132 McCredie Road Guildford West NSW 2161

Energy Efficiency and Ecologically Sustainable Design Report

Goodman Property Services (Aust) Pty Ltd

Prepared by:

SLR Consulting Australia

SLR Project No.: 610.31859.00001

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Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
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01	10 March 2025	Prameena Karunairaj	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Goodman Property Services (Aust) Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

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Executive Summary

This Energy Efficiency and Ecologically Sustainable Design Report has been prepared by SLR Consulting to accompany a State Significant Development Application (SSDA) for the construction and ongoing operation of a data centre facility at 132 McCredie Road, Guildford West NSW 2161, in the Cumberland Council Local Government Area (LGA). The site is legally described as Lot 1 in DP596315.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project Pluto Data Centre (SSD-69223466) dated 4 April 2024.

The proposed development is designed to operate with energy efficiency through the following planned considerations:

- High efficiency water-cooled magnetic bearing chillers.
- High efficiency cooling towers. Its design supports water-side economisation, which allows for efficient cooling at higher ambient temperatures, further reducing water consumption
- High-efficiency, direct-drive fans for the cooling towers reduce energy consumption by 40% when compared to the minimum efficiency standards outlined in ASHRAE Standard 90.1 (Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings).
- All pumps fitted with VSDs.
- High efficiency Fan Wall Units with Electronically Commutated (EC) fans serving data halls.
- High efficiency Computer Room Air Handling units with EC fans serving electrical rooms.
- Raised chilled water temperatures for improving chiller efficiency.
- Water-side free cooling using plate heat exchangers to minimise chiller operation.
- Mechanical systems operating in hot standby mode to improve operational efficiency.
- High efficiency Uninterruptible Power Supply (UPS) units to minimise electrical losses.
- Following energy efficiency measures are considered for lighting:
  - Provide LED fitting for the entire project.
  - Occupancy sensors to low occupancy areas.
  - Localised lighting for specific tasks rather than general overhead lighting for the entire space. For example, direct lighting can be provided at server racks or workstations.

This report concludes that the proposed data centre is suitable and warrants approval subject to the implementation of the following mitigation measures:

- It is recommended that a 500 kW PV Solar system can be installed on the roof of the proposed development. With the inclusion of the PV system the benefits to the development include:

- A 500 kW PV solar system will offset approximately 658 MWh/year of energy usage.
- The estimated greenhouse gas CO2 emission saving is approximately 540,000 kg CO2/annum.

- Low-carbon materials where possible to reduce the amount of upfront and embodied carbon associated with the project.
- It is recommended that 90% of the construction and demolition waste is diverted from the landfill to minimise the impacts of construction on the environment.
- Although the data halls are not expected to regularly produce much waste, from time-to-time significant quantities of e-waste will be generated. Disposal of e-waste will be the responsibility of equipment suppliers who will collect obsolete equipment when new equipment is installed.
- The proposed landscape plan includes trees around perimeters. The use of trees and perimeter planting is very effective in reducing the reflection of heat and light onto the building from surrounding paved areas. Planting also provides added cooling during the summer months through the leaf transpiration process.
- Most of the trees provided to the perimeter of the site will be evergreen trees, providing year-round wind, heat and solar mitigation.
- Provision of 60,000 L rainwater tank for irrigation and cooling towers.
- The following WELS ratings are proposed for the water fixtures used in the project:
  - Taps – 6 star
  - Toilets – 5 star
  - Urinals – 5 star
  - Showers – 4 star
- Native coastal and other drought resistant species that rely primarily on rainwater for their water needs where appropriate and possible;
- Indigenous species are currently proposed to comprise over 30% of the provided landscaping.
- 20% (spaces) of total parking spaces are dedicated for future electrical vehicle charging stations proposed in line with NCC 2022 requirements.

By implementing all energy efficiency measures described in Section 3 of this report, the project is predicted to achieve a 60% reduction in greenhouse gas (GHG) emissions with a 500kW PV Solar system, compared to a Reference Building, excluding the IT equipment load. When factoring in the IT equipment load, and assuming identical IT equipment loads for both the reference and proposed buildings, the GHG emission reduction is projected at 19.5%. Furthermore, a heat exchanger will be installed in parallel with the water-cooled chiller to allow the cooling towers to directly cool the facilities chilled water system without the use of chillers on days where the ambient wet bulb temp is suitable. The above calculation ignores the benefit of the economiser at this stage.

By installing 4-star rated toilets, urinals and taps and the proposed rainwater harvesting facility the proposed development will reduce the potable water demand for the amenities in the development by approximately 43%.

These features will help achieve significant reductions in energy and water required by the development both in building and operation, in addition to ensuring that high levels of sustainability are considered in the project.

It is recommended that the ESD initiatives proposed continue to be developed and implemented throughout the course of this project.

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1.0 Introduction

A State Significant Development Application (SSDA) has been prepared in support of a proposed data centre at 132 McCredie Road, Guildford West NSW 2161. The site is zoned E4 General Industrial and has a road frontage to McCredie Road. The developable site area is approximately 71,710 sqm.

The proposed development comprises:

- Site preparation works including bulk excavation and removal of existing hard standing and structures on the site, tree and vegetation clearing, and bulk earthworks.
- Construction, fit out and operation of a data centre with an approximate building height of 25.77m and total gross floor area of approximately 29,444 m2 comprising:
    - At-grade parking for 53 car parking spaces and 2 accessible car parking spaces
    - Two (2) loading dock spaces
    - Two (2) levels of technical data hall floor space with incorporating a total of nine (9) data halls
    - Ancillary office space
- Provision of required utilities, including:
    - Fuel storage
    - Two (2) Switch-rooms
    - Four (4) industrial water storage tanks
- Vehicle entry and egress driveways located along McCredie Road
- Internal access road
- Associated landscaping and site servicing
- Installation of services and drainage infrastructure.

The ESD report has been prepared in a standard form considering the following aspects of the development.

- Identify how ESD principles are incorporated in the design and ongoing operation of the development.
- Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.

The initiatives suggested throughout this report have been included as opportunities for the project team to adopt ESD initiatives that provide both direct and indirect benefits to the proposed development.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) and accompanying cover letter issued for the Project Pluto Data Centre (SSD-69223466) dated 4 April 2024.

Specifically, this report has been prepared to respond to the SEARs requirement issued below:

Table 1 Project Response to SEARs Requirements

ESD Requirement	Project Response
Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development	Section 3 details how ESD principial as determined in clause 7 (4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (reproduced in Clause 193 of the 2022 revision of the regulation) and up to date legislation are being incorporated in the design, construction, and operation phases of the project. In terms of Precautionary Principle, the project does not present threat of serious or irreversible environmental damage. The project conducted all required environmental studies and incorporated adaptability and resilience measures in the design. See **Table 4** for additional information.
Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards	Section 3 detail how the project exceeds relevant industry recognised building sustainability and environmental performance standards through the implementation of best practice design principles and a wide range of ESD initiatives including renewable energy to offset the site energy use and reduce peak demand on electricity supply infrastructure.
Demonstrate how the development minimises greenhouse gas emissions (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 of the report By implementing all energy efficiency measures described in Section 3, including the proposed PV solar system, the project will significantly minimise greenhouse gas emissions, reflecting the goal of achieving net zero emissions. • The project is anticipated to achieve a 60% reduction in greenhouse gas (GHG) emissions with a 500kW PV Solar system, compared to a Reference Building, excluding the IT equipment load. When factoring in the IT equipment load, and assuming identical IT equipment loads for both the reference and proposed buildings, the GHG emission reduction is projected at 19.5%. Furthermore, a heat exchanger will be installed in parallel with the water-cooled chiller to allow the cooling towers to directly cool the facilities chilled water system without the use of chillers on days where the ambient wet bulb temp is suitable. The above calculation ignores the benefit of the economiser at this stage and the model will be updated during the detailed design stage once all equipment for the data centre is specified.

	• The predicted reduction in lighting energy consumption is 22% when compared with the NCC Reference Building. • The project will use Greenpower to reduce the total greenhouse gas emissions produced by the proposed development. Goodman property is committed to achieve carbon neutrality across its global operations. • Provision of 60,000 L rainwater tank. By installing 4-star rated toilets, urinals and taps and the proposed rainwater harvesting facility the proposed development will reduce its potable water demand by approximately 43%. Refer Section 3.2 • High efficiency water-cooled magnetic bearing chillers. • High efficiency cooling towers. The proposed development will use Series 3000 cooling tower, with the ENDURA/H fan system. This model is known for its high efficiency and reliability, often exceeding industry standards like ASHRAE 90.1. Its design supports water-side economisation, which allows for efficient cooling at higher ambient temperatures, further reducing water consumption. • All pumps fitted with VSDs. • Water-side free cooling using plate heat exchangers to minimise chiller operation. • Mechanical systems operating in hot standby mode to improve operational efficiency. The project is designed with a maximum Power Usage Effectiveness (PUE) of 1.4. Refer Section 3.1.7 Other ESD initiatives are summarised in Section 3.1 of the report.
If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies: - Demonstrate how the development has been designed to address the provisions set out in Chapter 3.2(1) - Provide a NABERS Embodied Emissions Materials Form to disclose the amount of embodied	The following design considerations have been implemented to address Chapter 3.2.(1) of SEPP 2022: • More than 90% of the predicted construction waste arising from the development will be reused (on-site or at another development) or recycled offsite. Refer Section 3.5.4.1 • The reliance on artificial lighting and mechanical ventilation has been reduced via lighting control and efficient air conditioning systems. Refer Sections 3.1.2 and 3.1.5 • The peak demand for electricity is significantly reduce via a proposed 500 kW PV solar system. Refer Section 3.1.6.1

emissions attributable to the development in accordance with section 35BA of the EP&A Regulation	○ A 500 kW PV solar system will offset approximately 658 MWh/year of energy usage. ○ The estimated greenhouse gas CO2 emission saving is approximately 540,000 kg CO2/annum. • To enable effective review of energy usage by the project, sub-metering will be implemented for all major energy consuming processes or items of equipment including warehouse lighting, warehouse power, office lighting, office power and office HVAC. Refer Section 3.3 • The facility manager will ensure all monitoring and audit results are well documented and carried out as specified in the current Sustainability Management Plan (Refer Section 3.3.3). • Provision of 60,000 L rainwater tank for toilet flushing, irrigation and/or cooling towers. Refer Section 3.2.1

1.1 Objectives

The principal objective of this Energy Efficiency and Ecologically Sustainable Design Report is to identify all potential energy saving opportunities that may be realised during the operational phase of the project, including a description of likely energy consumption levels and options for alternative energy sources such as solar power in accordance with the SEARs requirements. In addition, this report also aims to provide an overview of recommendations on potential ESD initiatives that can be implemented.

In particular, the project is required to respond to the SEARs requirement as outlined in the table below:

Table 2 ESD Requirements as per Data Centre SEARs

8. Ecologically Sustainable Development (ESD)
• 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.
• Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.
• Demonstrate how the development minimises greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.
• If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies:
  ○ demonstrate how the development has been designed to address the provisions set out in Chapter 3.2(1).
  ○ provide a NABERS Embodied Emissions Material Form to disclose the amount of embodied emissions attributable to the development in accordance with section 35BA of the EP&A Regulation.
	• ESD Report
	• NABERS Embodied Emissions Materials Form

1.2 Site Description

The site is located on Gandangara Land and is in the Smithfield Industrial Area within the Cumberland Local Government Area (LGA). It is bounded by McCredie Road to the north.

The front part of the site adjoins the Guildford Transmission Substation, which is located immediately to the east and fronts onto McCredie Road. Other industrial uses are located further east, with residential properties beyond.

The Guildford West Sports Ground, which comprises several playing fields, is located to the south of the Guildford Transmission Substation. The playing fields bound the southern part of the site to the east. The playing fields / public recreation area also abut the southern boundary of the site.

Prospect Creek is located to the south of the public recreation area and is zoned C2 Environmental Protection. The area to the south of Prospect Creek is predominately characterised by low density single storey residential housing.

The site is located in the southeastern corner of the Smithfield Industrial Estate and is within close proximity of the Cumberland Highway (A28) and M4 and M7 motorways, which provide access to Sydney CBD, western Sydney and the south. A range of large format industrial uses are located to the west and northwest of the site. The Smithfield Industrial Estate extends across the A28 to Gipps Road (approximately 3km west of the site). It forms part of the broader Smithfield Wetherill Park industrial area, which is one of the largest of its kind in the Southern Hemisphere and makes a significant contribution to the New South Wales and Australian economies.

The site has a net developable area of 71,710 sqm and is currently vacant. It previously operated as a Castrol Lubricants facility. However, the majority of the site has now been cleared and subject to category 1 remediation works. A single storey office building is located on the northern portion of the site fronting McCredie Road. The building is vacant.

An aerial image of the site showing its location is shown below.

Figure 1-1 Site Aerial Image

The proposal seeks consent for development to be constructed and operated in two phases to reflect the staged availability power supply. The proposed stages involve the following:

Stage 1: Construction of the main data centre building as well as the car park, perimeter access road, site access/exit driveways and landscaping. Stage one will involve the fit-out and operation of five of the 9 proposed data halls at levels 1 and 2 as well as the associated electrical rooms, generators, storage and office rooms.

Stage 2: Completion of the ultimate development scheme involving the extension of the building to the south with an additional four data halls, associated electrical rooms and generators, and associated landscaping and external works. The electrical substations will also be constructed in the north of the site during this phase.

The works are to be completed in four (4) construction stages, as per below:

Stage 1:

- CC1 – Site Preparation works (including but not limited to vegetation removal, earthworks & piling, installation of footings, retaining walls)
- CC2 – Inground services installation, structural works
- CC3 – Façade construction, installation of services, fit out
- CC4 – Landscaping and external works

Stage 2:

- CC1 – Site Preparation works (earthworks & piling, installation of footings)
- CC2 – Inground services installation, structural works
- CC3 – Façade construction, installation of services, fit out
- CC4 – Landscaping and external works

1.3 Development Description

The proposed development comprises:

- Site preparation works including bulk excavation and removal of existing hard standing and structures on the site, tree and vegetation clearing, and bulk earthworks;
- Construction, fit out and operation of a data centre with an approximate building height of 25.77m and total gross floor area of approximately 29,444 m^2 comprising:
  - At-grade parking for 53 car parking spaces and 2 accessible car parking spaces
  - Two (2) loading dock spaces.
  - Two (2) levels of technical data hall floor space with incorporating a total of nine (9) data halls
  - Ancillary office space
- Provision of required utilities, including:
  - Fuel storage
  - Two (2) Switch-rooms
  - Four (4) industrial water storage tanks
- Vehicle entry and egress driveways located along McCredie Road
- Internal access road
- Associated landscaping and site servicing
- Installation of services and drainage infrastructure.

Based on the SSDA architectural drawings reviewed, the floor plans are shown below:

Figure 1-2 Ground Level

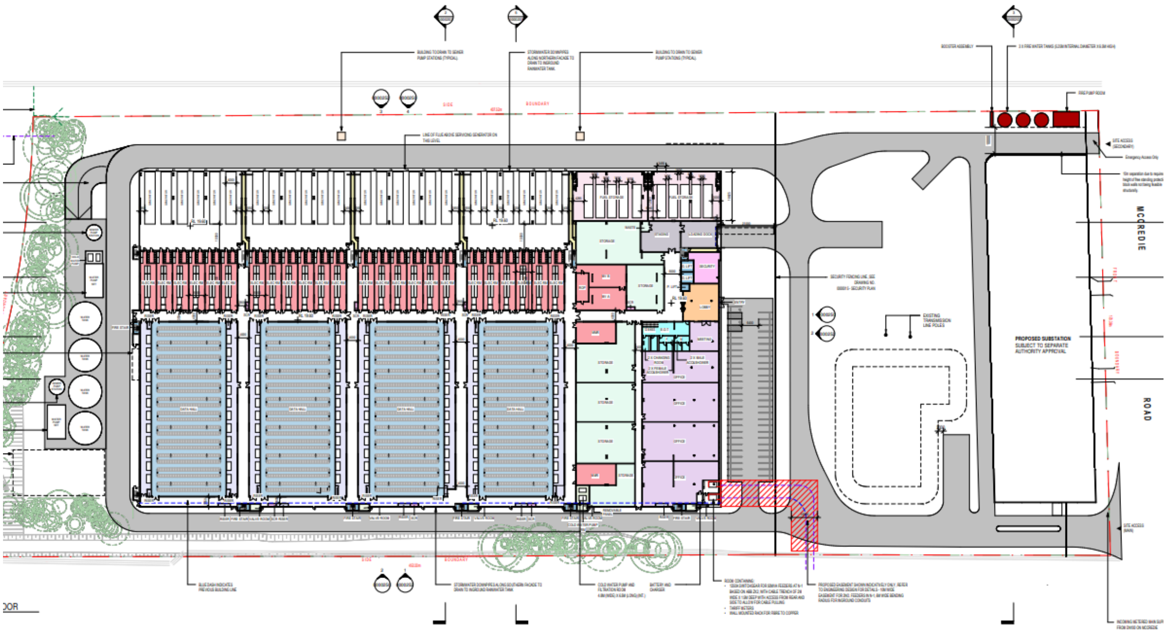


Figure 1-3 Level 1

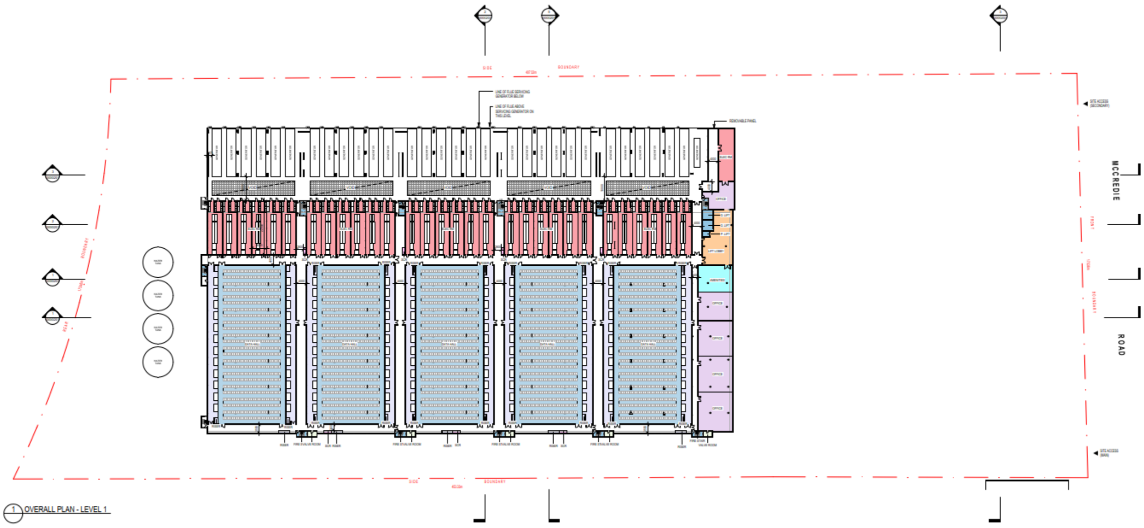
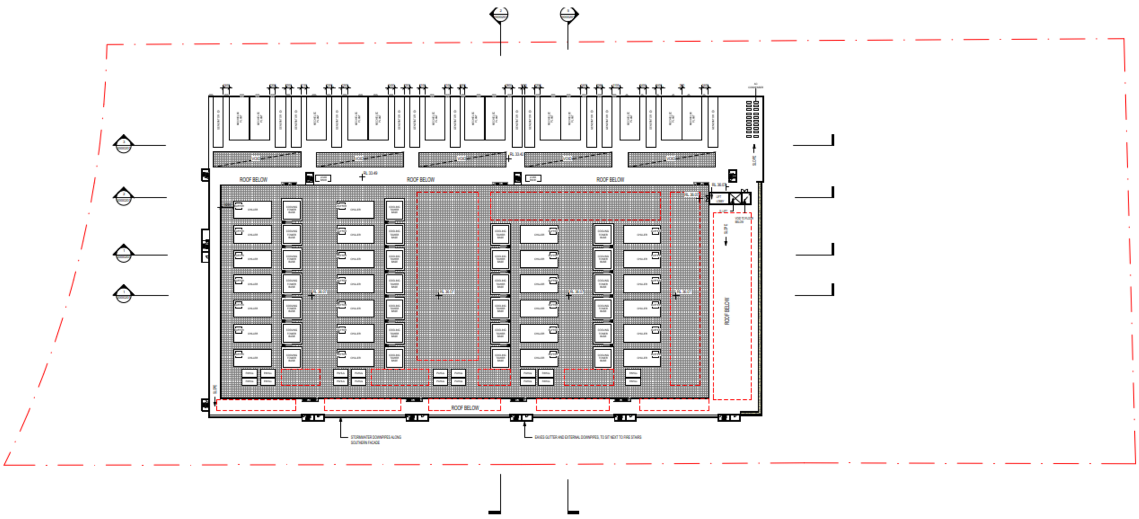


Figure 1-4 Roof Platform Level



2.0 Ecologically Sustainable Design

The concept of Ecologically Sustainable Development (ESD) was outlined in "Our Common Future", the report of the 1987 United Nations World Commission on the Environment and Development (the Brundtland Commission). It defined Sustainable Development as,

"Development that meets the needs of the present without compromising the ability of future generation to meet their own needs".

This concept was adopted within Australia in 1990 when the Council of Australian Governments endorsed a National Strategy for Ecologically Sustainable Development. The Commonwealth Government suggested the following definition for ESD in Australia:

"Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased".

Put simply, ESD is development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. To do this, it is necessary to develop ways of using those environmental resources which form the basis of our economy in a way which maintains and, where possible, improves their range, variety and quality.

The National Strategy for Ecologically Sustainable Development notes that there is no identifiable point where it can be said that ESD has been achieved. The strategy further states that there are two main features which distinguish an ecologically sustainable approach to development:

- We need to consider, in an integrated way, the wider economic, social and environmental implications of our decisions and actions for Australia, the international community and the biosphere; and
- We need to take a long-term rather than short-term view when taking those decisions and actions.

National Strategy for ESD Objectives and Guiding Principles are elaborated below.

The National Strategy for ESD sets its core objectives as:

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- To provide for equity within and between generations.
- To protect biological diversity and maintain essential ecological processes and life-support systems.

The Guiding Principles of the National Strategy for ESD are documented as:

- Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.
- Where 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.
- The global dimension of environmental impacts of actions and policies should be recognised and considered.
- The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.

- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
- Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
- Decisions and actions should provide for broad community involvement on issues which affect them.

These guiding principles and core objectives need to be considered as a package. No objective or principle should predominate over the others. A balanced approach is required that considers all these objectives and principles to pursue the goal of ESD.

2.1 Specific Requirements for Compliance

Specifications for environmental design measures required for the proposed site are detailed below:

2.1.1 Mandatory ESD Measures for Consideration

2.1.1.1 SEARS requirements

As per the Planning Secretary's Environmental Assessment Requirements for Data storage centres, the ESD controls of the project are to:

- 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.
- Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.
- Demonstrate how the development minimises greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.
- If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies:
  - Demonstrate how the development has been designed to address the provisions set out in Chapter 3.2(1).
  - Provide a NABERS Embodied Emissions Material Form to disclose the amount of embodied emissions attributable to the development in accordance with the section 35BA of the EP&A Regulation.

2.1.1.2 National Construction Code

The project is also required to comply with the energy efficiency requirements of National Construction Code Section J requirements.

2.1.2 Other ESD Measures for Consideration

In addition to the SEARs mentioned above, the following guidelines and standards are also considered to guide the project on energy efficient data centre design and operation:

- NABERS Energy Rating for Data Centres
- Australian Government Data Centre Panel
- ISO/IEC JTC 1/SC 39 – Sustainability for and by Information Technology

- ISO 50001 – Energy Management Systems

The following sections elaborate on the various ways the project responds to the above controls and requirements. Recommendations have also been made to go over and beyond minimum requirements and this will be evaluated as the design progresses.

2.2 Project Response to ESD Principles

A summary of the project response to the various ESD principles can be seen below:

Table 3 Response to SEARs Requirement

ESD Requirement	Project Response
Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development	Section 3 details how ESD principial as determined in clause 7 (4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (reproduced in Clause 193 of the 2022 revision of the regulation) and up to date legislation are being incorporated in the design, construction, and operation phases of the project. In terms of Precautionary Principle, the project does not present threat of serious or irreversible environmental damage. The project conducted all required environmental studies and incorporated adaptability and resilience measures in the design. See **Table 4** for additional information.
Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards	Section 3 detail how the project exceeds relevant industry recognised building sustainability and environmental performance standards through the implementation of best practice design principles and a wide range of ESD initiatives including renewable energy to offset the site energy use and reduce peak demand on electricity supply infrastructure.
Demonstrate how the development minimises greenhouse gas emissions (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 of the report By implementing all energy efficiency measures described in Section 3, including the proposed PV solar system, the project will significantly minimise greenhouse gas emissions, reflecting the goal of achieving net zero emissions. • The project is anticipated to achieve a 60% reduction in greenhouse gas (GHG) emissions with a 500kW PV Solar system, compared to a Reference Building, excluding the IT equipment load. When factoring in the IT equipment load, and assuming identical IT equipment loads for both the reference and proposed buildings, the GHG emission reduction is projected at 19.5%. Furthermore, a heat exchanger will be installed in parallel with the water-cooled chiller to allow the cooling towers to directly cool the facilities chilled

	water system without the use of chillers on days where the ambient wet bulb temp is suitable. The above calculation ignores the benefit of the economiser at this stage and the model will be updated during the detailed design stage once all equipment for the data centre is specified. • The predicted reduction in lighting energy consumption is 22% when compared with the NCC Reference Building. • The project will use Greenpower to reduce the total greenhouse gas emissions produced by the proposed development. Goodman property is committed to achieve carbon neutrality across its global operations. • Provision of 60,000 L rainwater tank. By installing 4-star rated toilets, urinals and taps and the proposed rainwater harvesting facility the proposed development will reduce its potable water demand by approximately 43%. Refer Section 3.2 • High efficiency water-cooled magnetic bearing chillers. • High efficiency cooling towers. The proposed development will use Series 3000 cooling tower, with the ENDURA/H fan system. This model is known for its high efficiency and reliability, often exceeding industry standards like ASHRAE 90.1. Its design supports water-side economisation, which allows for efficient cooling at higher ambient temperatures, further reducing water consumption • All pumps fitted with VSDs. • Water-side free cooling using plate heat exchangers to minimise chiller operation. • Mechanical systems operating in hot standby mode to improve operational efficiency. The project is designed with a maximum Power Usage Effectiveness (PUE) of 1.4. Refer Section 3.1.7 Other ESD initiatives are summarised in Section 3.1 of the report.
If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies: - Demonstrate how the development has been designed to address the	The following design considerations have been implemented to address Chapter 3.2.(1) of SEPP 2022: • More than 90% of the predicted construction waste arising from the development will be reused (on-site or at another development) or recycled offsite. Refer Section 3.5.4.1

provisions set out in Chapter 3.2(1) - Provide a NABERS Embodied Emissions Materials Form to disclose the amount of embodied emissions attributable to the development in accordance with section 35BA of the EP&A Regulation	• The reliance on artificial lighting and mechanical ventilation has been reduced via lighting control and efficient air conditioning systems. Refer Sections 3.1.2 and 3.1.5 • The peak demand for electricity is significantly reduce via a proposed 500 kW PV solar system. Refer Section 3.1.6.1 ○ A 500 kW PV solar system will offset approximately 658 MWh/year of energy usage. ○ The estimated greenhouse gas CO2 emission saving is approximately 540,000 kg CO2/annum. • To enable effective review of energy usage by the project, sub-metering will be implemented for all major energy consuming processes or items of equipment including warehouse lighting, warehouse power, office lighting, office power and office HVAC. Refer Section 3.3 • The facility manager will ensure all monitoring and audit results are well documented and carried out as specified in the current Sustainability Management Plan (Refer Section 3.3.3). • Provision of 60,000 L rainwater tank for toilet flushing, irrigation and/or cooling towers. Refer Section 3.2.1

Table 4 Response to Clause 193 of the Environmental Planning and Assessment Regulation 2021

ESD Requirement	Project Response	Reference
The Precautionary Principle	Climate Change Risk Assessment to be carried out	Refer Section 3.4.1
Inter-generational Equity	Use of renewable energy Energy efficiency measures Waste management Low carbon materials	Refer Section 3
Conservation of Biological Diversity and Ecological Integrity	Use of native and drought resistant species.	Refer Section 3.2.1
Improved Valuation, Pricing, and Incentive Mechanisms	Better leasing opportunities due to enhanced building performance Use of renewable energy to reduce dependence on grid power	Refer Section 3

3.0 ESD Initiatives Considered for the Proposed Development

In order to achieve a structured integrated approach to ESD, a series of indicators and strategic goals have been identified at the outset to be communicated to the design team. SLR Consulting's role, as the project's ESD consultant, has been to apply these principles to all aspects of the development ensuring a best possible ESD outcome.

ESD indicators identified for the proposed Concept Plan are:

- Energy Efficiency
- Water Efficiency
- Monitoring and Commissioning
- Resilience and Climate Adaptation
- Materials and Waste
- Indoor Environmental Quality
- Transport

The ESD initiatives to be committed for the proposed development will be outlined in the following sections below.

3.1 Energy Efficiency

Buildings have a significant environmental impact, accounting for 40% of global energy consumption. Measuring and managing energy use is essential to minimizing this impact.

Data centres, as critical infrastructure, are among the most energy-intensive building types. Improving their energy efficiency is vital, as it reduces operational costs, decreases greenhouse gas emissions, and supports the growing demand for digital services sustainably. Implementing strategies such as optimizing cooling systems, using energy-efficient hardware, and leveraging renewable energy sources can significantly enhance their performance.

By reducing energy consumption, buildings and data centres not only lower electricity costs but also demonstrate a strong commitment to sustainability. This approach enhances portfolio resilience, increases shareholder value, and contributes to the improvement of shared facilities.

3.1.1 Site Analysis

A key objective should be to optimise site conditions and minimise energy consumed for cooling and heating loads through proper selection of building orientation and internal layout. The following points are noted with respect to the siting of the proposed development.

- As opposed to new developments on the outer fringes of the city which require significant investment in new roads, sewerage, lighting and power the proposed development site will have immediate access to all of these at very little additional regional infrastructure investment. Furthermore, the project is adjacent to the Guildford Transmission Substation thus enjoying proximity to its critical infrastructure.
- Furthermore, the project is located on a remediated land that was previously operated as a Castrol Lubricants facility thereby encouraging brownfield redevelopment.

3.1.2 Mechanical Ventilation and Air Conditioning

These measures include linking mechanical ventilation to control the HVAC system where allowable under the NCC and using individual fans rather than a common ducted ventilation system with constant operation. These initiatives will provide significant savings in energy use and associated operational energy costs of the development.

3.1.3 Data Centre Design

An energy intensive operation such as data centre must consider specific energy efficiency parameters than conventional uses. For example, as per the new Data Centre Panel established by the Australian Government Digital Transformation Agency to promote sustainable practices across the data centre market and support the Government's move towards net zero, the following best practice measures are currently required by government agencies using data centres:

- Meet the requirements of the Government's ICT Sustainability Plan1 for data centres
- Comply with emission thresholds under the NGER Act if applicable
- Use accredited Greenpower from renewable sources
- Have a 5-star NABERS rating or equivalent environmental rating
- Target a Power Use Efficiency (PUE) of less than 1.4
- Have a roadmap to meet net zero emissions through innovation, planning and investment.

Some of the other data centre energy efficiency measures recommended are as below:

- Set Point Temperatures – The American Society of Heating Refrigeration and Air-Conditioning Engineers recommend that modern IT equipment (Class A1) can operate reliably at higher temperatures and have broadened their guideline IT operating temperature range out to 15°C to 32°C.
- Airflow Management – The efficiency and effectiveness of data centre cooling systems is heavily influenced by the temperature and quantity of air delivered to the IT equipment. There are a number of options to improve the effectiveness of air flow and could be considered during the detailed design stage of the project as listed below:
    - Configure racks in hot/cold aisle arrangements
    - Install blanking plates on racks
    - Install containment systems or curtains
    - Seal floor leakage paths
    - Balance floor grilles
- Rack Layout – Poorly configured layouts can contribute to inefficient air flow and cooling air distribution and result in cooling units working harder. Aisle containment systems, rack chimney systems and floor pressure management can provide increases in cooling efficiencies and better utilisation of existing equipment.
- Server Upgrades – New generation servers use less energy than traditional standalone systems. They utilise variable speed cooling fans, have power saving modes and are able to operate at higher temperatures; all contributing to lower infrastructure energy usage.

- Consolidation and virtualisation of servers – The resulting rationalisation of devices can reduce the IT footprint; improve server and storage device utilisation and lower overall energy consumption.
- Free Cooling Systems – Improved cooling solutions can incorporate direct or indirect free cooling solutions to leverage cooler outside temperatures to help cool the Data Centre. Higher operating temperature tolerances for IT equipment also facilitates the increased use of free cooling.
- Alternate architectures – Shifting the cooling source closer to the heat source with alternate cooling solutions such as In-row coolers or IT cabinet rear door heat exchangers can reduce energy consumption associated with cooling.

The proposed development is designed to operate with energy efficiency through the following planned considerations:

- High efficiency water-cooled magnetic bearing chillers
- Cooling towers fitted with Variable Speed Fans (VSDs)
- All pumps fitted with VSDs
- High efficiency Fan Wall Units with Electronically Commutated (EC) fans serving data halls
- High efficiency Computer Room Air Handling units with EC fans serving electrical rooms
- Raised chilled water temperatures for improving chiller efficiency
- Water-side free cooling using plate heat exchangers to minimise chiller operation
- Mechanical systems operating in hot standby mode to improve operational efficiency

3.1.4 Hot Water

The building intends to use electricity from renewable sources and/or heat pumps for hot water.

Furthermore, since data centres generate substantial amounts of waste heat during their operations, methods to capture and repurpose this heat for hot water generation, enhancing energy efficiency and sustainability will be evaluated as the design progresses. Notable approaches include heat recovery systems where implementing heat recovery systems allows data centres to capture waste heat and transform it into usable hot water.

3.1.5 Lighting

The project will adopt the following energy efficiency measures to reduce the lighting energy consumptions:

- Energy efficient LED fitting for the entire project.
- Daylight sensors to all areas with natural daylight where applicable.
- Occupancy sensors to low occupancy areas e.g. office, toilets and kitchens.
- Lighting will be dimmable up to 10% when daylight allows, or area is vacated.
- Use localized lighting for specific tasks rather than general overhead lighting for the entire space. For example, direct lighting can be provided at server racks or workstations.

Lighting Energy Consumption

In Section J6 of the NCC, the requirement for the total lighting power load within the proposed spaces of a building is to be no greater than a maximum illumination power load, measured in Watts (W). The maximum allowable building illumination power load is based on the total illumination power load calculated for each space. The maximum illumination power density for each space will be dependent on the purpose of the space within the building (refer to Table J6.2a of NCC 2022 Volume One).

For artificial lighting, the aggregate design illumination power load must not exceed the sum of the allowances. This may be obtained by multiplying the area of each space by the maximum illumination power density (as found in Table J6.2a of the NCC 2022 Volume One). The energy load (in MWh) is estimated by multiplying the power load by the hours of consumption (24hrs/day).

As per NCC 2022, Table J7D3a: Maximum Illumination Power Density, a reference case lighting power density of 4.5 W/sq m is considered.

A lighting power density of 3.5 W/sq m is considered for the project.

Based on the above reference and proposed case, lighting power consumption is calculated as shown below:

Table 5 Annual Lighting Energy Calculation

	LPD in W/sq m	Operating Hours	Lighting Control	Total Annual Lighting Energy Consumption (kWh)
Reference Case	4.5	Monday to Sunday 24 hours	Motion Detector	1,043,018
Proposed Case	3.5	Monday to Sunday 24 hours	Motion Detector	811,236

Note: The calculation is based on the assumption that the lighting must provide balanced ambient illumination, supporting both office-related tasks and overall operational needs.

This gives a reduction of 22% from reference base case.

3.1.6 Renewable Energy

As the worldwide demand for fuel increases, alternative and renewable energy sources are emerging as economical and sustainable. Alternative renewable energy sources are becoming more attractive options because of increased global demand for fuels, environmental responsibility, affordability and new local, state and federal government legislations.

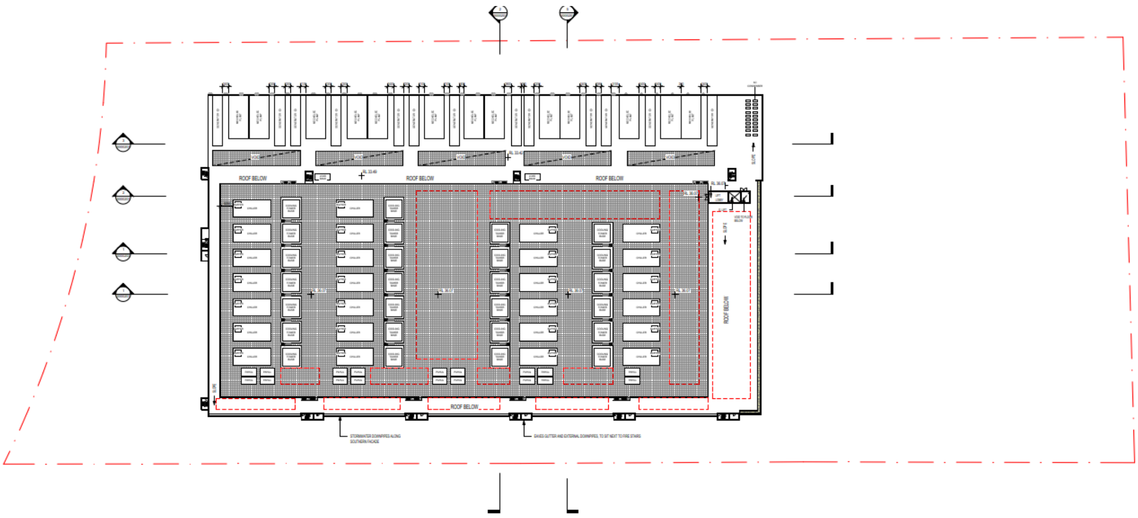
The following renewable energy options are available for the project:

3.1.6.1 PV Solar Green Initiatives

- SLR has assessed the potential for the installation of a Photo Voltaic (PV) Solar Power System for the Site. Solar system to be installed in accordance with NCC 2022. It is recommended that a 500-kW system can be installed on the roof of the proposed development. With the inclusion of the PV system the benefits to the development include:

- A 500 kW PV solar system will offset approximately 658 MWh/year of energy usage.
- The estimated greenhouse gas CO2 emission saving is approximately 540,000 kg CO2/annum.

Figure 3-1 Roof Space Available for PV



Green Power Initiative

It is recommended that a certain percentage (to be confirmed during the detailed design stage) of "Greenpower" should be made available to the project, providing the opportunity to contribute to a reduction in total greenhouse gas emissions produced by the proposed development. Greenpower is produced from environmentally friendly renewable energy sources such as solar, wind, water and biomass.

When a Greenpower product is selected by the owner, the energy supplier commits to buying a certain amount of electricity from approved new renewable energy sources. The financial accounts of Greenpower suppliers are audited independently. This makes a clear distinction between the services provided by standard energy suppliers and the more sustainable service offered through Greenpower options.

By choosing accredited Greenpower, up to 100% of a building's energy usage can be generated from renewable sources.

Furthermore, as per the new Data Centre Panel established by the Australian Government Digital Transformation Agency, using Greenpower from renewable sources has an added weightage.

3.1.7 Power Usage Effectiveness Calculation

The total energy consumption calculated by the building service engineers for the proposed development is as follows:

- Total Energy Consumption:11.3 MW/data hall
- IT Equipment Energy Consumption: 8.07 MW/data hall

The Power Usage Effectiveness (PUE) is the ratio of total amount of energy used to IT equipment energy used and is calculated as follows:

The PUE = 11.3/8.07 = 1.4

3.1.8 Energy Modelling

3.1.8.1 Baseline and Proposed Energy Consumption

Where applicable an NCC Sections J Deem-to-Satisfy compliant building is used as the baseline building for energy consumption savings. NCC Section J provides the minimum requirement for energy efficiency, and it is predicted that the proposed development will have approximately 60% energy reduction. The reduction has been enabled via:

- Efficient air conditioning system.
    - The chillers selected for this project feature magnetic bearing centrifugal compressors, delivering exceptional efficiency and achieving a Coefficient of Performance (COP) of up to 8, excluding pump and fan energy.
    - High-efficiency, direct-drive fans for the cooling towers reduce energy consumption by 40%. These cooling towers surpass the minimum efficiency standards outlined in ASHRAE Standard 90.1 (Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings).
    - Elevated chilled water supply and return temperatures, set at 19°C and 29°C respectively, enable the water-side economizer function to operate effectively at higher ambient temperatures. This extended functionality allows the economizer to run for more hours throughout the year, significantly enhancing overall efficiency.
- LED lighting fixtures;
- Daylight harvesting function to office with external windows; and
- On site PV solar system;

All building information and associated parameters are listed in the following sections of this report.

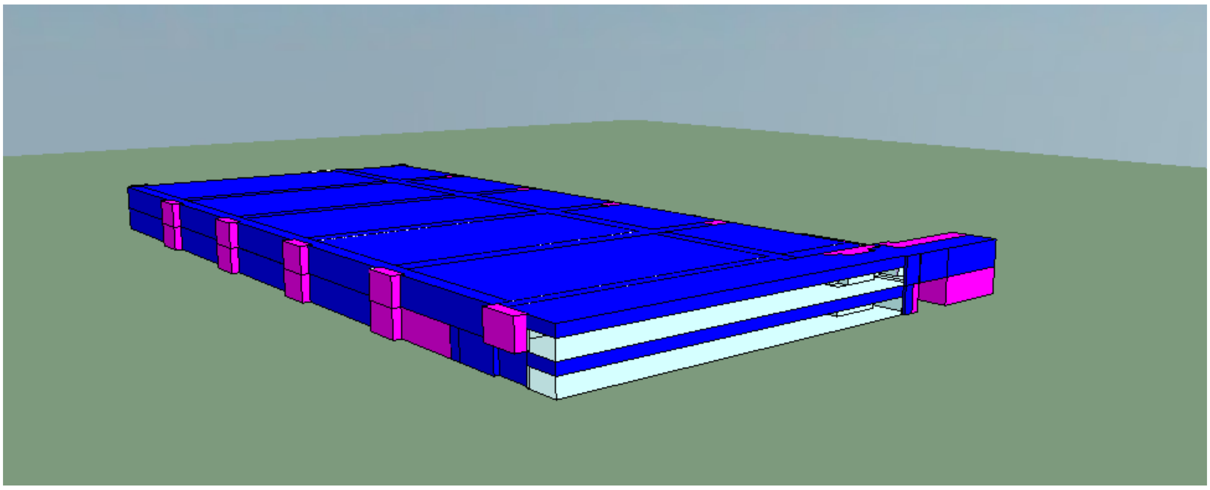
3.1.8.2 Energy Calculation of the Proposed and Reference Buildings

The Energy Simulation Program used in this study is the IES computer program Virtual Environment 2022 (VE). The program is based on the ASHRAE response factor and the modifications included utilising Australian weather data and including building materials more appropriate to those used in Australia and enabling the input of metric data.

- SLR supports a perpetual license of the Energy Simulation Software package IES <VE>;
- IES <VE> has passed the BESTEST (ASHRAE Standard 140) external validation process;
- The weather data from ACADS-BSG NSW_Sydney_RO_81 Test Reference Year (TRY) is used for the modelling;
- IES<VE> assesses U-Value, SHGC, and shade coefficient when evaluating the effect of glazing;
- Detailed warehouse operating schedules are not available at this stage. Therefore, NCC standard building operating profiles such as occupancy, lighting, air conditioning and equipment were adopted for the office areas; and
- At least 500 kW of PV system has been proposed the rooftop of the warehouse.

The developed 3D model for energy modelling is shown below.

Figure 3-2 Proposed Data Centre in IES Model



3.1.8.3 Model Configuration

The reference and proposed building fabric data and other modelling assumptions are shown below:

Table 6 Reference Dynamic Modelling Inputs – Reference Building

Item	Description
Climate Data	Weather data from ACADS-BSG, NSW_Sydney_RO_81 Test Reference Year
External wall	All external walls have a total R-value of R2.8
Internal wall	All internal walls to unconditioned space have a total R-value of R2.1
Glazing	Glazing system (glass and frame) with U value & Solar Heat Gain Coefficient as per reference wall glazing system building code calculations: GF: U value = 4.5, SHGC = 0.2 1F: U value = 1.5, SHGC = 0.28
Roof	Concrete/Metal roof with insulation, Total R-value= R3.7
Floor	Concrete Floors with carpet overlay / tiles with R2.0 floor insulation above unconditioned space.
Permeability	No more than 5 $m^3/hr.m^2$ at 50 Pa reference pressure
Lighting Density	As per NCC 2022 Table J6.2a for different classification of building
Lighting hours	24hrs for IT equipment rooms, and normal office operation hours as per NCC 2022 Section J for office spaces.
Equipment density	Office Equipment load in the model is 11W /m^2 as per 2022 NCC Table 2h for office. Peak IT equipment load is 61.2MW (90% of the ultimate equipment load) as per the provided data, resulting in an average 2,708W/ m^2 for all IT equipment rooms. The project is structured in two stages. The current study focuses on modelling the peak energy consumption for the entire scope of the project.
Occupant density	As per Table D1.13 of the 2022 NCC for office.

Item	Description
	0 occupancy assumed for all IT equipment rooms.
Occupancy Schedule	Schedules used in study are as per Table 2a in 2022 NCC JV Specification. See Appendix A
HVAC System type	HVAC efficiencies in the reference building are modelled in accordance with NCC Section J and Minimum Energy Performance Standards (MEPS). COP = 2.9 for both cooling and heating
HVAC Hours	24hrs for IT equipment rooms, and normal office operation hours as per NCC 2022 Section J for office spaces.
HVAC Control	Space temperature indoor conditions 22.0±2.0°CBD for office. Space temperature indoor conditions 28.0±2.0°CBD for all IT equipment rooms.
Document References	The reference buildings were modelled in IES <VE> as per the architectural drawings, dated March 2025.

Table 7 Proposed Dynamic Modelling Input – Proposed Building

Item	Description
Climate Data	Weather data from ACADS-BSG, NSW_Sydney_RO_81 Test Reference Year
External wall	All external walls have a total R-value of R2.8
Internal wall	All internal walls to unconditioned space have a total R-value of R2.1
Glazing	Glazing system (glass and frame) with U value & Solar Heat Gain Coefficient as per reference wall glazing system building code calculations: U value = 4.2, SHGC = 0.42
Roof	Concrete/Metal roof with insulation, Total R-value= R3.7
Floor	Concrete Floors with carpet overlay / tiles with R2.0 floor insulation above unconditioned space.
Permeability	No more than 5 $m^3/hr.m^2$ at 50 Pa reference pressure
Lighting Density	3.5W / m^2
Lighting hours	24hrs for IT equipment rooms, and normal office operation hours as per NCC 2022 Section J for office spaces.
Equipment density	Office Equipment load in the model is 11W /m^2 as per 2022 NCC Table 2h for office. Assuming full load of 2,708W/m^2 for all IT equipment rooms in the proposed case. The project is structured in two stages. The current study focuses on modelling the peak energy consumption for the entire scope of the project.
Occupant density	As per Table D1.13 of the 2022 NCC for office. 0 occupancy assumed for all IT equipment rooms.
Occupancy Schedule	Schedules used in study are as per Table 2a in 2022 NCC JV Specification. See Appendix A
HVAC System type	COP = 8 for both cooling and heating excluding the pump and fan for the cooling towers. The cooling tower selected at this stage uses high efficiency direct drive fans and offer a 40% decrease in energy consumption in comparison to the minimum efficiency required for cooling towers as per ASHRAE standard 90.1 (Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings)

Item	Description
HVAC Hours	24hrs for IT equipment rooms, and normal office operation hours as per NCC 2022 Section J for office spaces.
HVAC Control	Space temperature indoor conditions 22.0±2.0°CBD for office. Space temperature indoor conditions 28.0±2.0°CBD for all IT equipment rooms.
Document References	The reference buildings were modelled in IES <VE> as per the architectural drawings, dated March 2025.

3.1.8.4 Minimisation of Greenhouse Gas Emission

The predicted Total Annual Energy Consumption of the NCC Reference Building and the Proposed Building is summarised in **Table 8**.

The annual energy consumption of the proposed building may be reduced by the amount of energy obtained from:

- an on-site renewable energy source; or
- another process as reclaimed energy.

By implementing all energy efficiency measures described Section 3, the project is predicted to achieve an overall 19.5% GHG emission reduction when compared with a base case building assuming similar IT Equipment load for both the base case and proposed scenarios. The energy saving is approximately 60% when the IT Equipment load is excluded from the energy saving calculations.

Furthermore, a heat exchanger will be installed in parallel with the water-cooled chiller to allow the Cooling towers to directly cool the facilities chilled water system without the use of chillers on days where the ambient wet bulb temp is suitable. The above calculation ignores the benefit of the economiser at this stage and the model will be updated during the detailed design stage once all equipment for the data centre is specified.

Table 8 Comparison of Annual Energy Consumption Between the Reference and Proposed Building

Electricity Usage	Reference Building (MWh)	Proposed Building (MWh)
Mechanical System including cooling loads and Auxiliaries	258,211.9	104,065
Lighting	1,043	811.2
IT Equipment	536,112	536,112
DHW	assumed identical	assumed identical
PV System[1]		-658
Total	**795,366.9**	**640,330.2**
Greenhouse Gas Emission	**Reference Building**	**Proposed Building**
Kilo Tonnes CO2-e	580.617	467.921

Note 1: The project comprises two stages, with the current study dedicated to modelling the peak energy consumption across its entire scope. The PV solar system installation aligns with the project stages, with a capacity of 250 kW for Stage 1 and an additional 250 kW for Stage 2

3.2 Water Efficiency

3.2.1 Amenities

Australians use more than one million litres of freshwater per person each year (source: Green Building Council of Australia 2006).

In addition to increased water use efficiency, new developments can reduce potable water demand by occupants, and visitors through the provision of an on-site alternative water supply. There are three principal forms of alternative water supply:

- Reticulation of reclaimed water to the site
- Rainwater/storm water storage and reuse
- Grey water storage and reuse.

It is recommended to explore the use of the above types of alternate water supply for landscape irrigation and fire services, reducing the demand on potable water supply.

Use of recycled water for process cooling will also be evaluated as the design progresses.

The proposed development is designed to operate with the below water efficient features:

- Water efficient Cooling towers fitted with Variable Speed Fans (VSDs)
- Rainwater tank (refer Section 3.2.1)
- Efficient water fixtures (refer Section 3.2.2)

By installing 4 star rated toilets, urinals and taps and the proposed rainwater harvesting facility the proposed development will reduce its potable water demand by approximately 43%.

The quantities of each water fittings are assumed from the drawing and listed in **Appendix C**.

3.2.2 Cooling Tower

The selection of cooling towers for data centres offer several advantages. Ke Benefits include:

- **Water Conservation**: By recycling water through the cooling process, they help reduce overall water usage
- **Extended Equipment Lifespan**: Maintaining controlled temperatures prevents overheating, which can prolong the life of machinery and equipment.
- **Environmental Sustainability**: They contribute to reducing carbon footprints by optimizing energy use and minimizing waste
- **Cost Savings**: Over time, cooling towers prove to be an economical choice due to their efficiency and lower operational costs

The proposed development will use Series 3000 cooling tower, with the ENDURA/H fan system. Refer Figure 3-3.

This model is known for its high efficiency and reliability, often exceeding industry standards like ASHRAE 90.1.

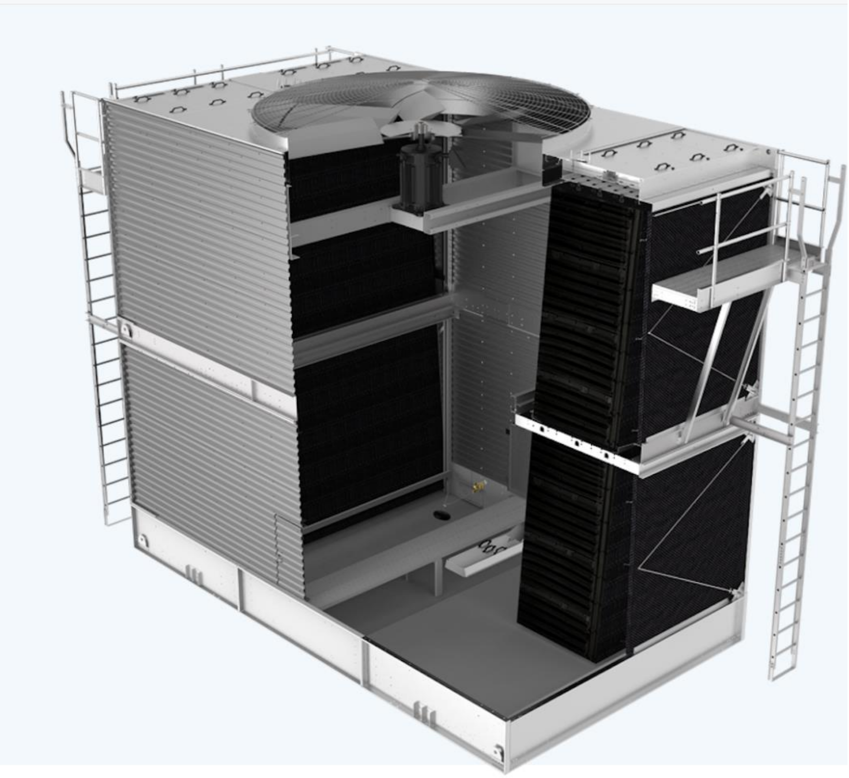
- It optimises cooling performance while minimizing water usage.

- Its design supports water-side economisation, which allows for efficient cooling at higher ambient temperatures, further reducing water consumption. Further information can be found at https://baltimoreaircoil.com.au/products/open-cooling-towers/3000-series-s3e

The estimated peak water consumption for the cooling towers for the proposed project is 4,802 kL per day at this stage.

The water consumption will be further minimised through the integration of a proposed rainwater tank and the utilisation of recycled water sources available near the project site.

Figure 3-3 Proposed Cooling Tower, Series 3000 (2021 WQF) XES3E-1222-07M ENDURA/H



Source: https://baltimoreaircoil.com.au/products/open-cooling-towers/3000-series-s3e

3.2.3 Landscaping

The following points are noted with respect to the landscaping of the proposed development:

- The proposed landscape plan includes trees around perimeters. The use of trees and perimeter planting is very effective in reducing the reflection of heat and light onto the building from surrounding paved areas. Planting also provides added cooling during the summer months through the leaf transpiration process.
- Most of the trees provided to the perimeter of the site will be evergreen trees, providing year-round wind, heat and solar mitigation.

Based on international best practice guidelines, it is generally recommended that either 90% of the water requirement for landscape irrigation is sourced from on-site rainwater collection or recycled water. Alternatively, best practice would also be achieved with the installation of a water efficient irrigation system comprising subsoil drip systems and automatic timers with rainwater or soil moisture sensor control override.

The landscape design should focus on using native and other drought resistant species that rely primarily on rainwater for their water needs. The following is recommended to be incorporated into the development to minimise water consumption for landscape irrigation.

- Provision of 60,000 L rainwater tank for irrigation and cooling towers;
- Native coastal and other drought resistant species that rely primarily on rainwater for their water needs where appropriate and possible;
- Indigenous species are currently proposed to comprise over 30% of the provided landscaping.

3.2.4 Water Efficient Fixtures

In addition, use of efficient water fixtures ensure less usage of potable water and reduced wastage. The following WELS ratings are proposed for the water fixtures used in the project:

- Taps – 6 star
- Toilets – 5 star
- Urinals – 5 star
- Showers – 4 star

3.3 Monitoring and Commissioning

Effective energy management reduces costs through the use of energy efficiency measures and improves environmental outcomes locally, regionally and globally.

As a first step, major energy use components of the project have been identified below based on information available within the project design brief:

- Air Conditioning
- Power
- Lighting

As the design progresses, it is recommended to reconfirm the top energy uses through energy modelling.

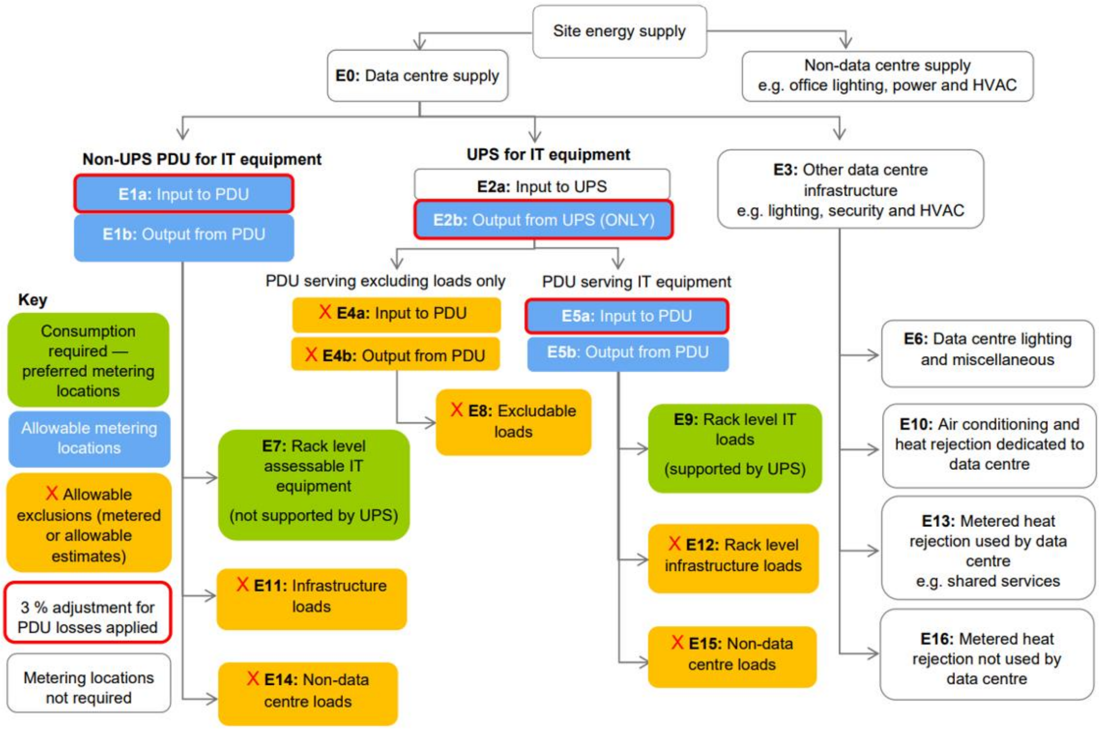
The main source of energy for the proposed site is electricity. All sustainable measures will be implemented into the project need to be commissioned and tuned once the project completed, to ensure all services operate to their full potential and as designed.

3.3.1 Energy Metering and Monitoring

To enable effective review of energy usage by the project, sub-metering should be implemented for all major energy consuming processes or items of equipment including sub-metering for all loads greater than 100 kVA, where possible. A metering and monitoring strategy in line with NABERS Energy for Data Centres shall be developed.

An example metering strategy is shown below:

Figure 3-4 Example Metering Strategy



Electrical equipment should be maintained to Australian Standards to ensure unnecessary energy wastage is minimised. Roof access system is proposed for third party access to roof for carry out necessary maintenance as required.

In accordance with the Goodman's general Industrial Building Specification, a Building Users' Guide is to be prepared for the Project. The Building Users' Guide provides details regarding the everyday operation of a building and should include energy minimisation initiatives such as user comfort control, maintenance of air conditioning units and other electrical devices to ensure maximum operating efficiency, and lighting zoning strategies.

Similarly, appropriate end uses of water systems shall also be metered and monitored.

3.3.2 Independent Commissioning

During construction and before practical completion, all building systems must be commissioned per a recognised commissioning standard (CIBSE or ASHRAE commissioning guides). A commissioning specification must be included in the construction documentation listing requirements for each system.

A commissioning plan must be developed prior to practical completion.

3.3.3 Energy Review and Audit

A Building User Guide outlining the various strategies and processes to be carried out to ensure energy efficiency must be developed. An energy usage review will be undertaken within the first few months of operation to ensure the Building User Guide is sufficient for the development's needs. A breakdown of energy usage per month will help to measure the development's baseline energy use and assess what appliances, equipment and processes are consuming energy.

An energy review will be conducted for the assessment of energy utilisation to further identify opportunities for improvement. Energy usage data obtained during the review process may be used to establish key performance indicators and annual energy targets for the project.

Energy usage to be included in the review should include all purchased electricity and energy which is consumed by equipment on site.

An energy audit and management review will be undertaken on a yearly basis to ensure employees are following energy savings procedures correctly. Where audits show that energy savings procedures are not carried out effectively, additional employee training should be provided and signage and procedures re-examined.

The Building User Guide shall be progressively improved and updated on an annual basis, to reflect changes to the Energy Management System and to promote continual improvement of energy management at industry best practice over time.

An effective Building Users Guide will ensure that:

- Facility managers understand in detail their responsibilities for the efficient operation of the facility and any additional building tuning necessary to continuously improve energy management.
- Maintenance contractors understand how to service the particular systems to maintain reliable operations and maximum energy efficiency.
- Employees understand energy minimisation procedures and working limitations required to maintain design performance for energy efficiency.
- Future fit-out / refurbishment designers understand the design basis for the building and the systems so that these are not compromised in any changes.

A Tenant Base Building Specification shall be developed which outlines the sustainability features implemented in the project and the required that are to be ensured by the tenant. As specified within the Tenant Base Building Specification, the building tuning will be provided by service contractors and overseen by an independent assessor, at least once a month within the Defects Liability Period (DLP) period to ensure that services are operating effectively and efficiently. Monthly reports need to be provided to the tenant for DLP.

3.4 Resilience and Climate Adaptation

It is important to address the impacts of potential climate risks and other future shocks such as pandemics on our built environment which in turn affects us. This enables building owners to fully understand and address potential climate risks that may impact the building's ability to function optimally over the long-term. The following recommendations are made to address this:

3.4.1 Climate Change Risk Assessment

It is recommended that a suitably qualified professional carries out climate change risk and adaptation assessment as per below during the detailed design stage:

- Perform the assessment using the information from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report Representative Concentration Pathway 8.5 (RCP 8.5) or most recently published version

- Define and include the consequence and likelihood tables and risk matrix used to assess climate risks
- Assess risks in consultation with multidisciplinary representatives from within the project team and a selection of relevant external stakeholders
- Develop a register of risks to the building and surrounding infrastructure, and provide treatment options for risks identified as ‘extreme’ or ‘high’
- Communicate the results of the assessment to the leads of all design disciplines
- All risks rated as 'Extreme' must be addressed through specific design responses
- All risks rated as 'High' must be addressed through design or future operational responses
- Regardless of risk rating, at least two risks identified in the assessment must be addressed by specific design responses.

3.5 Materials and Waste

3.5.1 Low Carbon Materials

It is encouraged to consider low-carbon materials where possible to reduce the amount of upfront and embodied carbon associated with the project.

Some measures that can be implemented are:

- Select materials with a low environmental impact over the lifecycle of the building.
- Choose timber from certified plantations and avoid unsustainable timber imports including western red cedar, oregon, meranti, luan or merbau. Timber with FSC certification
- Design works for de-construction.
- Select materials for development works with low embodied energy properties or materials that have been salvaged or recycled for the construction of the Development including concrete that utilises slag and fly ash content, structural and reinforced steel that uses recycled steel content or bulk insulation products that contain recycled content, such as recycled glass in glass-wool.

3.5.2 Building Materials

3.5.2.1 Walls

It is recommended that external walls are Brick or Hebel Power Panel with plasterboard with acoustic insulation where required. The use of this wall system will reduce the insulation required due to the inherent R value of the wall system. The insulation required will be determined by the NCC Section J calculations.

It is recommended internal walls are to be lightweight plasterboard on stud construction or Hebel Power Panel with plasterboard with acoustic insulation where required. This is advantageous from a building life-cycle perspective, as it maximises the adaptive reuse potential when a building reaches the end of its intended use.

Walls between energy intensive data centre spaces and other spaces such as offices, etc are required to have appropriate insulation to prevent cooling losses.

3.5.2.2 Roof

It is proposed to use concrete roof with plasterboard ceiling construction throughout the building. Insulation is to be provided to roof areas exposed to open air. The insulation required will be determined by the NCC Section J calculations.

In addition, roofing material is recommended to have an SRI (Solar Reflective Index) value of minimum 64 to mitigate heat island effect.

3.5.2.3 Glazing

Performance Glazing such as single glazed low-E and double glazed low-E glazing is recommended. The glazing required will be determined by the NCC Section J calculations.

3.5.2.4 Floor and Thermal Mass

Concrete slab construction is to be used for all floors throughout the development in accordance with BASIX and NCC Section J requirements. Concrete has amongst the highest thermal mass capacity among a range of common building products, as presented in the below table.

Generally, denser materials have higher mass which has the ability to store heat energy and then release it slowly to the room. This storage effectively smoothens out daily temperature variations within conditioned spaces, with corresponding reductions in both heating and cooling loads. Insulation is to be provided to floor areas exposed to open air.

3.5.3 Building Sealing

The purpose of sealing is to ensure that additional heating and cooling loads will not be introduced through building leakage.

A seal to restrict air infiltration must be fitted to each edge of an external door, operable external window or the like when serving a conditioned space in the proposed development. The seal may be a foam or rubber compressible strip, fibrous seal or the like.

The bathroom/toilet exhaust fans in the proposed development must be fitted with a sealing device such as a self-closing damper or the like.

3.5.4 Waste Management

3.5.4.1 Construction Waste Management

It is recommended that 90% of the construction and demolition waste is diverted from the landfill to minimise the impacts of construction on the environment.

3.5.4.2 Operational Waste Management

An Operational Waste and Recycling Management Plan is a minimum requirement to meet sustainable building design best practice. The Waste and Recycling Management Plan includes:

- Separate waste and recycling streams;
- Transfer of material to common storage area;
- Communal storage areas;
- Frequency of collection; and
- Signage and educational initiatives for occupants.

E-Waste

Although the data halls are not expected to regularly produce much waste, from time-to-time significant quantities of e-waste will be generated. E-waste may include broken or upgraded computer hardware, circuits and electrical components and their associated packaging. Some e-waste contains toxic chemicals, such as lead, mercury and arsenic, but can also contain precious metals that can be recycled.

Disposal of e-waste will be the responsibility of equipment suppliers who will collect obsolete equipment when new equipment is installed. Bulk bins, or other methods for transporting large quantities of e-waste, will be used at those times to remove it. Suppliers will use the loading dock as required. Once removed from the site it is expected that suppliers will sell-on any suitable hardware or recycle it lawfully through an approved recycler.

3.6 Indoor Environmental Quality

Achieving enhanced Indoor Environment Quality (IEQ) ensures that the building and building services are designed and managed to benefit the health and well-being of building occupants and visitors. Owing to the nature of the building, certain requirements such as daylighting will not be applicable (except for office spaces). The following are some of the strategies to be considered to ensure high levels of indoor environmental quality.

It is noted that the site has been previously developed and has been remediated to acceptable levels prior to this assessment.

3.6.1 Asbestos

It is recommended that Asbestos identification and removal procedures be included in the site Environmental Management Plan (EMP) where required.

3.6.2 Internal Noise Levels

Internal noise levels are a significant factor in determining occupant satisfaction and well-being. The aim of controlling internal noise levels is to encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level. It is recommended that appropriate acoustic treatments are applied for various areas of the development. This will be further developed as the design progresses.

3.6.3 Carbon Dioxide Monitoring and Control

Elevated carbon dioxide (CO2) levels are indicative of inadequate ventilation, affecting the quality of air within an enclosed occupied space, and the health of the occupants. CO2 monitoring systems can detect elevated concentrations of CO2 and automatically adjust ventilation supply rates before indoor air quality becomes problematic.

SLR Consulting recommends incorporating a CO2 monitoring system where appropriate to satisfy NCC requirements.

3.6.4 Paints and Floor Coverings

SLR recommends the use of paints and floor coverings with low levels of volatile organic compounds (VOC) and low formaldehyde wood products where possible.

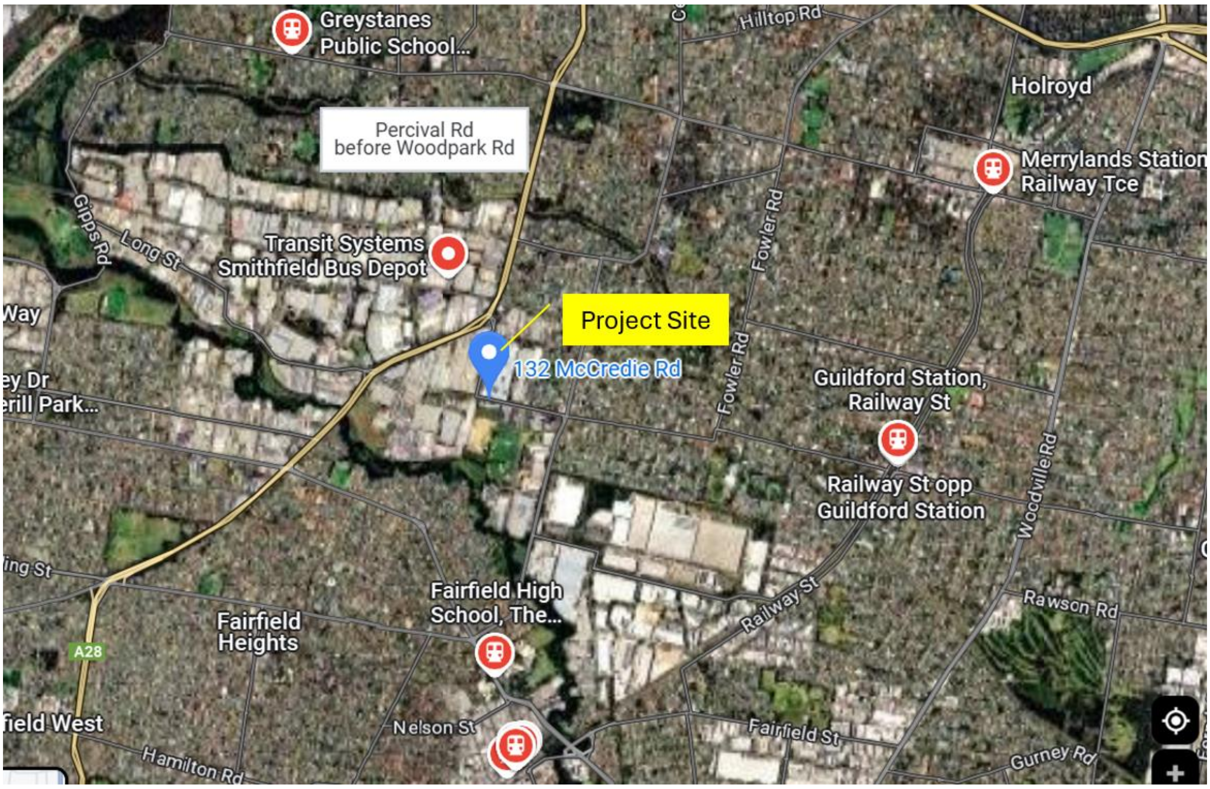
3.7 Transport

When designing a sustainable development, it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and environmental impact through reduced fossil fuel consumption and improved regional air quality. This can be achieved by encouraging the use of energy efficient public transport that is immediately at hand, reducing car parking facilities, and providing adequate bike storage facilities to minimise the requirement for individual motorised transport.

The project location is in close proximity to well-developed residential and mixed use neighbourhood which can form a base for the employees working at the data centre thereby encouraging the use of public transportation.

The project site is located near public transport options. It is a bicycle ride away from the nearest train station thus encouraging commuting using public transport.

Figure 3-5 Public Transport Infrastructure around the Project Site



3.7.1 Provision of Car Parking

Transport emissions are one of the largest contributors of greenhouse gas emissions in Australia.

20% (spaces) of total parking spaces are dedicated for future electrical vehicle charging stations proposed in line with NCC 2022 requirements.

3.7.2 Facilitation of Pedestrian and Non-motorised Transport

When designing a sustainable development, it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and reduce environmental impact through reduced fossil fuel consumption and improved regional air quality. This can be achieved by encouraging all users of the development to make use of the energy efficient public transport that is immediately at hand.

Bike storage facilities are proposed to be installed in the proposed development, which will also help to minimise the requirement for individual motorised transport.

In addition, provision of parking spaces for low emission vehicles such as motorbikes shall also be considered.

4.0 Conclusion

This Energy Efficiency and Ecologically Sustainable Design Report has been prepared by SLR Consulting to accompany a State Significant Development Application (SSDA) for the construction and ongoing operation of a data centre facility at 132 McCredie Road, Guildford West NSW 2161, in the Cumberland Council Local Government Area (LGA). The site is legally described as Lot 1 in DP596315.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project Pluto Data Centre (SSD-69223466) dated 4 April 2024.

The proposed development is designed to operate with energy efficiency through the following planned considerations:

- High efficiency water-cooled magnetic bearing chillers.
- High efficiency cooling towers. Its design supports water-side economisation, which allows for efficient cooling at higher ambient temperatures, further reducing water consumption
- High-efficiency, direct-drive fans for the cooling towers reduce energy consumption by 40% when compared to the minimum efficiency standards outlined in ASHRAE Standard 90.1 (Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings).
- All pumps fitted with VSDs.
- High efficiency Fan Wall Units with Electronically Commutated (EC) fans serving data halls.
- High efficiency Computer Room Air Handling units with EC fans serving electrical rooms.
- Raised chilled water temperatures for improving chiller efficiency.
- Water-side free cooling using plate heat exchangers to minimise chiller operation.
- Mechanical systems operating in hot standby mode to improve operational efficiency.
- High efficiency Uninterruptible Power Supply (UPS) units to minimise electrical losses.
- Following energy efficiency measures are considered for lighting:
  - Provide LED fitting for the entire project.
  - Occupancy sensors to low occupancy areas.
  - Localised lighting for specific tasks rather than general overhead lighting for the entire space. For example, direct lighting can be provided at server racks or workstations.

This report concludes that the proposed data centre is suitable and warrants approval subject to the implementation of the following mitigation measures:

- It is recommended that a 500 kW PV Solar system can be installed on the roof of the proposed development. With the inclusion of the PV system the benefits to the development include:

  - A 500 kW PV solar system will offset approximately 658 MWh/year of energy usage.
  - The estimated greenhouse gas CO2 emission saving is approximately 540,000 kg CO2/annum.
- Low-carbon materials where possible to reduce the amount of upfront and embodied carbon associated with the project.
- It is recommended that 90% of the construction and demolition waste is diverted from the landfill to minimise the impacts of construction on the environment.
- Although the data halls are not expected to regularly produce much waste, from time-to-time significant quantities of e-waste will be generated. Disposal of e-waste will be the responsibility of equipment suppliers who will collect obsolete equipment when new equipment is installed.
- The proposed landscape plan includes trees around perimeters. The use of trees and perimeter planting is very effective in reducing the reflection of heat and light onto the building from surrounding paved areas. Planting also provides added cooling during the summer months through the leaf transpiration process.
- Most of the trees provided to the perimeter of the site will be evergreen trees, providing year-round wind, heat and solar mitigation.
- Provision of 60,000 L rainwater tank for irrigation and cooling towers.
- The following WELS ratings are proposed for the water fixtures used in the project:
  - Taps – 6 star
  - Toilets – 5 star
  - Urinals – 5 star
  - Showers – 4 star
- Native coastal and other drought resistant species that rely primarily on rainwater for their water needs where appropriate and possible;
- Indigenous species are currently proposed to comprise over 30% of the provided landscaping.
- 20% (spaces) of total parking spaces are dedicated for future electrical vehicle charging stations proposed in line with NCC 2022 requirements.

By implementing all energy efficiency measures described in Section 3 of this report, the project is predicted to achieve a 60% reduction in greenhouse gas (GHG) emissions with a 500kW PV Solar system, compared to a Reference Building, excluding the IT equipment load. When factoring in the IT equipment load, and assuming identical IT equipment loads for both the reference and proposed buildings, the GHG emission reduction is projected at 19.5%. Furthermore, a heat exchanger will be installed in parallel with the water-cooled chiller to allow the cooling towers to directly cool the facilities chilled water system without the use of chillers on days where the ambient wet bulb temp is suitable. The above calculation ignores the benefit of the economiser at this stage.

By installing 4-star rated toilets, urinals and taps and the proposed rainwater harvesting facility the proposed development will reduce the potable water demand for the amenities in the development by approximately 43%.

These features will help achieve significant reductions in energy and water required by the development both in building and operation, in addition to ensuring that high levels of sustainability are considered in the project.

It is recommended that the ESD initiatives proposed continue to be developed and implemented throughout the course of this project.

5.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback. We recognise the value of your time and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.

Appendix A Net Zero Statement

Net-zero Statement for Project Pluto – the proposed datacentre development at 132 McCredie Road Guildford West

NSW has whole-of-economy targets to reduce greenhouse gas emissions by 70 per cent by 2035 compared to 2005 levels and reach net zero emissions by 2050.

The proposed development at 132 McCredie Road Smithfield is fossil fuel free and by implementing all energy efficiency measures described in the current study, including the proposed PV solar system, the project will significantly minimise greenhouse gas emissions, reflecting the goal of achieving net zero emissions.

The project has strong alignment to net-zero requirements. Some of the initiatives being proposed are:

- Key consideration for the building envelop include:
  - Appropriate R value for building envelope
  - High performance glazing
- Key consideration for the building system include:
  - High efficiency water-cooled magnetic bearing chillers.
  - High efficiency cooling towers. Its design supports water-side economisation, which allows for efficient cooling at higher ambient temperatures, further reducing water consumption
  - High-efficiency, direct-drive fans for the cooling towers reduce energy consumption by 40% when compared to the minimum efficiency standards outlined in ASHRAE Standard 90.1 (Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings).
  - All pumps fitted with VSDs.
  - High efficiency Fan Wall Units with Electronically Commutated (EC) fans serving data halls.
  - High efficiency Computer Room Air Handling units with EC fans serving electrical rooms.
  - Raised chilled water temperatures for improving chiller efficiency.
  - Water-side free cooling using plate heat exchangers to minimise chiller operation.
  - Mechanical systems operating in hot standby mode to improve operational efficiency.
  - Led lighting and controls for the entire project.
  - Led lighting and controls for the entire project to reduce the reliance on artificial lighting.
- It is recommended that a 500 kW PV Solar system can be installed on the roof of the proposed development. With the inclusion of the PV system the benefits to the development include:

- A 500 kW PV solar system will offset approximately 658 MWh/year of energy usage.
- The estimated greenhouse gas CO2 emission saving is approximately 540,000 kg CO2/annum.

- Other considerations to achieve a net zero development by 2050 include:
  - Electrification of all appliances and equipment.
  - Use of Green Power to contribute to a reduction in total greenhouse gas emissions produced by the proposed development. Greenpower is produced from environmentally friendly renewable energy sources such as solar, wind, water or biomass. Goodman property is committed to achieve carbon neutrality across its global operations.

Once the design of the building services is progressed during the detailed design stage, SLR will carry out detailed energy modelling to assess the energy use and optimise design as required.

Yours sincerely,

Nehad

Dr Neihad Al-Khalidy, ME Mech, PhD

SLR Consulting Australia

Technical Director – Accredited Green Star and NABERS Professional

MIEAust CPEng; NER

Appendix B Energy Saving Lighting Design Recommendations

BCA Lighting Requirements - Project Pluto

BCA Comply Building	Data centre		Area	Operating Hrs	Lighting Control			Total Annual Energy Consumption (kWh)
	Warehouse W/m2	4.5	29,399	Monday to Sunday 24 hours	Detector, Daylight	0.9	1	1,043,018
								0
			29,399				Total	1,043,018
							kWh/m2	**35.48**

BCA Lighting Requirements - Project Pluto

BCA Comply Building	BCA Requirements		Area	Operating Hrs	Lighting Control			Total Annual Energy Consumption (kWh)
	Warehouse W/m2	3.5	29,399	Monday to Sunday 24 hours	Detector, Daylight	0.9	1	811,236
							1	
			29,399				Total	811,236
							kWh/m2	**27.59**

Appendix C Water Saving Recommendations – Amenities

Amenities

Table B1 - Number of fixtures

Area	Toilets	Urinal	Basins	Showers
Amenities 3C	19	8	22	6
Total	19	8	22	6

Assume 100% of toilet water usage is supplied by rainwater

Fraction not supplied	0

Table B2 - Results

No water saving measures		Max water usage rate [1]	
Toilet	Adopt 3* Average Flush Usage in Table C3	76	L/s
Tap	Adopt 3* Tap Usage in Table C3	198	L/s
Urinal	Adopt 3* Urinal Usage in Table C3	16	L/s
Water reuse measures (4*) with RWH		**Max water usage rate [1]**	
Toilet	Adopt 4* Average Flush Usage in Table C3	66.5	L/s
Tap	Adopt 4* Tap Usage in Table C3	165	L/s
Urinal	Adopt 4* Urinal Usage in Table C3	12	L/s
Water reuse measures (5*) with RWH		**Max water usage rate [1]**	
Toilet	Adopt 5* Average Flush Usage in Table C3	57	L/s
Tap	Adopt 5* Tap Usage in Table C3	132	L/s
Urinal	Adopt 5* Urinal Usage in Table C3	8	L/s

	3* with RWH	4* with RWH	5* with RWH
Improvement Percent	**32**	**43**	**54**

Calculation Notes

[1] *Water usage rate per use = Number of items in Table C1 x Usage rate in Table C3*

[2] *Assume total water usage is proportional to max water usage rate*

[3] *Improvement percentage = % difference between 3* rated fixtures max water usage rate with no*

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