Private Hospital; Orange
DA Report – ESD Initiatives

08/10/2007
ADV070200

Client

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Authorised for Issue	DGJ	24/10/07
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Executive Summary

This report provides an overview of the environmentally sustainable design (ESD) initiatives for the proposed Private Hospital on Forest Road in Orange.

The objective of the report is to confirm commitment to a best practice level of sustainability and to demonstrate the inclusion of the ESD initiatives in the design of the entire development.

The goals of the ESD initiatives are to meet or better the benchmark targets required by

- A projected 4.5 Star ABGR status – for the hospital and commercial part of the development
- BASIX water and energy reduction targets – for the residential development

The ABGR rating focuses mainly on energy consumption by air-conditioning systems, but the BASIX rating systems take into account a wide range of issues, including energy and water consumption and the impacts of building design. Performance levels meeting the targets mentioned above would be considered best practice; while exceeding them would deliver a level of sustainability that sets the standard for Australian excellence.

The primary ESD initiatives proposed to achieve these ESD goals are

- Energy efficient building and system design
- Energy monitoring
- Efficient lighting system design
- Extensive use of daylight where possible
- Use of water-efficient fittings and water metering
- Good risk management
- Best practice construction techniques
- Best practice management and planning
- The use of environmentally sustainable and low emission building materials

The feasibility of the following items is being investigated further by the design team:

- the inclusion of on-site cogeneration to reduce carbon emissions
- On-site blackwater and stormwater management

It is currently estimated that these strategies would allow the buildings on the Forest Road Site to meet the benchmark requirements, recognising them as an example of “Australian Best Practice” in green design.

The strategies described in this report, as well as any new sustainable initiatives that may still be embraced, are an integral part of the commitment to achieving an environmentally sustainable development at the Forest Road site in Orange.

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Issue/Status	Revision	Date Issued	Author	Checked	Approved	Comment
Draft		08/10/2007	VB	DGJ	DGJ	

1 Introduction

This report provides an overview of the environmentally sustainable design (ESD) goals for the site development at Forest Road in Orange.

It outlines the benchmarks and measures to be undertaken in the development in order to demonstrate the overall sustainability of the project. The report includes a brief description of the initiatives already proposed to be incorporated in the building design and those that require additional confirmation or funding.

1.1 Objective

The objective of this report is to confirm commitment to a best practice level of sustainability and to demonstrate those ESD initiatives incorporated into the design of the entire site development that will realise that goal.

1.2 Benefits of ESD

There are significant benefits to adapting sound ESD principles for any new development. In addition to the obvious benefits to the environment, there are also significant benefits to the owners and occupants of the buildings; including but not limited to:

- Reduced risk (allowing for future adaptability)
- Market demand and Government subsidies
- Reduced operational costs
- Healthier, (more productive) and more pleasant internal environments

1.3 Sources of Information

- Site plans emailed by the architect in July 2007
- Areas and yields document and excel file from Architect dated – 14/05/07

1.4 Limitations

This study has been performed during the design phase of the project. Actual performance of the design will be dependent on the final implementation of the design.

2 Approach

This report has been produced to demonstrate a high level of sustainability and energy efficiency for the development. The objectives listed demonstrate the sorts of initiatives which if implemented, could clearly demonstrate that goal.

2.1 Environmentally Sustainable Design Principles

The Private Hospital Precinct at Forest Road is committed to achieving an environmentally sustainable outcome for the proposed site development. A holistic approach to ESD has been incorporated in the design process and the following principles have implemented:

- Best Practice Building Design and Construction Management
- Excellent Indoor Environment Quality
- Energy Efficiency
- Sustainable Transport (encouraging walking / the use of bicycles)
- Water Efficiency
- Sustainable Material Selection
- Minimised Ecological Impact
- Minimised Emissions

2.2 Design Initiatives

The core principles discussed in Section 2.1 have been implemented across a broad range of initiatives in the building design approach. These initiatives can be summarised by service as follows:

- Mechanical Initiatives
    - Energy Efficient HVAC System
    - Balancing energy efficiency with Improved air quality
    - Mould prevention in all conditioned spaces
- Electrical Initiatives
    - Efficient lighting systems and fittings
    - Energy monitoring for the hospital and commercial part of the development
    - Preventing light pollution
- Hydraulic initiatives
    - Water efficient fixtures including waterless urinals
    - Rainwater harvesting
    - Water metering

- Management and Planning
    - Risk management through quality commissioning and building tuning
    - Organised project Planning
    - Best Practice Construction
    - Waste minimisation during and after the construction phase
    - Extensive inclusion of passive design principles in all the buildings
- Material Selection
    - Low Emission Materials
    - Low Embodied Energy Materials and Practices
    - Climate responsive material selection
- Sustainable Infrastructure
    - Exploring the use of alternative energy sources
    - On-site blackwater treatment
    - Stormwater detention

Through implementation of these initiatives, the proposed hospital development at Forest Road in Orange will deliver a best practice level of environmentally sustainable design.

2.3 Benchmarking

The approach towards sustainability in the delivery of this project has been assessed with reference to objective benchmarks.

As the Forest Road Site development comprises of a number of types of developments; each is assessed by a different benchmark. The reference benchmarks used for the various developments are shown below:

- A projected 4.5 Star ABGR status – for the commercial part of the development
- BASIX water and energy reduction targets – for the residential component of the development

2.3.1 ABGR

The Australian Building Greenhouse Rating (ABGR) assessment is the most comprehensive rating tool available for assessing the energy performance of commercial office buildings in Australia.

It only considers the energy consumption used to maintain the buildings indoor environmental conditions and office operation.

A 4.5 Star ABGR design rating has been nominated as an objective third party benchmark for the commercial and retail component of the development.

2.4 BASIX

BASIX is a residential rating tool for assessing the water, energy and thermal efficiency of the design of a house or unit in NSW. The design of the dwelling is compared against energy and water reduction targets set out in BASIX by the New South Wales Government. BASIX requires a 40% water demand reduction on a benchmark of 247L per person per day and a 25% greenhouse gas emission reduction on a benchmark of 9kg CO2 emissions per person per day. To satisfy the thermal performance requirements, the heating and cooling loads for the dwelling must as a minimum meet the Building Code of Australia (BCA) requirements for the Nation Wide House Energy Rating Scheme (NatHERS).

The benefits of BASIX to residents include:

- A water and energy efficient dwelling
- A more comfortable home to live in
- On going savings on water and energy bills

The ESD initiatives for residential buildings in this report will drive a higher level of BASIX performance than that required as a minimum.

Also, while the BASIX tool applies mostly to residential developments such as houses and apartment buildings, the principles identified within the tool will also be applied to the residential facilities on site; such as the motel, short stay hostel etc.

3 ESD Initiatives

The Initiatives comprising a major part of the overall ESD strategy for the site; i.e. those mentioned in 2.2 are elaborated below

3.1 Mechanical Initiatives

3.1.1 HVAC System

Energy consumption for heating cooling and ventilation (HVAC) comprises at least 50% of a buildings overall energy consumption. An efficient HVAC system could significantly reduce the energy consumption of the individual buildings and of the entire development. With a building such as a hospital, the energy demand is extensive and consistent through the year hence an energy efficient HVAC system would be crucial to reducing the overall carbon emissions.

3.1.2 IEQ

Since maintaining air quality is critical in hospitals, the air conditioning system will be designed to achieve improvement on the minimum requirements for outside air provision and aim to provide as much fresh air as possible while effectively flushing contaminants from the space.

3.1.3 Other Mechanical Initiatives

The mechanical design features of the building provide the largest contribution in achieving a best practice level of environmentally sustainable design.

A brief description of additional mechanical design initiatives is as shown below.

- CO_2 Control: systems and sensors will be installed to monitor the carbon dioxide levels in the space to ensure that air quality is maintained at all times; this applies to the commercial as well as the hospital component of the development

- Thermal Comfort: A well designed mechanical system in combination with good passive design initiatives would ensure that a high level of thermal comfort would be maintained in all the proposed buildings on site.

- Mould Prevention: Humidity will be actively controlled in all conditioned spaces and the supply air ductwork, this is especially critical in all the hospital areas.

- Efficient Heat Rejection: Cooling towers will be designed to operate at a minimum of 6 cycles of concentration in order to minimise water consumption associated with cooling systems. Additionally alternative means of heat rejection would also be explored.

- Tenant Exhaust: Providing an exhaust riser for the removal of indoor air pollutants from printing and photocopy areas for the commercial part of the development.

3.2 Electrical Initiatives

3.2.1 Efficient Lighting System Design

Next to HVAC systems, lighting is the prime consumer of energy in buildings. Hence lighting system design and fitting efficiencies have significant impacts on the indoor environmental quality and energy consumption of the building.

The major benefits of an incorporating an efficient system are:

- Improved energy efficiency due to low energy density (i.e. low W/m^2 energy consumption).

- Reduced load on the HVAC system; as more efficient fittings have a reduced heat input into the space.

- Good addressability: appropriate zoning allows only necessary lighting to be used in off peak periods.

- Improved indoor environmental quality through appropriate lighting levels and minimisation of "flicker" effects encountered in some lighting designs.

3.2.2 Additional Electrical Initiatives

The following electrical initiatives have been targeted for the building:

- Electrical Sub-Metering: Effective energy monitoring is essential in effectively tracking the energy performance of the building and identifying operational issues will allow for identification and correction of inefficient building operation.

- Office Lighting Zoning: designated lighting zones of less than 100m^2 will allow occupants to use only the amount of lighting that is needed.

- High Frequency Ballasts: High frequency ballasts will provide good visual comfort in the space, minimising eye strain.

3.3 Hydraulic initiatives

3.3.1 Water Efficiency

Potable water efficiency is an important goal for the development. The most direct way to reduce potable water consumption is reduce the demand for water for all occupant amenities and building services. The second is to have a leak detection system that will help reduce wastage. The third is to use alternative supplies of water such as rainwater / blackwater that could replace potable water for non-potable applications where excessive water treatment is not required (e.g. flushing toilets and irrigation).

3.3.2 Details of Hydraulics Initiatives

The proposed components of a water saving strategy for the site development are:

- Use of water efficient fittings; including waterless urinals in public toilets, to reduce the daily demand for potable water.

- Installation of water metering for all major users linked to the BMS to provide leak detection.

- Efficient drip irrigation system to reduce water use in landscaped areas.

- Installation of a fire test water system that allows the collection and re-use of the water.

- Investigate potential for Rainwater capture

3.3.3 Benefits of water efficiency

- Reduction in water consumption; providing environmental and financial benefits

- Reduced dependency on centralised water supply and sewage disposal

3.4 Environmentally Sustainable Building Materials

Low emission and low embodied energy material selections are an important aspect of good building design. Additionally the use of building materials to provide a climate responsive design solution can go a long way towards reducing the energy consumption of the building by reducing heating and cooling loads.

3.4.1 Low Emission Materials

Many materials used in buildings (generally paints, carpets, sealants or composite wood products) release volatile organic chemicals (VOC), formaldehyde, and other indoor air pollutants into the building, and continue to do so over a number of years. This compromises air quality and creates unhealthy living conditions which can affect the immune system, especially with prolonged exposure. Therefore the choice of low emission materials is essential not only for the hospital areas but also across the entire development, where people would spend a large part of their day.

3.4.2 Environmentally Sustainable Materials

Material selection can also impact the environment at large. Certain materials, such as PVC can be toxic and leach harmful compounds into the environment throughout their lifespan, while other materials such as insulation often involve harmful gases and materials at the production stage. Furthermore, much of the timber used in the building industry is not sustainably sourced.

3.4.3 Materials Initiatives

The following material selection initiatives targeted for the private hospital precinct at forest road are aimed at improving indoor environmental quality and ensuring that unsustainable practices are discouraged:

- Volatile Organic Chemicals: Use of low VOC paints, carpets, and sealants.
- Formaldehyde Minimisation: Low emission formaldehyde composite wood products are targeted for the building.
- PVC Minimisation: PVC minimisation is targeted through specification of alternatives to PVC for pipes, cable conduits, finishes etc where economically and practically viable.
- Sustainable Timber: The use of Forest Stewardship Council (FSC) certified or recycled timber is recommended for the development.
- Insulation ODP: Materials that do not contain ozone depleting substances in material or manufacture are targeted for the project.
- Refrigerant ODP: Refrigerant for HVAC systems with zero ozone depleting potential (ODP) are recommended for the project.

3.5 Management and Planning Initiatives

There are large number of initiatives which meet the core ESD principles through smart building management and planning.

3.5.1 Building Commissioning

Building commissioning is a critical factor in the planning and design of any new development. A number of ESD initiatives are aimed at improving the overall management process.

These initiatives generally relate to the commissioning of the building at the end of the construction phase and providing information for occupants and tenants to run the building in accordance with its design intent.

Good management allows the design potential of the building to be realised and for systems to operate at their optimum efficiency. This is critical in terms of ensuring the performance of the building in the future.

3.5.2 Good Site Planning

Many of the ESD initiatives are part of good planning. The orientation, individual building design, landscaping and transport facilities are all areas where significant energy, waste management and indoor environmental quality improvements can be made.

Recycling is a key ESD initiative; especially as the site has a combination of different building types with varying volumes and types of waste generated. Sufficient dedicated space that has adequate access for recycling companies to retrieve the waste is an important consideration when planning the site layout.

Emissions of the building into the surrounding environment should also be considered when planning the building.

3.5.3 Good Building Design

Good building design would simultaneously help reduce the building energy consumption and provide a healthy internal environment. Some basic design initiatives that would contribute to good building design have been listed below:

- Day lighting: The provision of natural light to a substantial portion of the all the buildings on site through appropriate orientation and façade design.
- Daylight Glare Control: Providing fixed external or operable internal shading to reduce the glare from direct sunlight through the façade is recommended for inclusion in the design.
- External Views: The site layout seeks to maximise occupants' external views.
- Internal Noise Levels: Façade and services designs seek to provide internal noise levels within the recommended value stated in the Australian Standards.
- Light Pollution: External lighting will be designed to minimise light pollution to the night sky and surrounding buildings.

3.5.4 Best Practice Construction

ESD initiatives that indicate best practice construction are targeted for building as follows:

- ISO14001 certified contractors
- Construction waste recycling
- Installation of refrigerant leak detection and recovery on chillers
- Ensuring that construction materials used have a significant recycled component

3.5.5 Energy Monitoring

As Electrical energy consumption is the biggest contributor of greenhouse gas emissions; to effectively manage electrical consumption, it is essential for building managers to have sufficient data to monitor consumption and compare it to historical values.

Electrical metering is recommended for all large uses (greater than 100kVa) for the hospital component and on all floors and tenancies for the commercial part of the development to allow effective energy monitoring of the all the buildings. This would allow building managers to fine tune operational procedures and ensure that the building systems function as intended.

3.5.6 Details of Management and Planning Initiatives

A summary of the management and planning initiatives targeted for the building follows:

- Commissioning Clauses: Systems commissioning to ASHRAE and/or CIBSE standards is aimed for to achieve optimum efficiency out of the building services.
- Building Tuning: A 12 month building tuning period is recommended to achieve good seasonal performance.
- Commissioning Agent: Ensuring the person supervising commissioning is an objective 3rd party is recommended to provide objective advice due to the unique nature of the services.
- Building Users Guide: The design team plans to produce a simple guide for the users, occupants and tenants of the building containing information on the energy and environmental strategy, monitoring and targeting, building services, transport facilities, materials and waste management policy, and expansion/re-fit information.
- Recycled Waste Storage: Space dedicated to the sorting and storage of recyclable waste from the building.
- Environmental Management Plan: Contractors with ISO 14001 certification that can apply an environmental management plan will be selected.
- Construction Waste Recycling: The contractors will aim to recycle the construction and demolition waste.
- Recycled content of structural steel: Structural reinforcement would typically contain a high level of recycled steel.
- Recycled content of structural concrete: Replacement of up to 20% of cement in structural concrete is recommended for the development.

3.6 Infrastructure initiatives

Good infrastructure planning plays a significant role in reducing overall pollution from the site, both in terms of carbon emissions and waste management. To that end, the following initiatives are currently under investigation:

- Inclusion of alternative sources of energy; such as Gas fired cogeneration and renewable energy to help reduce carbon emissions.
- Investigate potential for on-site blackwater treatment
- Potential stormwater detention, treatment and re-use on site.

3.6.1 Description of Energy Infrastructure initiatives

Electricity obtained from the centralised energy grid is often sourced from coal fired power stations. As Coal fired electricity has inherently high CO_2 emissions, other options that would help reduce carbon emissions as described below, have been investigated.

- On-site energy generation through Gas fired micro-turbines; as electricity sourced from natural gas emits much less carbon dioxide than coal fired electricity, on site generation provides the double benefit of reducing emissions and supply losses through the grid.
- Energy sourced from renewable sources such as solar energy and wind energy provide electricity that has zero emissions. Emissions reduction can also be achieved through the partial use of renewable energy.

3.6.2 Description of Water Infrastructure initiatives

In addition to sustainable use of potable water through good management and the use of efficient fittings, other ways to reduce consumption include meeting all non-potable water needs with recycled water.

The potential for including of a blackwater treatment plant on site has been investigated. As blackwater includes wastewater from basins and showers and sewage, this would not only reduce the consumption of potable water but also reduce / negate the effluent discharged into the sewer.

The recycled water could be used for non-potable uses such as flushing toilets and irrigation. The treatment of sewage on site is also fortuitous as the site is currently not connected to the sewage mains. For similar reasons, on site stormwater capture and reuse is also being investigated.

3.7 Summary

In conclusion, the various ESD initiatives proposed for the Private Hospital on Forest Road in Orange are summarised below:

- Good Building planning and management
- Energy efficient mechanical system design
- Efficient lighting system design
- Use of water-efficient fittings and water metering
- Energy monitoring
- Good risk management
- Best practice construction techniques
- The use of environmentally sustainable and low emission building materials

Other initiatives currently under investigation are:

- Inclusion of on-site Gas fired energy generation to reduce carbon emissions
- On-site blackwater treatment
- Stormwater detention and management

The strategies described in this report, as well as any new sustainable initiatives that may still be embraced, are an integral part of the commitment to achieving a sustainable site development at the Private Hospital Precinct at Forest Road, Orange.

It is currently estimated that these strategies would make the building an example of “Australian Best Practice” in green design.