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Energy Efficiency Report
Oakdale West Masterplan

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Goodman Property Services (Aust) Pty Ltd
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Energy Efficiency Report

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned by Goodman Property Services to prepare a Sustainability Management Plan (SMP) for the proposed warehouse and distribution facilities located at Oakdale West, Horsley Park, NSW, as part Development Application works.

SLR Consulting has previously provided a sustainable management plan for Precinct 1 of the Oakdale West Estate (Warehouse 1A, 1B and 1C) – refer to report 610.15612-R2 dated 23 March 2016.

2 OBJECTIVES

The principal objective of this Sustainability Management Plan is to identify all potential energy savings 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 Fairfield City Council (Council) requirements.

The specific objectives of this plan are as follows:

- To encourage energy use minimisation through the implementation of energy efficiency measures.
- To promote improved environmental outcomes through energy management.
- To ensure the appropriate management of high energy consumption aspects of the Project.
- To identify energy savings procedures for overall cost reduction, greenhouse gas emission reduction and effective energy management.
- To assist in ensuring that any environmental impacts during the operational life of the development comply with Council's development consent conditions and other relevant regulatory authorities.
- To ensure the long term sustainability of resource use through more efficient and cost effective energy use practices for the life of the development.

3 ENERGY MANAGEMENT GUIDELINES AND LEGISLATION

3.1 National Construction Code of Australia

The National Construction Code (NCC) of Australia is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives efficiently. The NCC contains mandatory technical provisions for the design and construction of NCC class buildings.

Volume 1, Section J of the NCC (2016) outlines energy efficiency provisions required for NCC class buildings (including Class 7b Warehouses and Class 5 Offices). There are eight (8) Deemed-to-Satisfy subsections, J1 to J8, that focus on separate aspects of energy efficiency as follows:

- J1 - Building Fabric (i.e. the ability of the roof, walls and floor to resist heat transfer)
- J2 - External Glazing (i.e. the resistance to heat flow and solar radiation of the glazing)
- J3 - Building Sealing (i.e. how well parts of a building are sealed to ensure comfortable indoor environments are efficiently maintained)
- J4 - Air Movement (i.e. the provision of air movement for free cooling, in terms of opening and breeze paths). Note: This subsection has been removed from the most current version.
- J5 - Air Conditioning and Ventilation Systems (i.e. the efficiency and energy saving features of heating, ventilation and air-conditioning systems)
- J6 - Artificial Lighting and Power (i.e. power allowances for lighting and electric power saving features)
- J7 - Hot Water Supply (i.e. the efficiency and energy saving features of hot water supply)
- J8 - Access for Maintenance (i.e. access to certain energy efficiency equipment for maintenance purposes)

3.2 Secretary's Environmental Assessment Requirements

The Greenhouse Gas and Energy Efficiency section of the Oakdale South Estate- Secretary's Environmental Assessment Requirements states:

- *Including an assessment of the energy use on-site, and demonstrate the measures to be implemented to ensure the proposal is energy efficient.*

4 PROJECT DESCRIPTION

Goodman Property Services (Aust) Pty Ltd is developing the Oakdale West site (DP 1178389) at Erskine Park for the purposes of providing a warehouse and distribution complex. The Oakdale West site is a precinct within the wider Oakdale Estate development and forms part of a progressive development designed to make Oakdale a regional distribution park of warehouses, distribution centres and freight logistics facilities.

There are five (5) industrial precincts are proposed to be developed as new warehouse, distribution and freight transport centers, situated between Southern Link Road and Proposed Western North South Link Road. The regional site location and satellite image of the development location are shown in **Figure 1** and **Figure 2**

Figure 1 Regional Site Location of Oakdale West

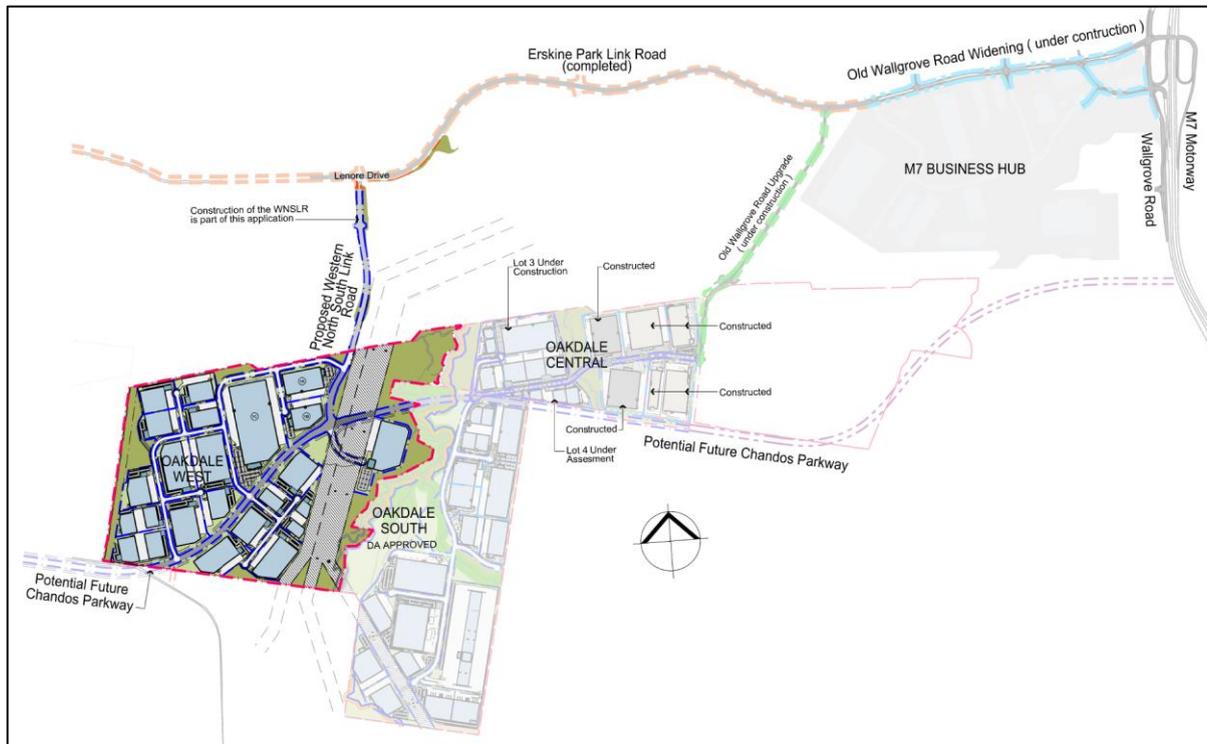


Figure 2 Satellite Image of the Development Site Location – Oakdale West Estate



Source: 15117_OAK MP 01a_Cover Sheet; boundary of Oakdale West Estate shown in 'blue' colour

4.1 Overview of Proposed Development

The overall Oakdale West Estate is a 154 hectare (ha) site located within the Oakdale Estate, a 421 ha area of land within the Western Sydney Employment Area. Oakdale West Estate is the third of four stages of the broader Oakdale Estate under the management of Goodman Limited.

Oakdale West is essentially a greenfield site at present which has been used for stock grazing. The surrounding areas are primarily rural in nature, but, the area to the north is becoming more industrial. Land uses in the surrounding area include:

- Rural (grazing, market gardens, etc) and rural residential to the south-east, south and west.
- Sydney Water Pipeline and industrial land to the north (industrial zones at Eastern Creek to the north and Erskine Park to the north-west).
- To the west land uses include a number of sensitive uses such as an aged care facility (Catholic Health Care) and three schools: Mamre Anglican School, Emmaus Catholic College and Trinity Primary School. Other land uses include recreational and sporting facilities.

Oakdale West Estate will be developed in stages with the first stage including:

- Staged bulk earthworks across the whole site.
- Stage trunk infrastructure for the site.
- Staged subdivision.
- Landscaping and public domain works.

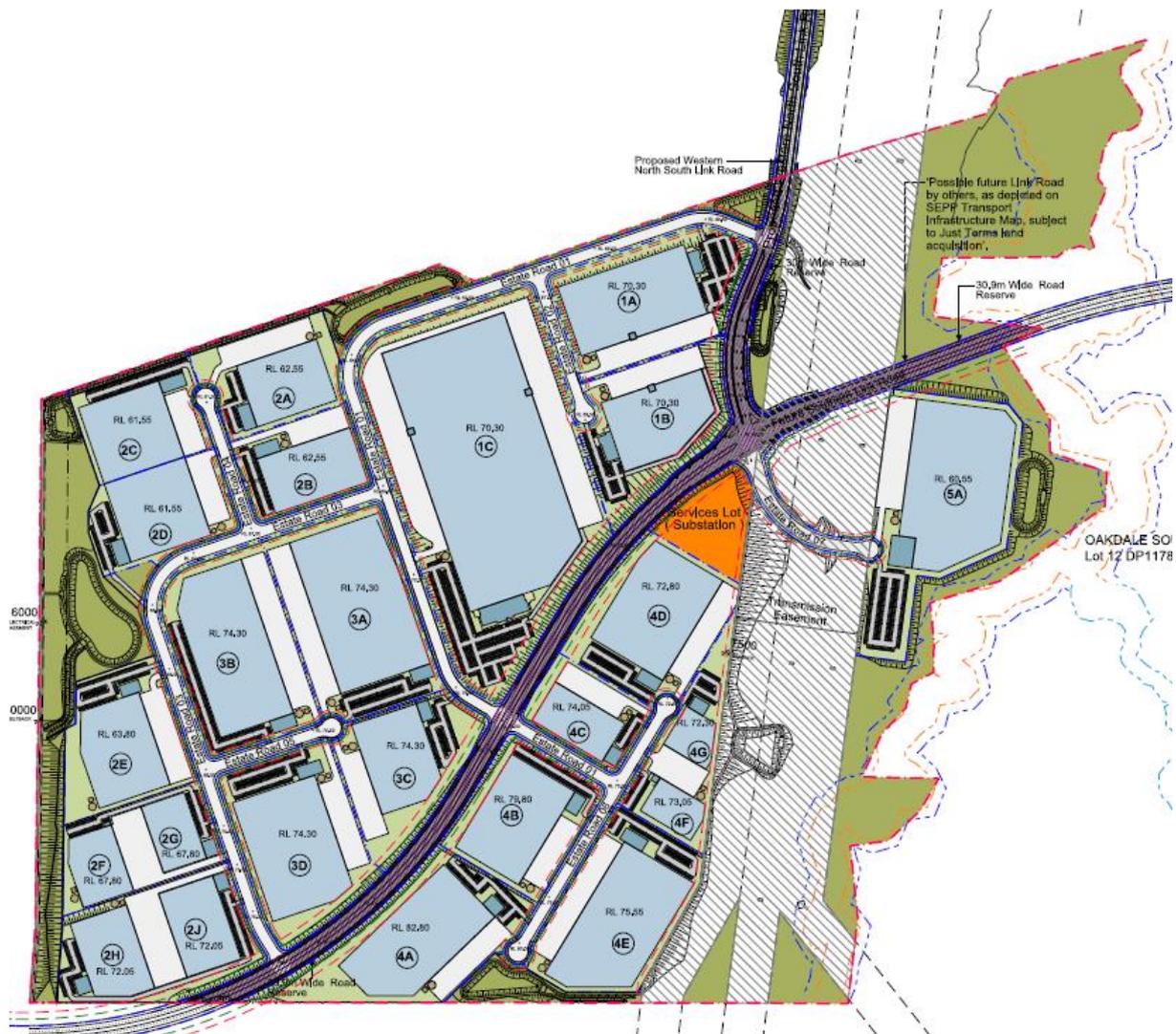
Development areas are outlined below in **Table 1**.

Table 1 Development Areas

Precinct 1	22.41 ha
Precinct 2	21.57 ha
Precinct 3	18.49 ha
Precinct 4	21.04 ha
Precinct 5	6.02 ha

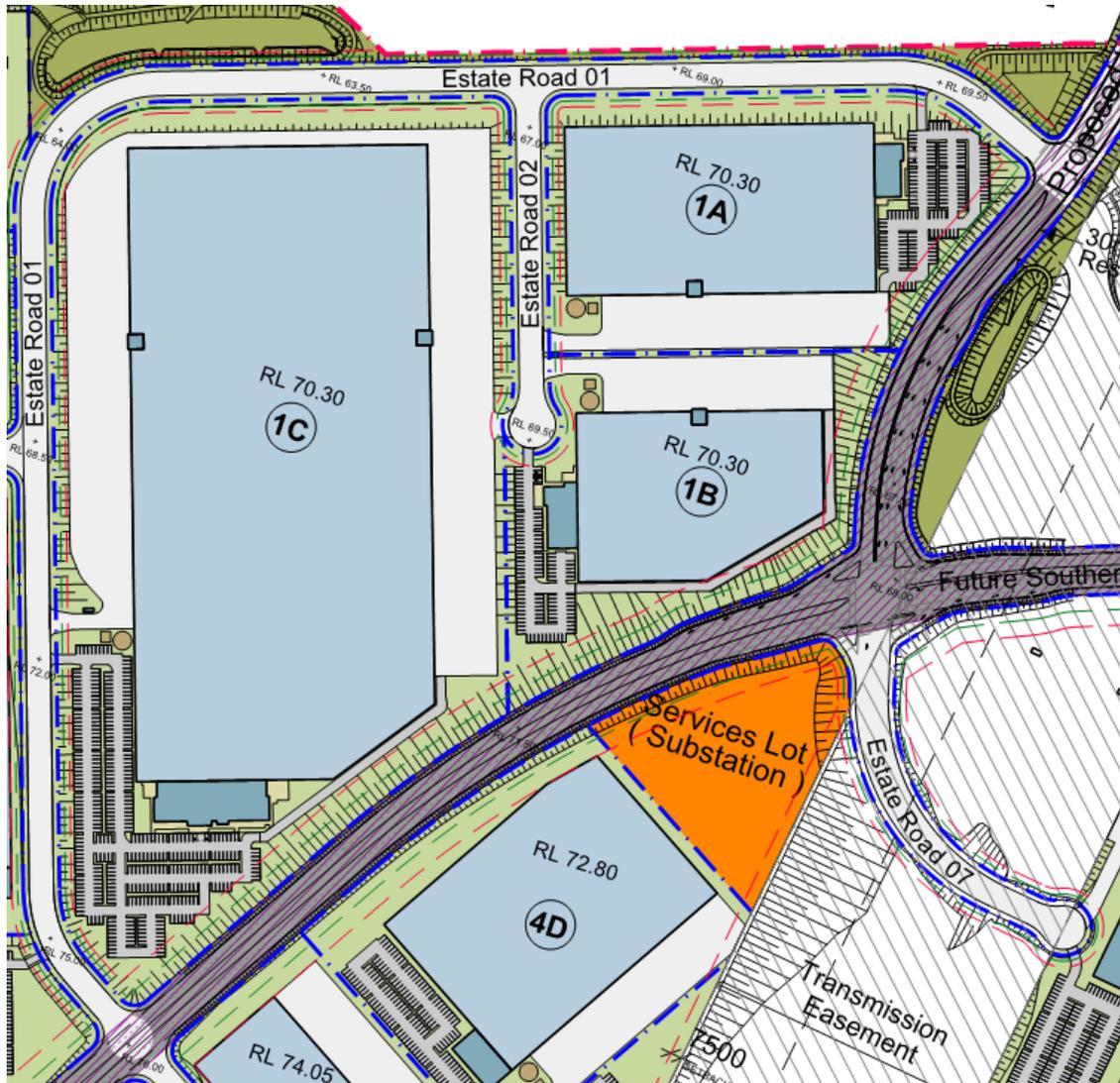
The overall site plan is shown in **Figure 3**

Figure 3 Oakdale West Masterplan



When completed, precinct 1 will consist of three (3) warehouses with associated offices, carparks and truck loading areas as shown in **Figure 4**.

Figure 4 Site Plan for Precinct 1



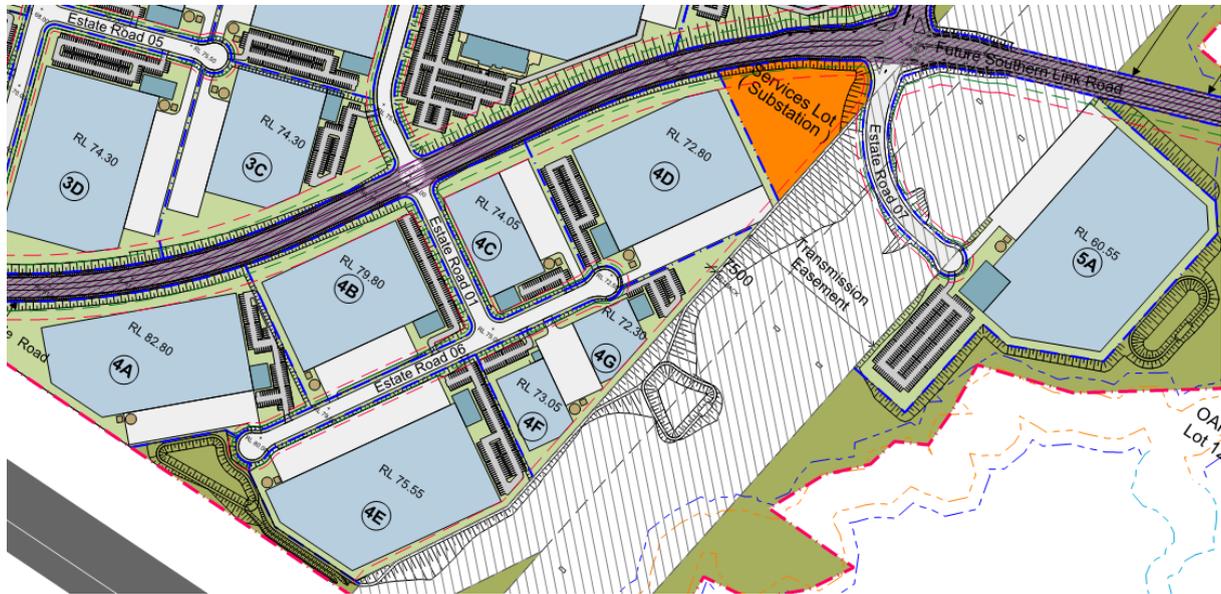
When completed, Precinct 2 and 3 will consist of nine (9) and four (4) warehouses respectively, with associated offices, carparks and truck loading areas as shown in **Figure 5**.

Figure 5 Site Plan for Precinct 2 and 3



When completed, Precinct 4 and 5 will consist of seven (7) and one (1) warehouses respectively, with associated offices, carparks and truck loading areas as shown in **Figure 6**.

Figure 6 Site Plan for Precinct 4 and 5



The development provides a logistics hub for the receipt, storage and dispatch of products, which will be packaged for offsite transport and sale. Operational activities are approved 24 hours a day, seven days a week and include the following:

- 453,369 m² total warehouse areas
- 23,555 m² total office area
- 6.43 ha future regional roads
- 8.92 ha Estate roads

5 OPERATIONAL ENERGY MANAGEMENT

Ineffective energy management for commercial premises can lead to unnecessary growth in greenhouse gas emissions and consumption of natural resources. Effective energy management reduces costs through the use of energy efficiency measures and improves environmental outcomes locally, regionally and globally.

Effective energy management is achieved through the implementation of an SMP for the operational life of the Project.

5.1 Identified Major Energy Use Components

Major energy use components of the Project Site have been identified below based on information available within the Project Design Brief.

- Lighting (include natural and artificial lighting and shading)
- Air Conditioning
- Ventilation Fans
- Domestic Water Heating
- Appliances and equipment.

5.2 Energy Sources

The main source of energy for the proposed site is electricity, but it is also proposed to have gas available at the site if required by the tenant. The domestic hot water (DHW) will be powered by solar energy for solar panel located on the roof of the building. For optimal solar radiation incident on the panel, the panel should be facing north and inclined at an angle of 25 degrees. Solar energy is considered a renewable energy source as no greenhouse gas emissions are produced from the production of electricity utilising solar panels.

5.3 Proposed Sustainable Measures

The following measures may assist in reducing the energy consumption of the development:

5.3.1 Building Passive design

- Good levels of day lighting will reduce the amount of artificial lighting required during the day. Fire retardant polycarbonate roof sheeting to 10% of the roof area will be provided to warehouses for natural daylight.
- Heat-reflective semi-translucent roller blinds on all windows will reduce solar heat load to the building.
- Awnings over windows or shading devices where appropriate will reduce the solar heat load to the building therefore decreasing the cooling load requirements from the air conditioning system. To be implemented where practical.
- Achieving high insulating values of external development fabrics (in compliance with NCC requirements) will allow for lower energy demand on the air-conditioning system and higher thermal comfort level for occupants.
- Provide performance laminated or heat strengthened safety glazing to all external windows to meet the NCC Section J and the relevant Australian Standards.
- Predominantly south facing office space, consider insulated external walls where appropriate to reduce the glazing area and associated heat loss in winter.
- Predominantly north and west facing office, consider additional shading or solar controlled glazing to reduce heat transfer into the office space where appropriate.

- Warehouse can be naturally ventilated via roller shutter openings to reduce the internal temperature during hot summer.
- Awnings are proposed for loading doors and big openings to prevent direct solar radiation through openings.
- Door seals for office doors and airlock for reception areas will help to maintain a comfortable indoor air environment and lower energy demand on the air-conditioning system.

5.3.2 Lighting

- Provide lighting control system to manage and minimise power consumption.
- Dimmable lighting, T5 Fluoro fittings or equivalent environmentally friendly fitting proposed for the development. LED lighting is to be explored and implemented where possible. LED lighting benefits include lower energy consumption and a longer bulb lifespan.
- Lighting zoning will offer flexibility for light switching in zones.
- Lighting system is to be programmable and incorporate timeclock, photo electric (PE) daylight sensors and motion sensors in the warehouse.
 - Office areas – Movement control and timeclock
 - Amenities and circulation areas - Movement control and timeclock
 - Warehouse areas – PE (daylight harvesting) and timeclock.
 - Warehouse peripheral areas, Service and plant rooms - Movement control and timeclock
 - Warehouse awnings - PE and timeclock
 - External – PE and timeclock
- Lighting system is to be programmable and incorporate timeclock, and motion sensors in the office, lunch room and amenities.
- Energy efficient floodlights will be consider for lighting of external perimeter of building .

5.3.3 Air conditioning

- Air-conditioning control zoning provided where necessary to cater for varying occupancy rates, orientation to solar loads etc. Also, time clock provided with provision for after hour override.
- Air conditioning systems shall be of the air-cooled, reverse cycle, packaged unit type, incorporating economy cycles where required under the NCC Section J Energy Efficiency.
- Natural ventilation will be in accordance to NCC requirements for all areas.
- Mechanical ventilation fans will be meet NCC Section J5 to minimize the fan power consumption.

5.3.4 Domestic Water Heating

- Hot water systems implemented in staff amenities, including toilets, lunchrooms and cleaners room to be connected to a solar hot water system.
- Hot water shall be generated through a roof mounted solar water packaged plant.
- Piping insulation to both external and internal DHW & DCW circulation pipes.

5.3.5 Energy Metering

- Electrical sub-metering to all metered loads will facilitate ongoing management of energy consumption.

5.3.6 Water

- Rainwater reuse for toilet flushing and irrigation.
- Water efficient bathroom hardwares.

5.4 Baseline and Proposed Energy Consumption

The Sections J of the National Construction Code (NCC) of Australia will be used as the baseline building for energy consumption savings. NCC Section J provides the minimum requirement for energy efficiency and it is expected that the proposed development will result in an approximate 20-30 % reduction in greenhouse gas (GHG) emission via:

- Improved daylight to warehouse with up to 10% of the roof area as a sky light where possible.
- T5 or LED fitting with control to warehouse and offices
- Daylight controlled fluorescent lighting for the warehouse instead of metal halide, resulting in a considerable energy reduction and reduced maintenance.
- High efficiency glazing and shading for the offices.
- Solar hot water system.
- More efficient ventilation and air-condition systems.

It is assumed that the warehouses are occupied 24 hours a day, 7 days a week.

5.5 Signage and Education for Employees

It is recommended that information on energy savings procedures, annual energy targets for the Project, as well as the results of energy usage reviews and audits, be communicated to all employees via monthly forums. Improvements in project energy usage levels should be celebrated openly with employees and signage placed in lunchroom and other shared employee areas to help reinforce employee involvement in the Energy Efficiency Report. Signs should also be placed adjacent to any appliances or equipment etc, where significant energy savings can be made through employee awareness of simple energy savings procedures. This is an effective and easy way to encourage appropriate energy management by employees.

Employees should receive training in energy management and energy savings procedures especially in regard to high energy consumption aspects of the project.

Energy management procedures should also be clearly communicated to cleaners (and form part of any contractual conditions) to outline the cleaner's energy use minimisation responsibilities.

5.6 Monitoring and Reporting Requirements

5.6.1 Energy Review and Audit

An energy usage review will be undertaken within the first few months of operation to ensure the Energy Efficiency Report is sufficient for the development's needs. A breakdown of energy usage per month at the Project Site 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 stationary equipment on site. Energy consumed by mobile equipment (e.g. forklifts) should also be examined as this will identify variations in warehouse operation efficiency. (Refer to '*Guidelines for Energy Savings Action Plans*' (2005) (as developed by the former Department of Energy, Utilities and Sustainability) for reporting templates and further information.)

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 undertaken and signage and procedures re-examined.

The Energy Efficiency Report shall be reviewed on an annual basis to consider changes to the Energy Management System and to promote continual improvement of energy management at industry best practice over time..

5.6.2 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.

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 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 natural ventilation strategies, user comfort control, maintenance of air conditioning units and other electrical devices to ensure maximum operating efficiency, and lighting zoning strategies.

An effective Building Users' Guide will ensure that:

1. 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.
2. Maintenance contractors understand how to service the particular systems to maintain reliable operations and maximum energy efficiency.
3. Employees understand energy minimisation procedures and working limitations required to maintain design performance for energy efficiency.
4. Future fit-out / refurbishment designers understand the design basis for the building and the systems so that these are not compromised in any changes.

5.7 Roles and Responsibilities

It is the responsibility of the facility manager to routinely check energy savings procedures are undertaken correctly (i.e. lighting turned off while areas of the development are not in use). The facility manager should also ensure all monitoring and audit results are well documented and carried out as specified in the Energy Management Plan.

Senior management should also be involved in energy management planning as an indication of the organisation's commitment to the Energy Management Plan.

6 ADDITIONAL ENERGY USE MINIMISATION STRATEGIES

In addition to the Outline Building Specification for Goodman Industrial Buildings, the following energy use minimisation strategies may be implemented for the Project:

Natural Ventilation versus Air Conditioning:

- Provision of increased outside air rates, during favourable climatic conditions, maintains general contaminants (odour, VOCs etc) at lower concentrations than artificially ventilated spaces, improving the indoor air quality environment.
- Consider alternative passive exhaust options such as wind or solar assisted whirly birds to improve thermal comfort.

Daylight versus Artificial Lighting:

- Increased reliance on artificial lighting in buildings may have a detrimental effect on the health and wellbeing of occupants. Natural lighting from the sun is freely available and improves the mindset and health of workers and visitors.

Solar Powered versus Electricity Powered:

- Electricity is provided from the burning of coal in NSW and therefore greenhouse gas is a derived product from the production of electricity. In NSW, 0.9 kg CO₂-e (carbon dioxide equivalent) is emitted from every 1 kWhr of purchased electricity by end-users. The provision of solar panels to produce electricity will reduce the electricity demand and therefore reduce greenhouse gas emission.

GreenPower can also be purchased from the electricity provider.

- GreenPower is electricity from wind or solar energy which does not emit greenhouse gas.

7 CONCLUSION

SLR Consulting Australia Pty Ltd (SLR Consulting) was commissioned by Goodman Property Services to prepare a Sustainability Management Plan (SMP) for the proposed warehouse and distribution facilities located at Oakdale West, Horsley Park, NSW, as part Development Application works.

The SMP has been undertaken in accordance with the Secretary's Environmental Assessment Requirements (SEARs) for the State Significant Development (SSD 15_7348) application.

The principal objective of this Sustainability Management Plan is to identify all potential energy savings 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 Fairfield City Council (Council) requirements.

A 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 expected that the proposed development will operate energy efficiently via:

- Improved daylight to warehouse with translucent sheeting to 10% of the roof area.
- Daylight controlled T5 lighting for the warehouse instead of metal halide, resulting in a considerable energy reduction and reduced maintenance.
- Programmable lighting system incorporating timeclock, photo electric (PE) daylight sensors and motion sensors in the warehouse.
- More cross ventilation to the warehouse by using effective natural ventilation strategies such as louvre grilles in the façade of the building where effective natural ventilation can be achieved by means of door openings.
- High efficiency glazing and shading for the offices.
- Solar hot water system with gas boost.
- Other measures are detailed in **Section 5.3**.

In conclusion, the relevant ESD initiatives and Energy Efficiency measures outlined in this report are currently in place. The proposed ESD initiatives will help to achieve significant reductions in the energy required by the development both in building and operation.

Building tuning will be conducted by builder and SLR Consulting recommends that a quarter reviews of actual building energy and water consumption be carried out once the warehouses are operational to check the actual energy usage and energy savings and verify that all systems are performing at their optimum efficiency. This will provide an opportunity for the systems to be tuned to optimise time schedules to best match occupant needs and system performance while satisfying the sustainability target for the project.

8 CLOSURE

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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