

# Mamre Road Data Centre Campus

Plant and Equipment Systems Report

Reference: 529643-000

Revision: 6

# Document control record

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Document control		aurecon				
<b>Report title</b>		Plant and Equipment Systems Report				
<b>Document code</b>		<b>Project number</b>		529643-000		
<b>File path</b>						
Rev	Date	Revision details/status	Author	Reviewer	Verifier (if required)	Approver
1	2025-10-22	Draft Issue	OS/IR	JC/JN		SK
2	2025-11-07	Comment Updates	OS/IR	JC/JN		SK
3	2025-11-13	Project description update	OS/IR	JC/JN		SK
4	2025-12-04	EME Information update	OS/IR	JC/JN		SK
5	2025-12-11	Fuel option update	OS/IR	JC/JN		SK
6	2025-12-12	Comment Updates	OS/IR	JC/JN		SK
<b>Current revision</b>		<b>6</b>				

Approval			
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# 1 Preface

## 1.1 Executive Summary

This *Plant and Equipment Systems* report has been prepared by *Aurecon* on behalf of the Development to accompany a detailed State Significant Development Application (SSDA) for a data centre development at 706 – 752 Mamre Road, Kemps Creek, as well as the battering and road works at 1-23 Aldington Road and 754 Mamre Road. The site is legally described as Lot 10 in Deposited Plan 1280592.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-92743706). This report concludes that the proposed data centre development is suitable and warrants approval subject to the implementation of the following mitigation measures.

- Acoustic attenuation on generator engine and mechanical equipment

Following the implementation of the above mitigation measures, the remaining impacts are appropriate.

Backup power is required for the proposed mission critical facility as outlined in Section 3. Considerations for the equipment selection have been outlined in Section 4 in terms of the generator itself, acoustics and the fuel used.

The proposed mechanical systems and design principles for the mission critical facility have been outlined in Section 5. The mechanical section is aimed to address the council's concern to achieve more efficient solutions that reduce reliance on utilities and minimise environmental impacts on nearby residents and public infrastructure.

## 2 Introduction

### 2.1 Purpose of this Report

This report has been prepared to accompany a detailed SSDA for the proposed data centre development at 706 – 752 Mamre Road, Kemps Creek. The requirements are contained within the Secretary’s Environmental Assessment Requirements (SEARs) dated 30 September 2025 issued for the project (SSD-92743706). Specifically, this report has been prepared to respond to the SEARS requirement issued below.

**Table 2-1 SEARs Compliance**

Item	Description of Requirement	Response
1	<p>Detailed justification for the chosen back-up power, load smoothing and grid stabilisation systems, including:</p> <ul style="list-style-type: none"> <li>■ A comprehensive assessment of alternative commercially available technologies (e.g. solar power, largescale batteries, hydrogen cells, etc)</li> <li>■ Demonstration of a commitment to continual improvement with respect to the design of the back-up power system and its associated emissions</li> </ul>	<p>As outlined within the following sections:</p> <ul style="list-style-type: none"> <li>■ 3 Backup Power and Grid Interface</li> <li>■ 4.2 Alternatives Considered</li> </ul>
2	<p>A detailed overview of the proposed back-up generator system (if chosen), including:</p> <ul style="list-style-type: none"> <li>■ Number and individual capacity of each generator (in terms of megawatts and megajoules per second)</li> <li>■ Maximum operating time during a power outage event</li> </ul> <p>Testing procedure (including whether testing will be carried out individually or in clusters), frequency and duration (including confirmation and, if necessary, justification of the need to test during sensitive time periods).</p>	<p>As outlined within the following sections:</p> <ul style="list-style-type: none"> <li>■ 4.3 Site Design</li> <li>■ 4.4 Generator Design</li> </ul>
3	<p>A detailed justification for the chosen data hall cooling system, including:</p> <ul style="list-style-type: none"> <li>■ A comprehensive assessment of alternative commercially available technologies (e.g. evaporative cooling, immersion cooling, direct-to-chip cooling, etc);</li> <li>■ Demonstration of a commitment to continual improvement and consideration of retrofitting with respect to new and efficient data hall cooling systems;</li> </ul>	<p>As outlined within the following section:</p> <ul style="list-style-type: none"> <li>■ 5.3 Data Hall Cooling</li> </ul>
4	<p>A detailed overview of the proposed data hall cooling system including:</p> <ul style="list-style-type: none"> <li>■ Number and details of associated plant and equipment (cooling towers, evaporative chillers etc);</li> <li>■ Energy and water demands of the proposed data hall cooling system</li> </ul>	<p>As outlined within the following section:</p> <ul style="list-style-type: none"> <li>■ 5 Mechanical Plant Selection</li> </ul>
5	<p>Demonstration of the placement of mechanical plant and equipment has considered the impact of heat rejection on habitable rooms and communal open spaces, including those of neighbouring properties.</p>	<p>As outlined within the following section:</p> <ul style="list-style-type: none"> <li>■ 5 Mechanical Plant Selection</li> </ul>
6	<p>Details and demonstration that adequate provision of water tanks and fire hydrants for the purposes of fire fighting has been provided on-site.</p>	<p>As outlined within the following section:</p> <ul style="list-style-type: none"> <li>■ 5.4 Fire Protection Infrastructure</li> </ul>

## 2.2 Project Description

The project area for the proposed development, 706-752 Mamre Road, Kemps Creek (Lot 10 DP 1280592), constitutes the main development site with areas across the shared boundaries to the east and south (described below) utilised to facilitate roadworks and bulk earthworks:

- Gibb Group site to the East known as 1-22 Bakers Lane, Kemps Creek (Lot 40 in DP 709347).
- GPT Group site to the South known as 754 Mamre Road, Kemps Creek (Lot 180 in DP 1290397).

Additionally, power supply lead-in from Sydney-West Substation is proposed as part of the development, which traverses through multiple landholdings.

The site is proposed for development under a State Significant Development Application (SSDA) as a data centre campus comprising:

- - Approximately 26 shells across four-storeys data centre buildings (4x four shells and 2x five shells), including six technical office buildings, plus a campus office.
- - Incoming and internal electrical substations and associated infrastructure
- - Site preparation, including earthworks, stormwater, sewer, roads, and associated infrastructure.

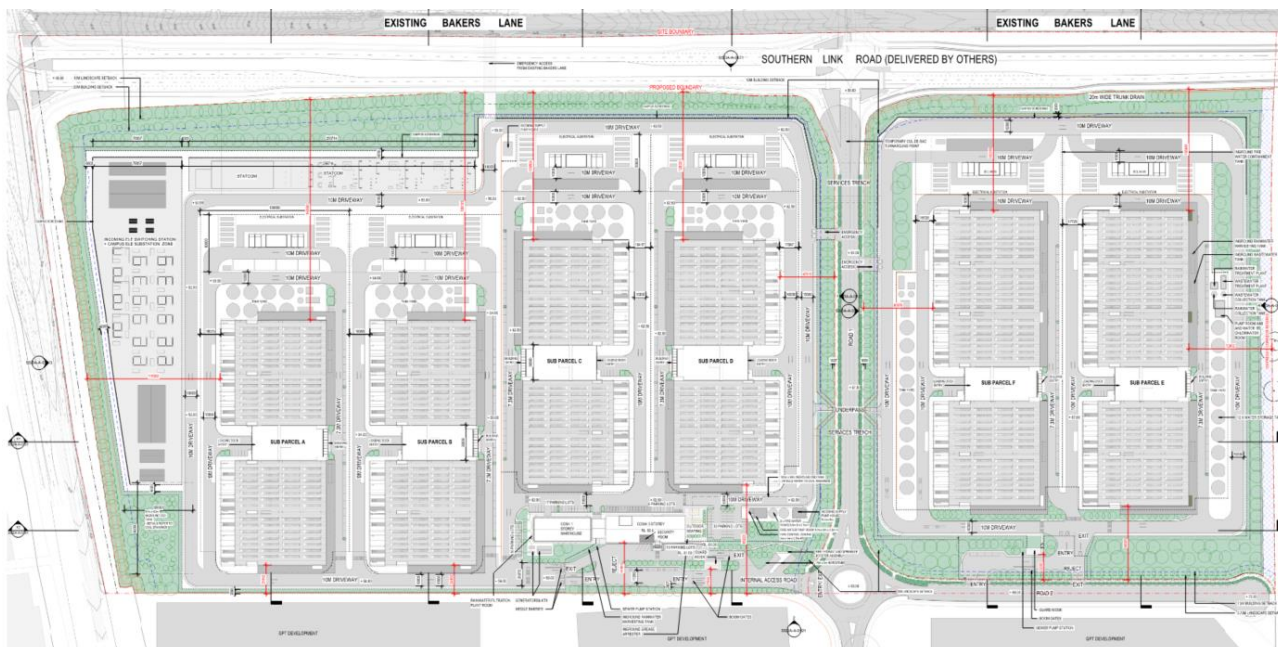


Figure 2.1: Project Overview (source Greenbox Architecture)

## 2.3 Project Location

The site located at 706–752 Mamre Road, Kemps Creek as well as adjoining sites at 1-23 Aldington Road and 754 Mamre Road NSW (Lot 10 DP 1280592) is within the Penrith City Council and is an approximately 52-hectare parcel of largely undeveloped rural land within the Mamre Road Precinct. The local area is an area rezoned for industrial and employment uses as part of the Western Sydney Employment Area. The precinct is experiencing significant growth due to its proximity to the future Western Sydney International Airport and major transport corridors, with ISPT planning a large-scale logistics hub on the site (Currently under assessment SSD-9522).

Surrounding land use is a mix of rural, agricultural, and emerging industrial activity, supported by infrastructure upgrades such as the Mamre Road widening. The site is located approximately 39 kilometers west of the Sydney CBD.

Figure 2.2 Site Location (source: Nearmaps)



## 2.4 Methodology

This section outlines the methodology used to define the baseline and undertake the assessment of selection and potential impacts of the proposed backup power system on the surrounding area.

### 2.4.1 Study Area

The assessment area will be limited to the subject site (including site boundary) and the surrounding roads/buildings.

### 2.4.2 Method of Assessment

To address the project SEARs, this report has analysed the proposed electrical and mechanical topologies of the site and assessed the equipment types required. The equipment has been identified through availability and viability for the proposed site. Through discussions with vendors and the Development and application of Australian design standards and proven designs on existing projects, the equipment types have been selected as documented within this report.

### 3 Backup Power and Grid Interface

The Development is proposed to be supplied by new 330/132kV and 132kV/33kV infrastructure. The power supply will be distributed within the site via the Development's own underground electrical infrastructure and a substation per sub-parcel. The Development is proposed to provide a STATCOM (Static Compensator) facility as part of the main substation that interfaces with the grid. This has been requested by Lumea and the Development as a load smoothing measure to improve the power quality impacts of the site. Ongoing development of power quality improvements is expected as part of the ongoing design of the HV system. The data centre is a mission critical facility and therefore requires back up generation if there is interruption to the utility supply. Each building will be provided with diesel-generators and uninterrupted power supply (UPS) systems. The UPS system is designed to maintain supply between loss of utility and changeover to the generator supply; it is not intended to maintain the full load on site for an extended period. For the purposes of this report, only the diesel-generators are considered as "Backup" power, the UPS and battery system are for energy storage and short-term supply only.

In terms of electromagnetic emissions there are typically 2 sources for data centres:

- HV Utility Power Supply: Source of power frequency electromagnetic emissions (50Hz) – This is usually addressed by an EMF assessment during the substation/ incoming power supply detailed design. As the incoming supplies are underground cables instead of overhead lines, this risk is low likelihood and low impact and will be assessed accordingly at the appropriate design stage to ensure compliance with the limits set by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).
- Radio Frequency (RF) emissions: High frequency emissions (>100kHz) typically associated with radio antennas, satellite dishes, or similar RF transmission equipment. The site is not currently proposing the installation of any RF generating equipment/ antennas, and so there is no associated risk at this stage. Should equipment of this type be proposed for future development stages, an appropriate risk assessment and EMF study will be undertaken to ensure compliance with the ARPANSA Standard for limiting exposure to radiofrequency fields (100kHz – 300GHz).

Although the energy transmission system in the area is designed to be highly reliable, there is always risk of interruption to utility supplies. Any utility outage without backup power generation on site would impact critical sectors of the economy and community which rely upon cloud computing, including banking, business operations and communication. The facility will play a key role in providing stable cloud infrastructure to the region.

# 4 Backup Power Equipment Selection

## 4.1 Selected Power Generation Technology

The Development has opted for diesel-generator sets for the backup power source for the proposed site. This is based on the most appropriate technology for a mission critical data centre and the market readiness for this technology in New South Wales. Alternatives have been considered for this site, but none are considered viable except for alternative fuel for the generator engines. See Section 4.2 for further details.

## 4.2 Alternatives Considered

### 4.2.1 Potentially suitable for deployment

The following table outlines backup supply technology options and summarises the assessed suitability for the site.

Table 4-1 Backup Power Options Analysis Summary

Technology	Description	Viability for Proposed Site
<b>Solar Power (Photovoltaic Cells)</b>	<ul style="list-style-type: none"> <li>Power can be harvested from photovoltaic cells during daylight hours and provide DC power that must be transformed into usable AC power for the Development via numerous rectifier systems.</li> </ul>	<p>Based on the size, height and intended rooftop usage of the proposed sub-parcels, there is limited roof and site space available for solar power at scale.</p> <p>Additionally, the 24hr load profile of the Development does not suit the generation of Solar Power during daylight hours only. A significant energy storage solution would need to be implemented to provide sufficient backup power during non-daylight hours. This means large scale Solar power is <b>not viable</b> for the site.</p>
<b>Large-scale batteries (Lithium-ion Batteries / Flow Batteries)</b>	<ul style="list-style-type: none"> <li>Lithium-ion batteries use a cathode (positive electrode), an anode (negative electrode) and electrolyte as a conductor. Li-ion battery cells come in many varieties – but all use lithium ions. During charging the lithium ions flow from the cathode to the anode through the electrolyte and separator. When discharging the flow of ions reverses from the anode to the cathode.</li> <li>Flow batteries store energy in electrolytes in electrolyte tanks. The electrolyte is pumped through a reaction stack of electrochemical cells, in which charge, and discharge reactions take place at electrode surfaces.</li> <li>Vanadium redox is the leading flow battery technology in terms of technical and commercial readiness.</li> </ul>	<p>Due to the spatial requirements of Lithium-ion batteries for both fire-separation, fuel separation, and general safety requirements, there is insufficient space to provide enough battery storage to the site for a medium-term power failure. The current provision for battery storage on site is for short-term supply and energy storage for uninterruptable power systems only, to facilitate the switch between utility supply and the backup power supply if interruption to utility occurs (up to 5 minutes only). Thus, this technology is <b>not viable</b> be used as a standalone backup power supply for this site.</p> <p><b>Not viable</b> for this site due to commercial availability and scale required to achieve energy autonomy on site during utility failure.</p>
<b>Hydrogen fuel</b>	<ul style="list-style-type: none"> <li>Hydrogen can be used as a fuel source or using fuel cells. A fuel cell consists of a negative electrode (anode) and a positive electrode (cathode) sandwiched around an electrolyte.</li> </ul>	<p><b>Not Viable</b> – significant spatial requirements of industrial tanks for 24 hours of hydrogen fuel on site. No current hydrogen pipeline would be possible within site development timeframe. Additional safety requirements for hydrogen usage on site and for the nearby school and residential areas would need to be considered.</p>
<b>HVO renewable diesel fuel</b>	<ul style="list-style-type: none"> <li>Biodiesel is produced from a diverse mix of resources including vegetable oils (corn, soybeans, rapeseed, palm etc.), animal fats (beef tallow, pork lard etc.), and recycled cooking oil.</li> <li>Conventionally feedstock goes to a transesterification process and becomes biodiesel, which can be blended with petroleum diesel.</li> <li>Advanced methods such as hydrotreatment, gasification, and pyrolysis can be used to produce 'drop in' biofuels. These biofuels are chemically the same as petroleum diesel fuel and is compatible with existing infrastructure designed around petroleum.</li> </ul>	<p><b>Viable</b> – Biodiesel for use in existing diesel engines is available within Australia and often used in first fill and testing arrangements. This site is proposed to use diesel generators, and HVO renewable diesel fuel is a viable option subject to further investigation.</p>

## 4.2.2 Ongoing Improvements

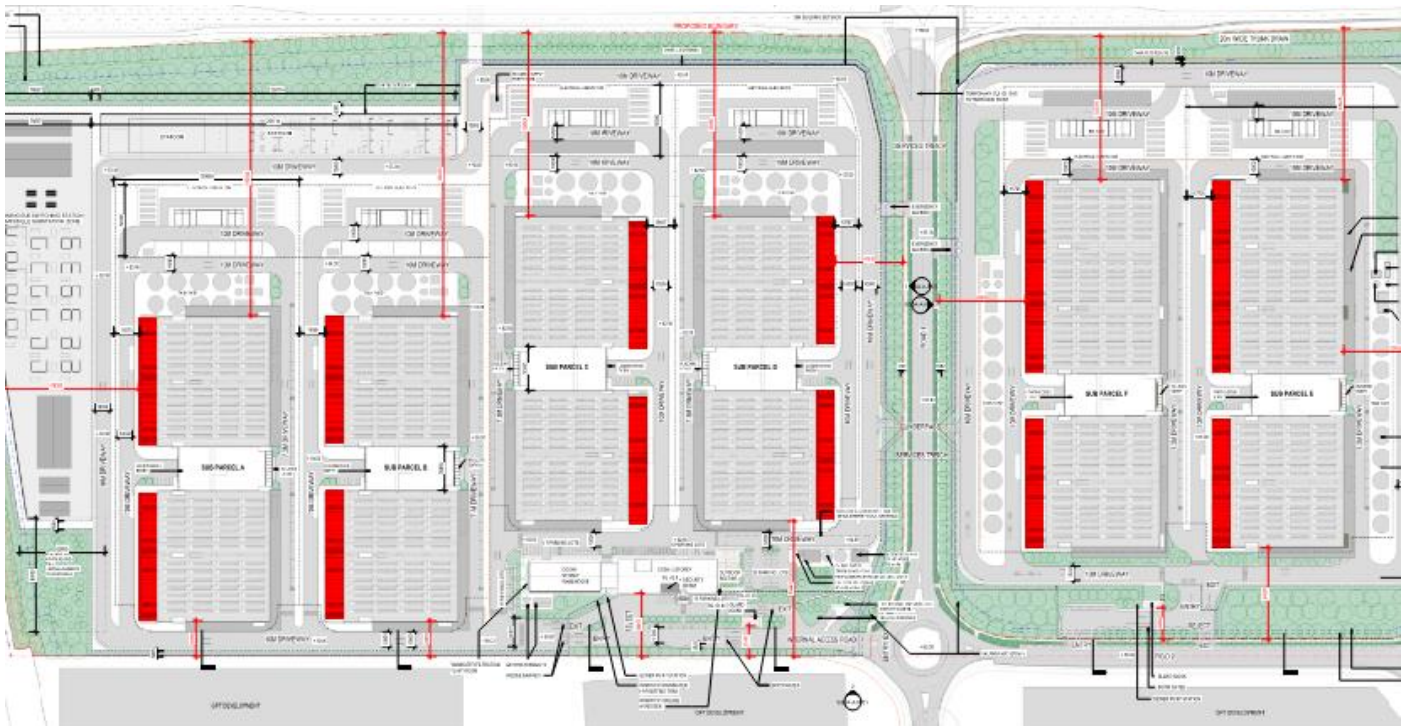
The development is planned to encompass multiple stages as each sub-parcel is constructed. With each new design stage, there are opportunities for the development to adopt new technologies or improved forms of the technologies mentioned in Table 4-1. The main opportunities to explore are renewable fuel sources that can be used by the proposed diesel generator engines, and a shift to alternative energy sources to replace the generator containers in a modular arrangement as the technology becomes readily available within Australia.

While onsite solar and other renewable generation on site is not viable, the Principal's Renewable Electricity Procurement Strategy calls for the use of power purchasing agreements, renewable energy certificates, and collaborative renewable energy procurement with tenants to use large scale renewables from upstream sources to drive their Net Zero strategy. For further details refer to the Ecologically Sustainable Design (ESD) report.

## 4.3 Site Design

The generators are located adjacent to the buildings they serve in a gantry structure (Figure 4.1). The generators are housed in prefabricated enclosures on every level of the 5-storey gantry.

Figure 4.1 Location of Generators on Proposed Site (Red)



## 4.4 Generator Design

The proposed site will use approximately 846 low voltage 2.2MW generators for the Lot 10 buildings (Sub parcel A-F). These generators will only operate in the event of a mains utility failure to the respective electrical block or for testing purposes. These generators provide a total capacity of 1861.2MW backup power. This capacity exceeds the total consumption of the site because of redundant power strings that provide resiliency to the operation of the facility. The quantity of generators is outlined in Table 4-2 below.

Table 4-2: Maximum Generator Quantities across the Site

	Sub-Parcel A	Sub-Parcel B	Sub-Parcel C	Sub-Parcel D	Sub-Parcel E	Sub-Parcel F	COSH
Level 4	24	24	24	24	30	30	N/A
Level 3	29	29	29	29	36	36	N/A
Level 2	29	29	29	29	36	36	N/A
Level 1	24	24	24	24	30	30	N/A
Ground	24	24	24	24	30	30	2
<b>Total</b>	<b>130</b>	<b>130</b>	<b>130</b>	<b>130</b>	<b>162</b>	<b>162</b>	<b>2</b>
							<b>846</b>

#### 4.4.1 Generator Enclosures

Each Sub-parcel A-F features a 5-storey generator gantry which support the containerised generators. All generators discharge hot air on the façade side, and intake cold air from within the gantry structure. Exhaust flue pipes discharge at the effective height of the building as detailed within the emissions report []. Ground floor tanks provide bulk storage of diesel fuel for the stack of generators.4.4

Each containerised generator enclosure generally includes the following:

- Generator Engine Set (2MW).
- Fuel System, including pumps.
- Control and Power Panels.
- Acoustic attenuation for cold air intake, hot air discharge (for ventilation).
- Exhaust Gas Silencer & Flue Connections
- Radiator & Fan

#### 4.4.2 Acoustics

For further details please refer to the *Acoustic Mitigation Investigation (TP886-01F02)* by Renzo Tonin & Associates [].

#### 4.4.3 Emissions

For further details please refer to the *Air Quality Impact Assessment (26.1012.DR1V1)* by Northstar [].

#### 4.4.4 Operating Time during a Power outage Event

The backup power generators are intended to run for the total time stable utility mains is not available. As per Section 4.5, 26 hours of fuel is allowed for onsite but refuelling will allow the site to remain operational under backup power until stable utility power is again available.

#### 4.4.5 Testing Procedures

The Generators will each be tested to ensure they are functional in the event of a utility failure. Initially all generators as they are installed at the proposed site will undergo individual commission testing which involves several hours that the generator will run including but not limited to full load tests, partial load tests, load step tests. After the generator is installed and commissioned, regular testing will occur for all generators.

Generators are tested by connecting to a mobile load bank (equipment that consumes electricity for testing purposes) at each sub-parcel. Only one generator per sub-parcel is tested at any one time during daytimes hours of 7:00am to 6:00pm. For further details please refer to the *Air Quality Impact Assessment* for testing limits [].

## 4.5 Fuel on Site

The generator engines on site will use diesel fuel to generate power. All 2.2 MW generators enclosures will be located within the gantry. Each generator enclosure contains a fuel day tank. These generator day tanks will be supplied with fuel from bulk fuel tanks located in tank chambers on the ground floor. The fuel system in each shell provides sufficient fuel to run the generators for 26 hours. Fuel tanks will be designed to comply with AS 1692 and AS 1940 requirements.

The following table provides the storage requirements per shell configuration based on the proposed design.

Table 4-3 Fuel Storage per Shell Configuration

Shell	Nominal Fuel Storage Capacity	Comment
Typical	696 kL	34 x 2.2MW Gensets with 5 x 132 kL Bulk Tanks and 34 x 1 kL Day Tanks  Additional 2 x 2.2MW Gensets and 2 x 1 kL Day Tanks for shells with tech space

The fuel system design is based on the fuel consumption of the Cummins C2750D5BE (standby) generator at 100% load, running on diesel. The generators are less efficient at 100% load, making this the governing case for fuel consumption.

### 4.5.1 Worst-Case Fuel Consumption

The worst-case fuel consumption configuration per shell is shown below.

Table 4-4 Worst-case Shell Fuel Consumption

Description	Value	Comment
<b>N Gensets Required</b>	32	
<b>Technology Building Gensets required</b>	2	
<b>Consumption per standard Genset</b>	539.9 L/h	Based on Cummins standby C2750D5BE datasheet at 100% load, running on diesel.
<b>Consumption per Technology Building Genset</b>	263.7 L/h	Tech space generators are expected to be only 43% utilised.
<b>Total Consumption</b>	17,805 L/h	
<b>Backup Provided</b>	26 hours	24 h fuel storage + 2 h additional capacity for maintenance activities
<b>Pumpable Fuel Required</b>	462,909 L	

### 4.5.2 AS 1940 Separation Distances

AS 1940 details separation distance requirements dependent on the size and type of tank. The design utilises rectangular single skin tanks within tank chambers. The tank chamber should be designed as per section 5.13 of AS 1940. There are no specific separation distances which apply to tanks within a tank chamber.

# 5 Mechanical Plant Selection

## 5.1 Design Principle

The mechanical design has been developed to accommodate two possible scenarios where industrial water is either available or unavailable for use in the mechanical systems. The volume of water to be supplied by the authority is currently under assessment and remains undetermined at the time of writing. Once the water availability is confirmed, the design will be optimised and balanced to achieve the best outcome across key parameters including acoustic performance, power efficiency, water consumption and spatial requirements.

The design also incorporates flexibility in the roof plant, ancillary equipment, and construction to avoid impacting neighbouring public infrastructure and services. In addition, later stages of the design will include a Computational Fluid Dynamics study to further validate the effect of the mechanical equipment on the surrounding areas.

## 5.2 Mechanical Roof Plant Cooling

The principal is aware of the ongoing development of data centres, particularly within the LGA, and is mindful of minimising the use of industrial water demand wherever possible to achieve better sustainability and environmental outcomes. This approach is reflected in the current conceptual design of the mechanical rooftop cooling system, with a full comparison provided in Table 5-1, further demonstrating the principal's commitment to collaborate with council and relevant authorities.

Several technologies were investigated, resulting in two likely rooftop solutions. Air-cooled Chillers (ACCs) are currently put forward for this application to address the most extreme condition of insufficient industrial water. An alternative scheme for Water-cooled Chillers (WCCs) Coupled with Hybrid Dry Coolers (HDCs) has been developed to leverage higher efficiency equipment capable of using the ambient weather to provide indirect free cooling. This alternative scheme is subjected to final agreement of outcomes with stakeholders.

### 5.2.1 Air-Cooled Chillers (Proposed)

With the likelihood of insufficient industrial water being allocated for mechanical systems, Air-cooled Chillers (ACCs) are the proposed solution due to their ability to provide continuous cooling without water use. This design can also be implemented alongside HDCs with WCCs if a water supply is available but insufficient to support a full campus HDC design. The number of ACCs is determined by the end customer, with quantities expected to range from 24 to 28 units. Mechanical equipment placement on the roof has been considered the impact of heat rejection to not affect habitable rooms and communal open spaces.

### 5.2.2 Water-Cooled Chillers Coupled with Hybrid Dry Coolers (Alternative)

If sufficient industrial water is available for the mechanical systems, the Hybrid Dry Cooler is the preferred solution due to its inherent water-saving characteristics. The design and operation of this HDC enables a 25 percent water saving at peak usage compared with a standard open loop cooling tower of equivalent heat rejection. Furthermore, an HDC can eliminate water use under specific ambient conditions. Based on the end user's cooling water temperature requirements, the HDC can provide up to 60 percent of indirect free cooling through the year, with remaining cooling demand achieved by highly efficient water-cooled chillers, further minimising the power consumption of mechanical systems. The number of HDCs and WCCs also depend on the end customer, with typical quantities ranging from 16 to 18 HDCs and 6 to 8 WCCs. Mechanical equipment placement on the roof has been considered the impact of heat rejection to not affect habitable rooms and communal open spaces.

### 5.2.3 Power and Water Consumption

Power and water consumption are influenced by a range of factors, including ambient weather conditions, air recirculation, customer-specific design setpoints, and the final distribution between air and liquid cooling. Water-based chiller systems typically achieve better efficiency compared with air-based systems, reflecting the higher efficiency of mechanical rooftop equipment.

## 5.2.4 Mechanical Roof Plant Assessment

Table 5-1 Mechanical Roof Plant Assessment

Technology	Description	Technology maturity	Viability for proposed site
<b>Air-cooled Chillers (Proposed)</b>	<p>Heat absorbed from the IT equipment within the data hall is extracted by an air-cooled chiller, which then supplies cooling water to the field again at the required design temperature.</p> <p>The air-cooled chiller directly rejects heat from the data hall cooling water to the atmosphere.</p>	<b>High</b> – Air-cooled chillers have been deployed in data centres	<p><b>Viable</b> – The building design is intended to accommodate situations where industrial water is not available or limited. Air-cooled chillers are suitable for cooling sites that do not have access to industrial water.</p> <p>This technology enables faster deployment through reduced plant room installation and supports a modular construction. It is also well suited to facilities targeting lower compute densities.</p> <p>In addition, air-cooled chiller systems generally offer improved water efficiency per MW of IT cooling.</p>
<b>Water-cooled Chillers Coupled with Hybrid Dry Coolers (Potential Alternative)</b>	<p>Heat absorbed from the IT equipment within the data hall is extracted by a water-cooled chiller, which then supplies cooling water to the field again at the required design temperature.</p> <p>The water-cooled chiller rejects heat from the data hall cooling water, to a separate condenser water system. This heat is then rejected into the atmosphere through the Hybrid Dry Cooler.</p> <p>Under suitable ambient conditions, the water-cooled chiller is bypassed, and heat from the data hall IT equipment is rejected directly into the atmosphere by the Hybrid Dry Cooler.</p>	<p><b>High</b> – Water-cooled chillers are among the most energy-efficient mechanical cooling systems and are therefore widely used within the data centre industry.</p> <p><b>Moderate</b> – Hybrid Dry Coolers are not the most commonly used type of heat rejection equipment, but this technology has been extensively developed over time.</p>	<p><b>Viable</b> - Water-cooled systems are generally the preferred choice for data centres due to their high efficiency, resulting in more sustainable use of the facility's intended purpose.</p> <p>By utilising high-efficiency equipment, both capital and operating costs per MW of IT load are typically reduced compared with alternative cooling solutions. The integration of HDCs further enhances efficiency by minimising the use of industrial water relative to conventional water-consuming technologies, while also reducing spatial requirements.</p> <p>Overall, water-cooled systems generally offer improved power efficiency per MW of IT cooling.</p>
<b>Water-cooled Chillers Coupled with Open Loop Cooling Towers (Not recommended due to water usage versus anticipated availability)</b>	<p>Heat absorbed from the IT equipment within the data hall is extracted by a water-cooled chiller, which then supplies cooling water to the field again at the required design temperature.</p> <p>The water-cooled chiller rejects heat from the data hall cooling water, to a separate condenser water system. This heat is then rejected into the atmosphere through the Open Loop Cooling Tower.</p> <p>Under suitable ambient conditions, the water-cooled chiller is bypassed, and heat from the data hall IT equipment is rejected directly into the atmosphere by the Open Loop Cooling Tower.</p>	<p><b>High</b> – Water-cooled chillers are among the most energy-efficient mechanical cooling systems and are therefore widely used within the data centre industry.</p> <p><b>High</b> – Open Loop Cooling Towers are a common used type of heat rejection equipment.</p>	<p><b>Moderately Viable</b> – Despite great technological maturity and proven performance of open-loop cooling towers, they consume a significantly higher volume of water per MW of IT compared with alternative heat rejection systems. This characteristic is inconsistent with the project's design principle</p>

Technology	Description	Technology maturity	Viability for proposed site
<p><b>Water-cooled Chillers Coupled with Evaporative Dry Coolers (Not recommended)</b></p>	<p>Heat absorbed from the IT equipment within the data hall is extracted by a water-cooled chiller, which then supplies cooling water to the field again at the required design temperature.</p> <p>The water-cooled chiller rejects heat from the data hall cooling water, to a separate condenser water system. This heat is then rejected into the atmosphere through the Evaporative Dry Cooler.</p> <p>Under suitable ambient conditions, the water-cooled chiller is bypassed, and heat from the data hall IT equipment is rejected directly into the atmosphere by the Evaporative Dry Cooler.</p>	<p><b>High</b> – Water-cooled chillers are among the most energy-efficient mechanical cooling systems and are therefore widely used within the data centre industry.</p> <p><b>Low</b> – Evaporative Dry Coolers are not commonly used type of heat rejection equipment.</p>	<p>of minimising water consumption and reducing dependency on industrial water supplies.</p> <p>As a result, open-loop cooling towers were not considered a suitable long-term solution and were excluded from further development within the design strategy.</p> <p><b>Not Viable</b> – Although water-cooled chillers offer high efficiency, Evaporative Dry Coolers are comparatively inefficient in terms of both water and power consumption when applied as heat rejection equipment.</p> <p>In general, this technology is more suitable for regions with low ambient temperatures or for higher water temperatures within IT equipment. Evaporative Dry Coolers also require considerable spatial provision, which increases the capital and operating costs per MW of IT compared with alternative equipment.</p> <p>Furthermore, the operation generates high noise levels, making it unlikely that this technology would comply with the local environmental noise criteria.</p>

### 5.3 Data Hall Cooling

The conceptual design deploys direct liquid to chip data hall cooling. Direct to chip technology allows the majority of heat from IT equipment to be transferred into a water network rather than into the air. This results in a more efficient system with reduced reliance on air, which typically requires more power per kilowatt of IT cooling capacity. Additional benefits of direct liquid to chip include the ability to operate at higher water temperatures, thereby enhancing system efficiency by reducing the workload on chiller compressors and or hybrid dry coolers. As the end customer’s data hall cooling strategy shifts toward a higher proportion of direct-to-chip liquid cooling, this in turn further improves the overall system efficiency.

The principal, with experience across numerous portfolios of sites, has demonstrated expertise in a range of data hall cooling technologies, including fully air-cooled systems and liquid-cooling technology. In addition, the principal also possesses first-hand knowledge of the daily operational expenditure associated with various cooling approaches. Direct to chip technology is currently among the more efficient cooling approaches supported and requested by the principal’s end-user requirements, aligning with current industry trends.

Recognising the continued evolving nature of data centre innovation, the mechanical design for the data halls has been developed to remain versatile and capable of accommodating or retrofitting future emerging, more efficient cooling solutions.

## 5.4 Fire Protection Infrastructure

Fire protection infrastructure comprises a combined sprinkler and hydrant fire water tanks and pumpset. At this stage. The fire water storage tank effective capacity has been calculated based on the assumption that there is no water available in the town's main. Should pressure and flow available in the assets near the site confirmed, the tank effective capacity will be revisited.

The buildings effective height is greater than 25 meters and therefore, dual water supply is required for the sprinkler system under the NCC.

Based on the above assumptions and fire hydrant and fire sprinkler demands calculations, the summary of the firewater tank sizing is shown in the Table below:

**Table 5-2 Fire Water Requirements**

<i>System/Specification</i>	<i>Basis of Design</i>	<i>Requirement</i>	<i>Water Storage</i>
Fire hydrant component	FM Global and Airtrunk TR: 1-hour on-site hydrant supply for 3 x hydrants  Australian Standard- AS2419.1-2021: 4-hours fire hydrant supply.	3 x 10 L/s X 3600 X 4hr= 432,000L	1 X 432,000L
Fire sprinkler component	FM Global and Airtrunk TR: 1-hour on-site sprinkler supply. Sprinkler demand: 61 L/s  Australian Standard- AS2419.1-2021: 1-hour sprinkler supply Dual supply for building with effective height more than 25m.	60.5 L/s X 3600 X 1hr= 217,800L	2 x 217,800 L = 435,600L
Total effective capacity		Combined fire tanks	Total effective capacity required: <b>867,600L.</b>  <b>2 x 433,800L tanks</b>

# 6 Conclusion

## 6.1 Power Systems

This report has provided an overview of the proposed diesel backup power system which will support the site electrical capacity through 846 no. 2.2MW generators. These generators will be tested at commissioning and subsequently every quarter at a frequency compliant with emissions and acoustic limits.

Although alternative technologies exist to provide backup power generation, none are viable at scale due to several factors. The main issues for alternatives are market availability and the space available on site to make alternative options work for a medium-term utility power interruption.

The backup power equipment has been curated to deliver the most viable solution for the proposed site and ensure this state significant development will provide its services as early as possible with minimal impact to the surrounding area and community.

## 6.2 Mechanical Systems

This report has presented the proposed strategy for the progression of mechanical cooling systems, which remains pending to outcomes from ongoing discussions with relevant parties and authorities. The core objective of the design is to minimise environmental impact through the efficient use of industrial water and power resources, addressing the key concerns raised by the council.

A balance between water-based and air-cooled compressor systems has been considered to optimise utility demands of power and water. These considerations have informed the selection of two rooftop system configurations, developed with careful attention to their placement, operation and potential impacts on neighbouring and public infrastructure. Mechanical rooftop equipment is arranged in concentrated zones, maintaining sufficient clearance from nearby intakes, to prevent re-entrainment of heat-rejected fluids. Discharge from these systems is generally directed vertically to mitigate wind-driven recirculation.

In line with current industry trends, the data hall cooling approach targets direct-to-chip liquid cooling technology, recognised as a very efficient data hall cooling solutions within the Australian market. This reflects a broader transition away from less efficient, fully air-based cooling systems. The mechanical design remains adaptable, allowing for the integration of future emerging technologies as the site and customer requirements evolve.

The fire protection infrastructure has been designed for the worst-case assumption that there is no water available for the town's main supply, and is compliant with the latest Australian standards as well as FM Global standards.

Further design optimisation will depend on the outcomes of end customer requirements, stakeholder engagements and coordination with relevant authorities.

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