deliver reductions in Scope 1 emissions through the mitigation of high-intensity GWP products and early detection and prevention of refrigerant leakage. In addition, further Scope 1 emissions mitigation through adaptable generator specification and fossil-free back up equipment will be investigated.

The Scope 2 emissions for the proposed facility account for ~73% of the total development emissions.

Scope 2 emission reductions will be driven by ongoing operational efficiency and optimisation measures, supported by a continuous cycle of assessment, implementation, and refinement. The Proponent will also play a key role in supporting tenants' transition to renewable electricity by facilitating access to viable procurement options. Through engagement with utility providers, energy retailers, and renewable energy project developers, the Proponent aims to offer innovative and commercially attractive supply arrangements. This will be underpinned by the provision of detailed energy consumption data and associated emissions profiles, enabling tenants to make informed, sustainability-aligned decisions.

The mitigation of Scope 3 emissions is an ongoing challenge with the industry and requires continued collaborative effort between the data centre operators and supply chain to decarbonise. As previously highlighted, the proponent of this proposed development will strive to mitigate its Scope 3 impact wherever commercially viable, working with both its supply chain and head contractor to seek innovative, best-practice solutions.

Data centres now are widely classed as critical infrastructure, acting as the backbone of an ever-growing digital economy that is so heavily reliant on cloud computing, data storage, artificial intelligence and real time digital services. This proposed facility, in addition to aligning with NSW's ambitions for Net Zero by 2050, will be a valuable addition to the digital economy of the region and serve as best-practice example of sustainable data centre design and build.

7. Offsetting

Mitigating carbon emissions through smart design and lean operation are the best ways to systemically reduce to environmental footprint of the development, however, even with these measures in place it is likely that some residual emissions will need to be mitigated through an offset scheme.

For the Proposal, residual emissions beyond 2050—the year by which the facility is expected to achieve net zero in line with government targets—are estimated at approximately 566 tCO_2e per annum, totalling around 16,400 tCO_2e over the remaining operational life until decommissioning. This represents a conservative assumption, based on the continued use of conventional diesel generators and the exclusion of potential future upgrades to adaptable or fossil-free backup systems.

The Proponent has committed to offsetting residual emissions as required by government policies and net zero targets. Beyond this obligation, any additional offset procurement will be evaluated for commercial viability.

8. Performance monitoring and reporting

GHG mitigation plan review, monitoring and reporting

As part of the ongoing process of setting its own net zero goals and corporate emissions reporting, the Proponent have confirmed they are establishing an emissions baseline that will then inform emissions reduction targets as part of a wider road map to net zero. Once established, this will be used to review, monitor and report the GHG impact of then Proponent's operations.

This should be inclusive of:

- A description of the measures that would be implemented to monitor and periodically report on the GHG emissions performance relative to the project's emissions goals
- Details of monitoring and reporting on the implementation and effectiveness of emission mitigation measures and progress being made towards goals
- A description of related GHG reporting obligations, such as under the NGER scheme, and whether any additional information on GHG emissions is proposed to be made publicly available (if so, indicate the format, frequency, and form of such reporting).

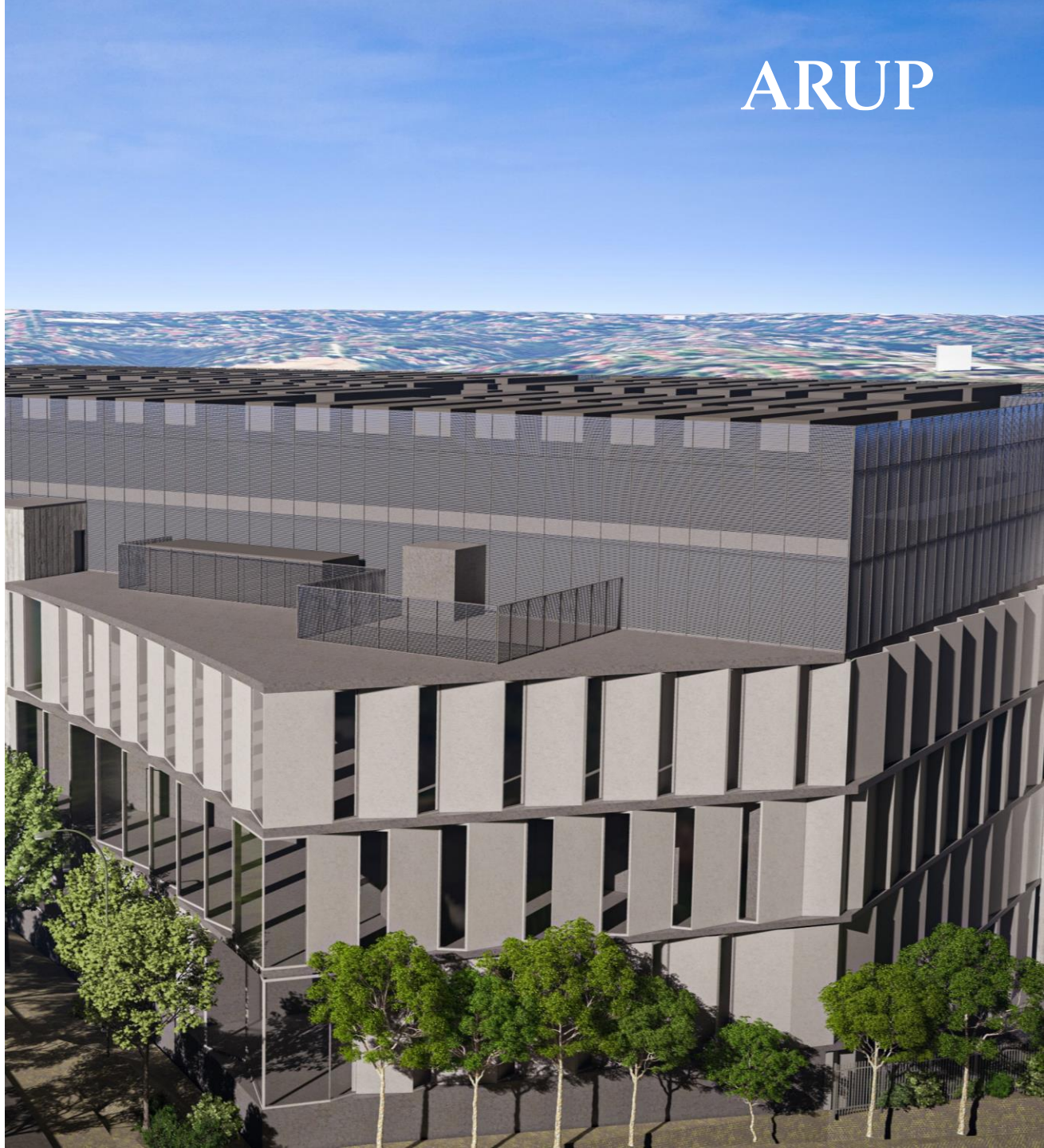
The Proponent will also continue to monitor market trends and new technologies that will enable the decarbonisation of their business operations.

ISPT
Julius Avenue Data Centre
Section J Assessment

SSDA resubmission

28 Nov 2025

Document reference: JADC-ARP-RP-ED-000004



NCC Section J assessment

Overview

We have undertaken preliminary deemed-to-satisfy (DTS) calculations in accordance with the following scenarios to understand performance of the building fabric from an NCC compliance perspective:

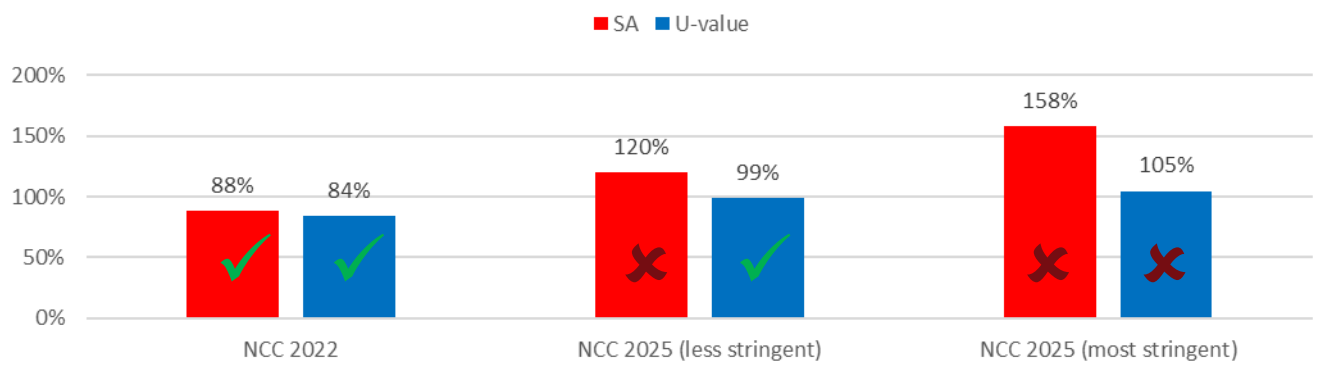
- NCC 2022 Part J4
- NCC 2025 ‘less stringent’; and
- NCC 2025 ‘more stringent’.

NCC 2025 ‘more stringent’ case is based on performance that was released in the public comment draft version of the code. NCC ‘less stringent’ is based on performance that has been subsequently issued to Arup by the ABCB for comment on. The outcome of NCC 2025 is TBC, though we expect it will land somewhere between these two cases.

Results are be presented similar to the example on the RHS. Both the red bar (Solar Admittance) and blue bar (U-value) must be below 100% for the building fabric to be deemed complaint.

We note that in NCC 2025, unlike NCC 2022, every floor must be assessed individually, i.e. whole of building assessment. If one floor is not compliant, J1V3 energy modelling pathway is required.

EXAMPLE RESULT – WHOLE BUILDING



NCC Section J assessment

Conditioned area boundary

The thermal envelope including conditioned areas subject to Section J is outlined for each floor in Appendix A. Shaded green area in the RHS outlines the general thermal envelope for typical floors (L2 to L4) which includes:

- Front of house (FOH) office spaces incl. support facilities; and
- Corridors adjacent to FOH spaces providing entry to data halls

We note that a DTS solution requires extensive ceiling insulation to the Ground floor soffit in order to close the thermal boundary of the L1 conditioned spaces. Ceiling details would need to ensure insulation the required insulation can be accommodated. Otherwise, changes to the thermal boundary or a performance solution approach via J1V3 could be explored in due course to test removal of insulation to these areas.

NCC Section J assessment

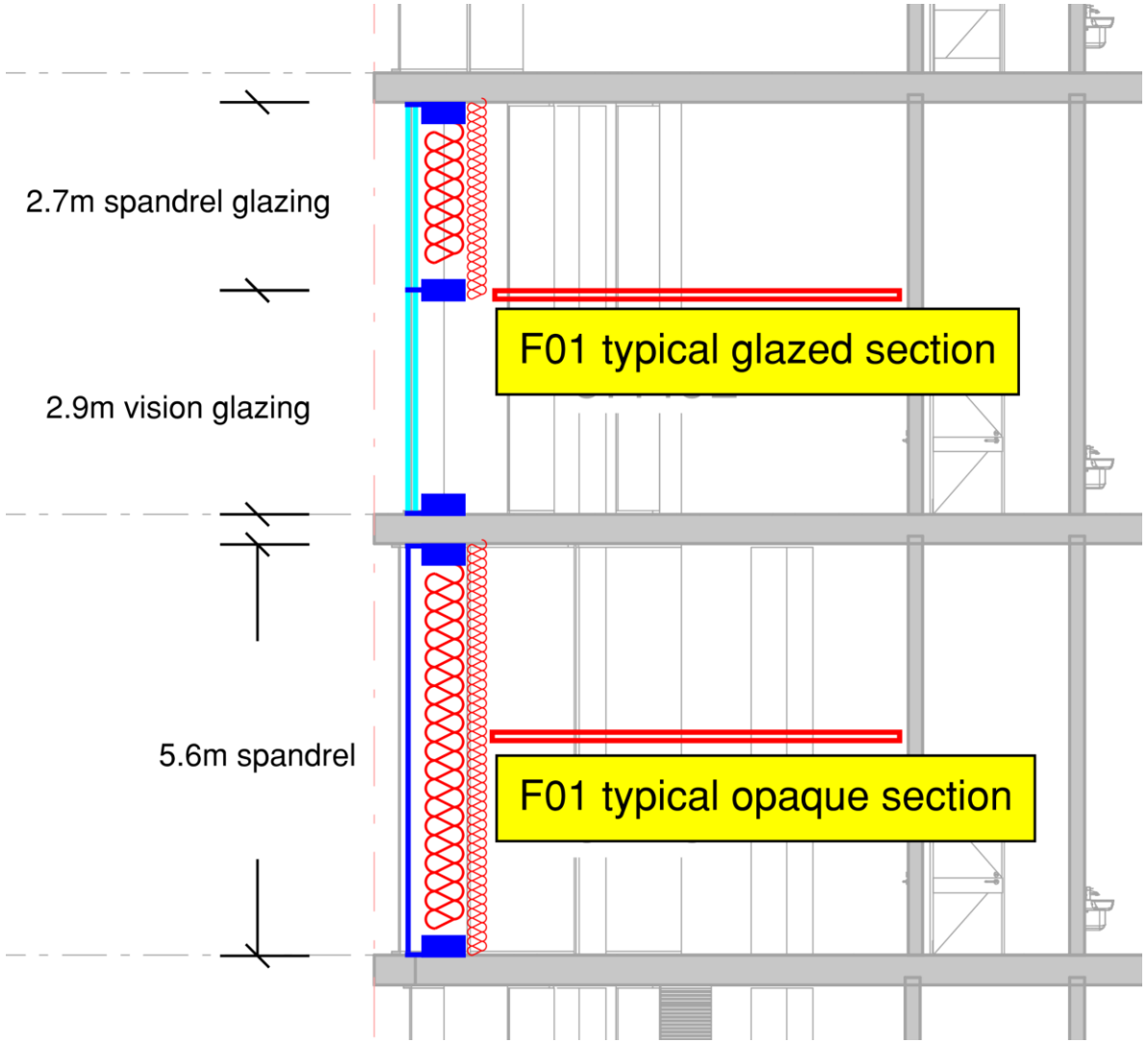
FOH façade performance

Assessment has been undertaken assuming the following window-to-wall ratio (WWR) build-up for the FOH façade:

- 2.9m ht glazing (where glazed)
- 2.7m ht spandrel

Glass and wall thermal performance has been assumed commensurate with market-available glazing systems.

- Glazing U-value = 3.5
- Glazing SHGC = 0.35 (approx. 60-70% VLT)
- Wall / spandrel R-value = 1.4
  - For F01 window wall glazing, this will likely require an internal insulation layer behind wall / spandrel panels (refer to RHS)
  - Other opaque wall build-ups need to be assessed individually



Building fabric

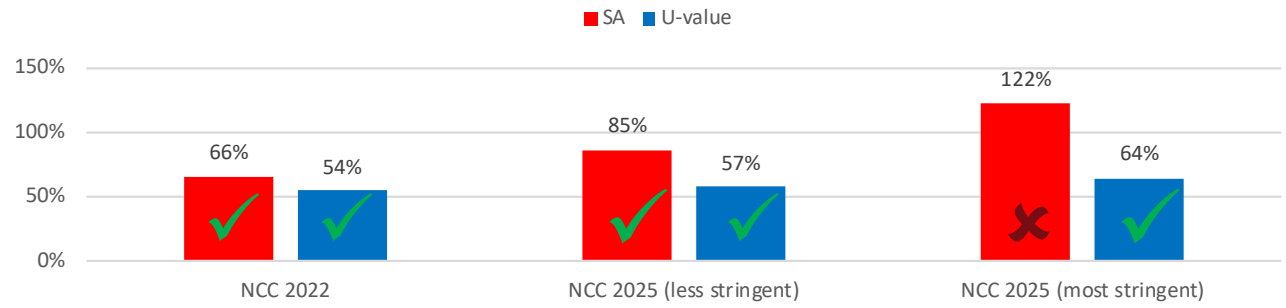
Results

Results are presented for each case assuming two different cases for the glazing selection consistent with different performance:

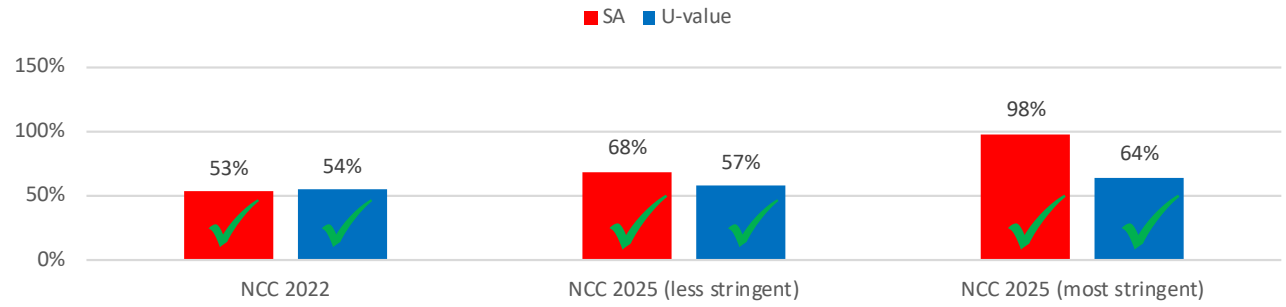
1. Glass SHGC ~0.35 (60-70% VLT)
2. Glass SHGC ~0.27 (50-55% VLT)

Case 1 (SHGC 0.35) demonstrates compliance with NCC 2022 and the ‘less stringent’ version of NCC 2025. It fails to comply should the ‘most stringent’ version of NCC 2025 take effect.

Case 2 (SHGC 0.27) demonstrates compliance under either stringency case. It is recommended to adopt this if required to align with the most stringent version of NCC 2025. Note this may need some tuning if façades on the Ground floor of the building (e.g. entry) are intended to be clearer than typical.



Current design, Glass SHGC ~0.35 (60-70% VLT)



Current design, Glass SHGC ~0.27 (50-55% VLT)

Building fabric

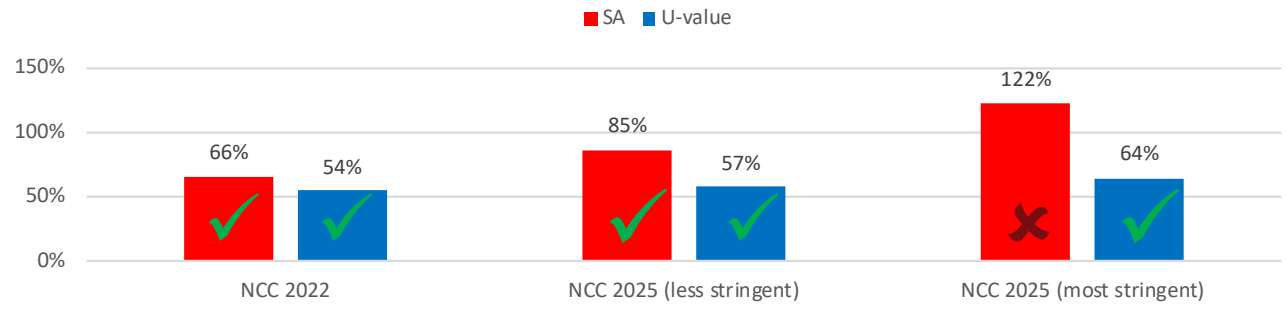
Summary

Based on current WWR assumptions, there appears to be a glazing selection to achieve compliance with Section J under NCC 2022 or NCC 2025 conditions. Compliance with NCC 2025 would require the following performance set.

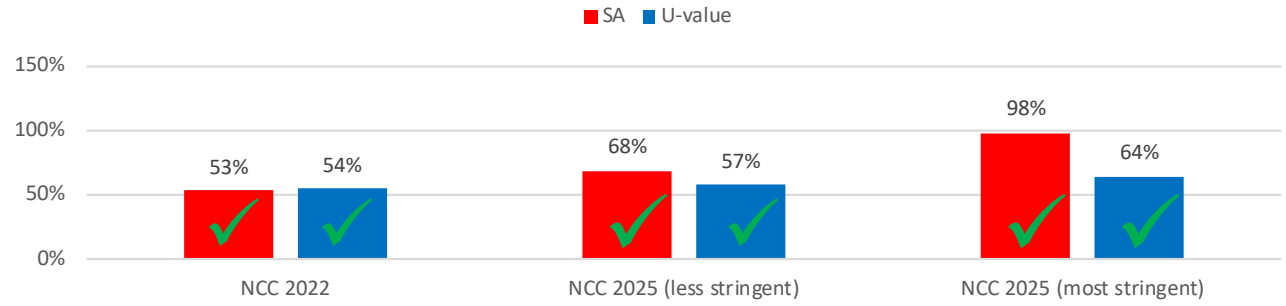
- Glazing U-value ≤ 3.5
- Glazing SHGC = 0.27-0.35 (depending on NCC 2025 final stringency case)
- Wall / spandrel R-value ≥ 1.4
- Ceiling R-value ≥ 2.0 (refer to Appendix A)
- Ceiling R-value ≥ 3.7 (refer to Appendix A)

Extent of the thermal line as shown in Appendix A needs to be reviewed carefully to ensure that all walls and ceiling can be insulated in the required locations.

For F01 façade, suggest to allow space for an internal lining behind the window wall all spandrel areas.



Current design, Glass SHGC ~0.35 (60-70% VLT)



Current design, Glass SHGC ~0.27 (50-55% VLT)

ARUP

Appendix A

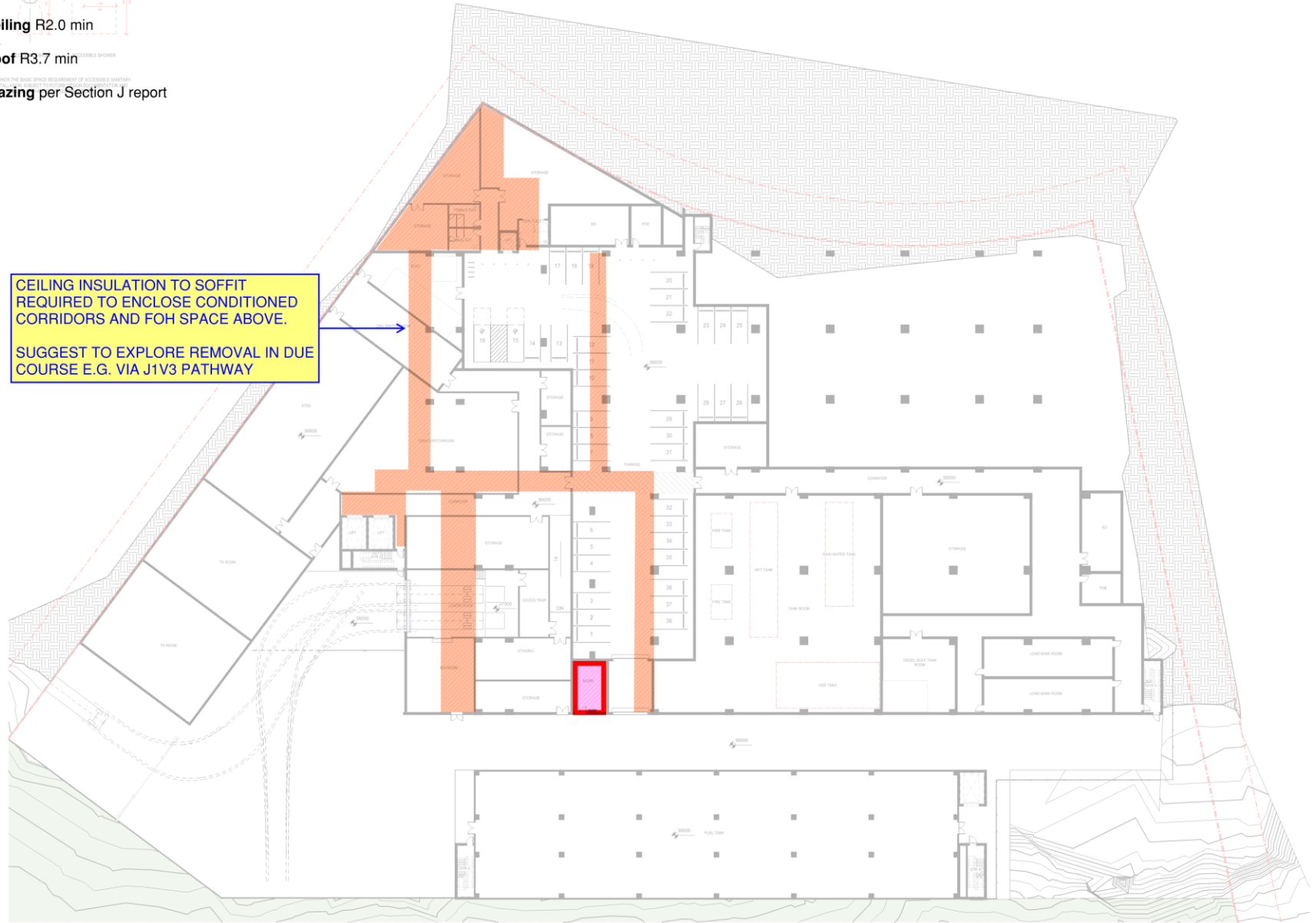
Fabric Performance Mark-ups

ARUP SECTION J FABRIC PERFORMANCE MARKUP

- **Walls** R1.4 min (conditioned boundary)
- **Ceiling** R2.0 min
- **Roof** R3.7 min
- **Glazing** per Section J report

CEILING INSULATION TO SOFFIT REQUIRED TO ENCLOSE CONDITIONED CORRIDORS AND FOH SPACE ABOVE.

SUGGEST TO EXPLORE REMOVAL IN DUE COURSE E.G. VIA J1V3 PATHWAY



1 DA GROUND FLOOR PLAN
1:200

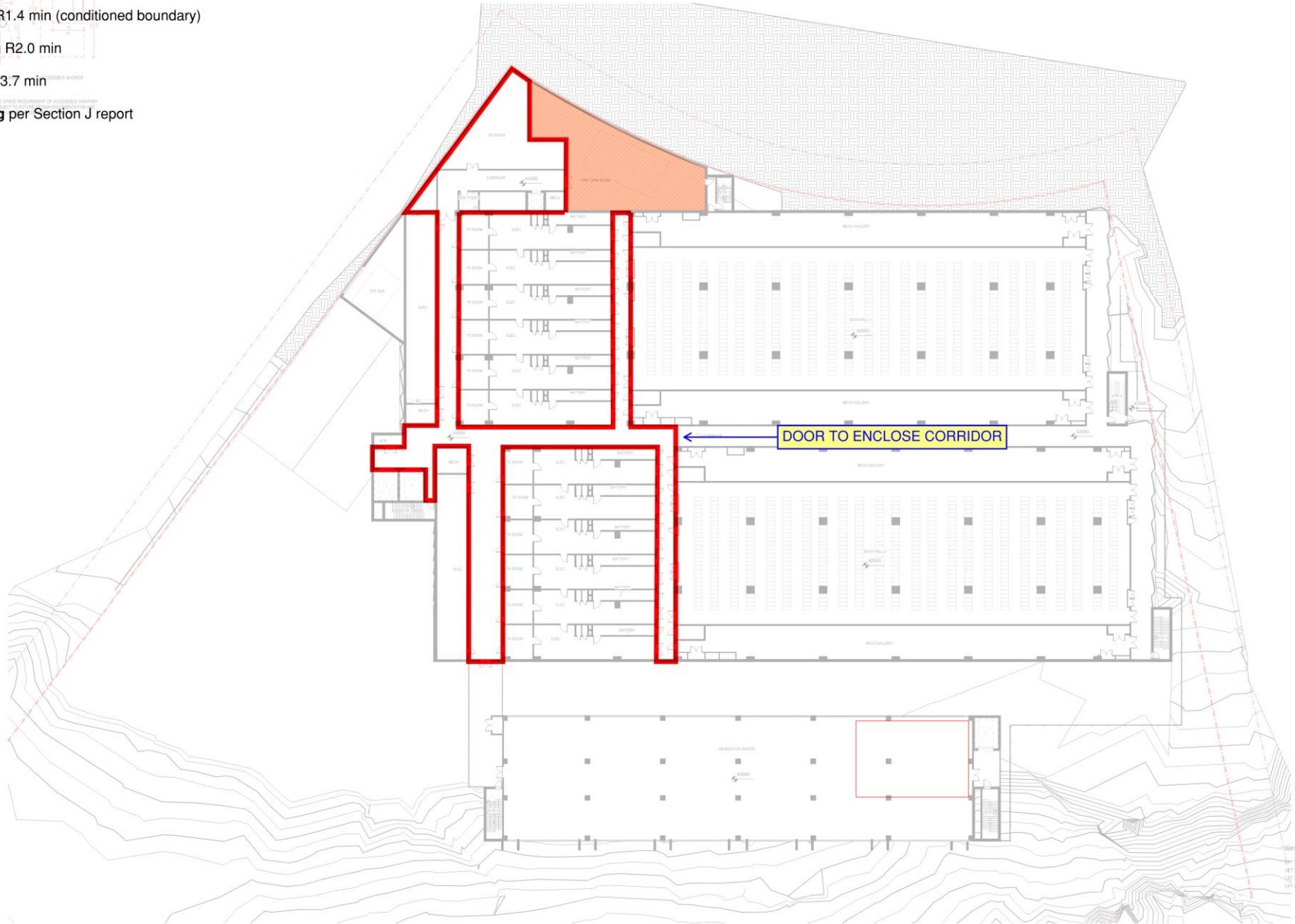
ARUP

Ground

Project Manager: logic — Construction Manager
Client: ISPT
Greenbox
Project: JULIUS AVENUE DATA CENTRE, 6-8 JULIUS AVENUE
Scale: As indicated (A0) 1:200
Project Status: PRELIMINARY
Drawing Title: GROUND FLOOR PLAN
Job Number: 240089
Drawing Number: 101001
Issue: 2

ARUP SECTION J FABRIC PERFORMANCE MARKUP

- **Walls** R1.4 min (conditioned boundary)
- **Ceiling** R2.0 min
- **Roof** R3.7 min
- **Glazing** per Section J report



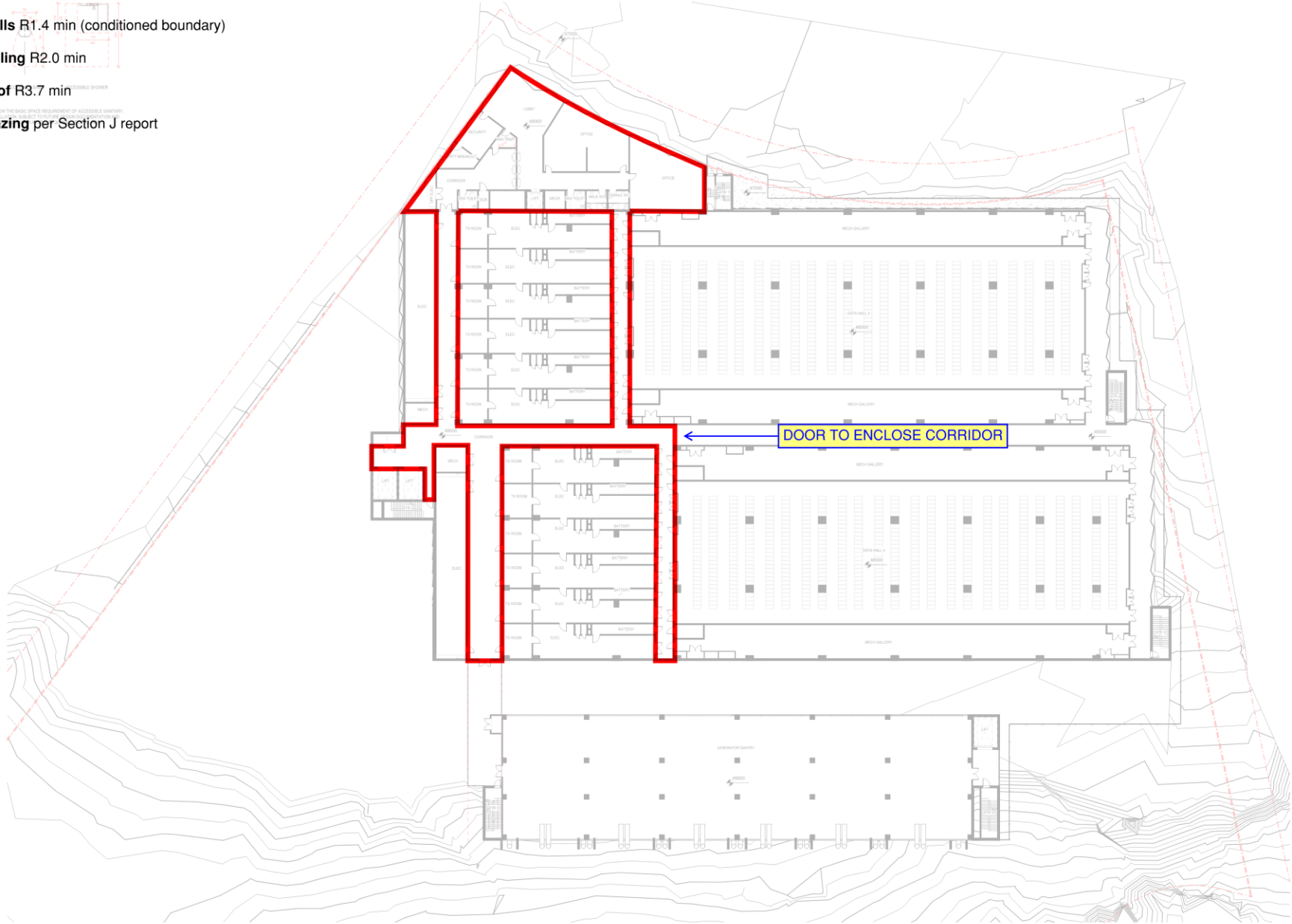
1 DA LEVEL 01
1:200

ARUP

Level 1

ARUP SECTION J FABRIC PERFORMANCE MARKUP

- **Walls** R1.4 min (conditioned boundary)
- **Ceiling** R2.0 min
- **Roof** R3.7 min
- **Glazing** per Section J report



ARUP

Level 2

1 DA LEVEL 02
1 : 200

Project Manager: logic
Construction Manager

Client: ISPT

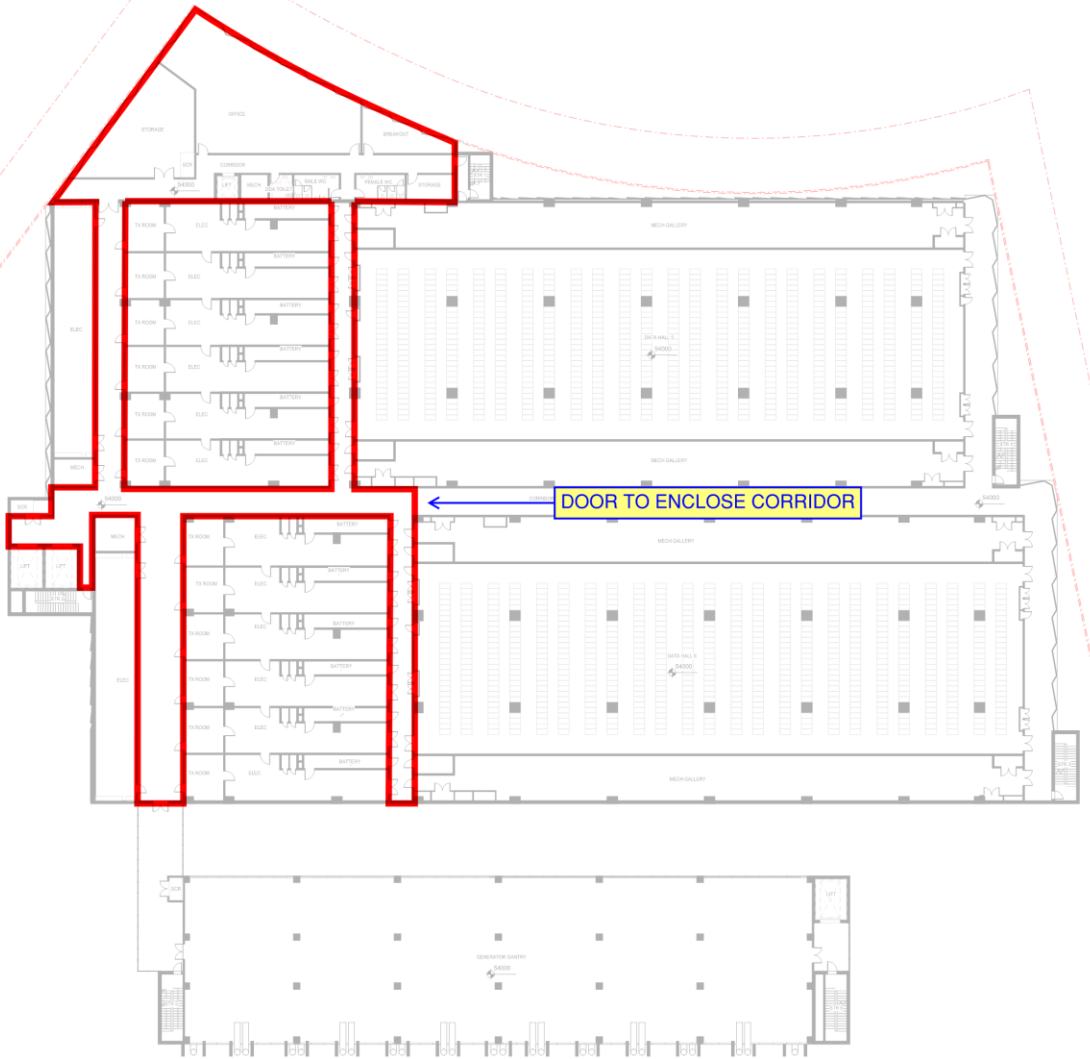
Greenbox
+61 2 8003 8930
LEVEL 22
68 PITT STREET
SYDNEY NSW 2000 AUSTRALIA
GREENBOX ARCHITECTURE PTY LTD
ABN: 78 159 779 099
ISO 9001 CERTIFIED QUALITY SYSTEM

Client: ISPT
Project: JULIUS AVENUE DATA CENTRE
6-8 JULIUS AVENUE

Scale: As indicated
Sheet: A0
Scale Bar: 1:200 0 1 2 3 5 10m
Drawn By: AD
Checked By: AD
Approved By: AD
Project Status: PRELIMINARY
Drawing Title: LEVEL 02 PLAN
Job Number: 240089
Drawing Number: 101201
Issue: 2

ARUP SECTION J FABRIC PERFORMANCE MARKUP

- **Walls** R1.4 min (conditioned boundary)
- **Ceiling** R2.0 min
- **Roof** R3.7 min
- **Glazing** per Section J report



ARUP

Level 3

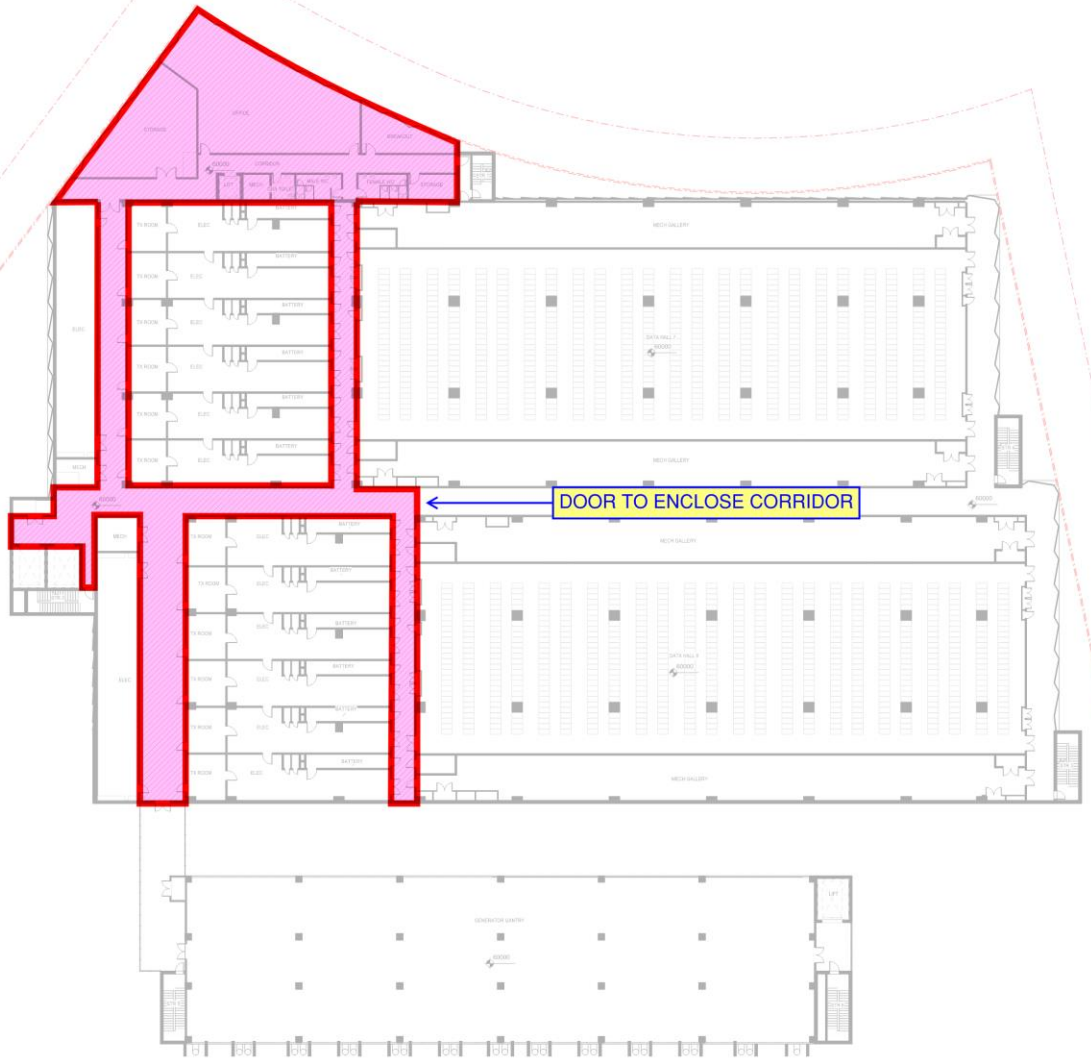
1 DA LEVEL 03
1 : 200

VERTICAL TRANSPORTATION LEGEND
LIFT 1: DATA HALL GOODS LIFT, MRL 1
LIFT 2: DATA HALL GOODS LIFT, LMR 2
LIFT 3: GENERATOR GANTRY GOODS LIFT, MRL 3
LIFT 4: OFFICE PASSENGER LIFT, MRL 4

Project Manager: logic
Construction Manager
Client: ISPT
Greenbox
GREENBOX ARCHITECTURE PTY LTD
ABN 78 130 779 099
ISO 9001 CERTIFIED QUALITY SYSTEM
Project: JULIUS AVENUE DATA CENTRE
8-8 JULIUS AVENUE
Scale: As indicated
Drawn By: AD
Checked By: AD
Approved By: AD
Project Status: PRELIMINARY
Drawing Title: LEVEL 03 PLAN
Job Number: 240089
Drawing Number: 101301
Issue: 2

ARUP SECTION J FABRIC PERFORMANCE MARKUP

- **Walls** R1.4 min (conditioned boundary)
- **Ceiling** R2.0 min
- **Roof** R3.7 min
- **Glazing** per Section J report



ARUP

Level 4

1 DA LEVEL 04
1 : 200