June 2011

61 Mobbs Lane, Epping Park
Stage 2 – Buildings 6, 9, 10 & 17
ESD Report

Prepared for

Meriton Apartments Pty Ltd

CUNDALL
Level 1, 48 Alfred Street
Milsons Point NSW 2061
Phone: +61 2 8424 7000
Fax: +61 2 8424 7099
Please contact: David Collins

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Author:	David Collins				
Checked by:	Marlon Kobacker				
Approved by:	Tim Elgood				

Revision	**Description**	**Date**
A	Stage 2 Development Application report	27/06/2011

The success and realisation of the proposed initiatives will be dependant upon the commitment of the design team, the development of the initiatives through the life of the design and also the implementation into the operation of the building. Without this undertaking the proposed targets may not be achieved.

CUNDALL
Level 1, 48 Alfred Street
Milsons Point NSW 2061
Phone: +61 2 8424 7000
Fax: +61 2 8424 7099
ABN: 16 104 924 370
www.cundall.com.au

Contents

1 Executive Summary

61 Mobbs Lane, Epping Park is located within the Parramatta Local Government Area. The site is 89,190 sqm in extent and is situated approximately 1.4km from both Epping and Eastwood rail stations. The site has a frontage to Mobbs Lane of approximately 500m which is accessed via Midson Road to the east, and Marsden Road to the west.

The site is bounded to the south by Mobbs Lane, to the east by single houses fronting Edenlee Street, to the north by a branch of Ryde Horticultural TAFE, to the northwest by rear yards of single houses and some dual occupancies, and to the west by Mobbs Lane Reserve open space bushland.

This Stage 2 phase is comprised of four buildings, Buildings 6, 9, 10 and 17, for the purpose of this report ' the site' refers to these buildings only.

Stage 2 is for the construction of four (4) residential flat buildings comprising 221 apartments and 326 associated car spaces. The proposed development comprises a mixture of three and four storey residential buildings.

The development is subject to BASIX compliance for energy and water efficiency. The non-residential sections of the development will be subject to the BCA Section J1 & J2.

This report has been written in response to the Director General Requirements and highlights the ESD initiatives that will be investigated under the Stage 2 development.

This report reviews the principles which can be incorporated into the proposed design of the development with respect to environmental performance in the following categories:

- Building Form & Fabric
- Indoor Environmental Quality
- Sustainable Building Materials
- Water Consumption
- Waste Management
- Energy Consumption & Renewable Energy
- Environmental Site Management
- Groundwater & Stormwater Management
- Air & Noise Pollution

Initiatives to be included or investigated in further detail are as below:

Director General Requirements (DGR)

1. An Executive Summary;
2. A thorough site analysis including site plans, aerial photographs and a description of the existing and surrounding environment;
3. A thorough description of the proposed development;
4. An assessment of the key issues specified above and a table outlining how these key issues have been addressed;
5. An assessment of the potential impacts of the project and a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures to be implemented to minimise any potential impacts of the project;
6. The plans and documents outlined below;
    a. Site Survey Plan
    b. Site Analysis Plan
    c. Locality/Context Plan

d. Architectural Plans

e. Geotechnical and Structural Report

f. Stormwater Concept Plan

g. Erosion and Sediment Control Plan

h. Landscape Plan

i. Shadow Diagrams

j. Construction Management Plan

k. Traffic Management Plan

7. A signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading;

8. A Quantity Surveyor's Certificate of Cost to verify the capital investment value of the project (in accordance with the definition contained in the Major Projects SEPP); and

9. A conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest.

National Construction Codes (NCC) Requirements

The minimum regulatory ESD requirements applying to this site include the following:

- Building & Sustainability Index (residential only)
- BCA Section J for Energy Efficiency (non-residential)

New residential developments in NSW must reduce their energy and water use, according to BASIX requirements developed by the Department of Planning. The objectives of the BASIX scheme are relative to an average development in NSW and are targeted as:

- 40% reduction in water consumption
- 20-40% reduction in greenhouse gas emissions, depending on building height.
- Minimum thermal performance requirements for heating and cooling loads.

ESD Strategies

The ESD strategies proposed to address the requirements of BASIX and the DGR include:

- Carefully considering building form and fabric to balance solar heat gains, daylight, glare and views to outside.
- Passive design strategies including external shading, insulation for walls and ceilings
- Energy efficiency in building systems and services, including:
    - A highly efficient lighting design and control strategy to reduce artificial lighting energy consumption and allow maximum advantage to be taken of daylight incorporating natural daylight sensing, zoned switching and motion sensors
    - Florescent light fittings
    - Gas Cook tops and electric ovens
    - Hallways and lobbies to be partially naturally ventilated.
    - Car park ventilation to be fitted with CO monitoring and VSD control

  - Investigation of Heat Pumps/Solar Panels on site to supply domestic hot water demands
  - Investigate renewable energy generation such as incorporating photovoltaics on site
- Water-efficient fittings targeting 3 Star WELS rating showers and 4 Star WELS rating taps
- Native/drought-resistant landscape to reduce potable water demands
- Rainwater harvesting for use in landscape irrigation and car washing.
- Water efficient washing machines and dryers targeting 2 Star dryers and 3 Star dishwashers
- Apply Water Sensitive Urban Design principles to assist in stormwater management;
- Select materials to maximise recycled content, minimise indoor pollutant emissions and avoid ecologically sensitive products.
- Waste Management Plan to minimise waste during the operation and construction of the development

Additional ESD initiatives

Energy consumption can be reduced through the efficient design of lighting, air-conditioning hot water and ventilation systems.

Focus will also be placed on lighting controls including consideration of:

- Daylight dimming or extinguishing of external and streetscape perimeter lighting
- Localised light switching, with lighting zones to be ≤ 250m2 including plantrooms
- Central automatic timed control of lighting

The following energy initiatives can help to reduce air-conditioning energy:

- Select equipment with a high Coefficient of Performance (COP), particularly at part load.
- Control Outside Air supply by use of CO_2 sensors to reduce energy consumption at part occupancy;
- Consider a wider, internal temperature range. For example, when it is 36°C outside, an internal temperature of 24 - 26°C is considered quite comfortable by most people provided radiant temperature is reduced (e.g. no direct solar gain) and air movement is provided (e.g. natural ventilation or ceiling fans). This could use significantly less energy than trying to cool to a standard 22 - 24°C throughout the year.

Water reduction strategies such as:

- Use of 3 / 4.5L dual flush toilets;
- Showers with a maximum flow rate of 7.5 L/min (e.g. Ecoshower)
- Wash hand basin faucets with a maximum flow rate of 4 L/min
- Cleaners and kitchen taps with a maximum flow rate of 6L/min
- Installing watering systems with either a rain sensor or soil moisture sensor as part of the control system
- Cleaning of paved areas with an alternative to water unless cleaning is required as a result of an accident, fire, health or safety hazard, or other emergency
- Consideration of flow shut-off device for all hoses

Incorporation of sustainable building materials such as recycled or FSC timber, low formaldehyde composite wood products, low VOC paints and adhesives, recycled steel, recycled content in concrete, and recycled aggregate.

2 Introduction

61 Mobbs Lane, Epping Park is located within the Parramatta Local Government Area. The site is 89,190 sqm in extent and is situated approximately 1.4km from both Epping and Eastwood rail stations. The site has a frontage to Mobbs Lane of approximately 500m which is accessed via Midson Road to the east, and Marsden Road to the west.

The site is bounded to the south by Mobbs Lane, to the east by single houses fronting Edenlee Street, to the north by a branch of Ryde Horticultural TAFE, to the northwest by rear yards of single houses and some dual occupancies, and to the west by Mobbs Lane Reserve open space bushland.

This Stage 2 phase is comprised of four buildings, Buildings 6, 9, 10 and 17, for the purpose of this report ' the site' refers to these buildings only.

Stage 2 is for the construction of four (4) residential flat buildings comprising 221 apartments and 326 associated car spaces. The proposed development comprises a mixture of three and four storey residential buildings.

The development is subject to BASIX compliance for energy and water efficiency.

Figure 1: Proposed site boundary – towards Epping

Figure 2: Proposed site boundary - towards city

This report highlights the ESD initiatives that will be investigated for the new proposed development. The report also highlights environmental requirements to meet the Director General Requirements.

Principles which can be incorporated into the design of the development with respect to environmental performance can be evaluated in the following categories:

- Building Form & Fabric
- Indoor Environmental Quality
- Sustainable Building Materials
- Water Consumption
- Waste Management
- Energy Consumption & Renewable Energy
- Environmental Site Management
- Groundwater & Stormwater Management
- Air & Noise Pollution

3 Director General Requirements

The Director General Requirements requests that the following key issues are addressed:

Planning provisions applying to the site, including permissibility and the provisions of all plans and policies including, but not limited to:

1. An Executive Summary;
2. A thorough site analysis including site plans, aerial photographs and a description of the existing and surrounding environment;
3. A thorough description of the proposed development;
4. An assessment of the key issues specified above and a table outlining how these key issues have been addressed;
5. An assessment of the potential impacts of the project and a draft Statement of Commitments, outlining environmental management, mitigation and monitoring measures to be implemented to minimise any potential impacts of the project;
6. The plans and documents outlined below;
    a. Site Survey Plan
    b. Site Analysis Plan
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7. A signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading;
8. A Quantity Surveyor's Certificate of Cost to verify the capital investment value of the project (in accordance with the definition contained in the Major Projects SEPP); and
9. A conclusion justifying the project, taking into consideration the environmental impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest.

The above regulations must be addressed by the relevant members of the design team.

4 Regulatory Framework

The minimum regulatory ESD requirements applying to this site include the following:

- Building & Sustainability Index (BASIX, residential only)
- BCA Section J for Energy Efficiency (non-residential)

4.1 BASIX

New residential developments in NSW must reduce their energy and water use, according to BASIX requirements developed by the Department of Planning. The objectives of the BASIX scheme are relative to an average development in NSW and are targeted as:

- 40% reduction in water consumption
- 20-40% reduction in greenhouse gas emissions, depending on building height.
- Minimum thermal performance requirements for heating and cooling loads based on thermal comfort

4.2 Basix Thermal Comfort

Thermal comfort for BASIX is assessed using the Building Energy Rating Scheme (BERS). In NSW, the software required to perform thermal assessments is AccuRate.

BASIX requires that each unit achieve a minimum thermal performance. This is calculated using AccuRate which predicts annual heating and cooling loads for a dwelling.

In order to pass BASIX requirements, these loads may not exceed the maximum heating and cooling caps proposed for a certain location. The following objectives must be met:

- Heating and cooling loads for individual dwellings must not exceed the limit specified in the BASIX scheme
- The average of heating and cooling loads of all the proposed dwellings in a development must not exceed the specified average limit.

Each unit in the proposed development will be assessed to determine heating and cooling load performance.

The requirement under the DCP is to achieve a minimum 4.5 NatHers rating which has been superseded by the AccuRate rating methodology. Further investigations will be required to determine the equivalent minimum AccuRate star rating the development must meet.

4.3 BCA Section J

The Building Code of Australia (BCA) Section J sets minimum energy performance requirements for all new non-residential developments. The minimum requirements cover air-conditioning, ventilation, lighting, power and hot water, as well as building fabric considerations including thermal construction and insulation, building sealing, glazing and shading.

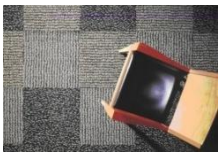
The Deemed-to-Satisfy Provisions in Section J of the BCA 2010 are defined in eight parts:

Part J1 – Building Fabric	Part J5 – HVAC Systems
Part J2 – External Glazing	Part J6 – Artificial Light & Power
Part J3 – Building Sealing	Part J7 – Hot Water Supply
Part J4 – Air Movement	Part J8 – Access for Maintenance

Any non- residential sections of the proposed site development will need be developed to meet the BCA energy efficiency requirements.

4.4 Statement of ESD Principles

The ESD initiatives have been evaluated in response to the Director General's requirements and the following framework will be addressed to ensure that the objectives are being met.

	ESD Initiatives
Management	• Environmental Management Plan during construction and operation • Waste Management Plan during construction and operation • Minimise natural resource consumption, waste, pollution and toxicity during the construction and operation of the facility;
Indoor Environmental Quality	• Preservation of amenity including internal air quality, daylighting and comfort; • Efficient Air conditioning and ventilation • Maximise External Views • Minimisation of Volatile Organic Compound emissions
Energy Conservation	• Reducing greenhouse gas emissions through energy efficiency of building services and building façades • Natural Ventilation where possible • Investigate the use of heat pumps/solar gas boosted hot water • Variable Speed Drives and CO control for Car Park Ventilation • Energy monitoring via Building Management Systems 
Transport	• Good public transport links • Transportation and Travel Guide • Provision of cyclist facilities for staff and visitors • Regular bus service 
Water Conservation	• Conserving water and preserving natural waterways • High Efficiency fittings • Alternative Sources – rainwater storage 
Materials	• Reduce impacts on the internal and external environments • Preference for environmentally responsible materials • Dedicated waste recycling areas 
Emissions	• All refrigerants used in air conditioning equipment will have Low Ozone Depletion Potential • Filtered stormwater runoff

5 ESD considerations

5.1 Energy & Emissions

Greenhouse reductions are achieved in a staged approach:

- Reduction in overall energy consumption through demand reduction and energy efficiency.
- Reduction in electricity and gas utility consumption by utilising waste products and renewable energy technologies.

The integrated energy strategies being considered for the development include:

Load Reduction	• Passive design • Mixed-mode AC systems • Daylighting to reduce reliance on artificial lighting; • Selection of energy efficient lighting and equipment • Water efficiency in hot water systems
System Efficiency	• Efficient air-conditioning services; • Fluorescent or T5 lighting where possible with lighting control systems • Selection of efficient equipment and appliances
Renewable Sources	• Solar hot water • Consider alternative energy sources, including Photovoltaics

5.2 Passive Design

The development will utilise passive design to minimise the amount of air-conditioning required and therefore significantly reduce the building's energy consumption and greenhouse performance. A building's form, fabric and orientation will have the biggest influence on its thermal comfort and environmental performance. The following factors will be considered in the detailed stages of the design:

- Orientation
- Shading
- Structure
- Insulation
- Glazing

An efficient building fabric reduces heat losses and gains inside the building. This not only affects sizing of the mechanical plant but also the thermal comfort of occupants.

Choice of glazing will be vital in reducing heating and cooling energy consumption and maintaining occupant comfort. The selected glazing will help to avoid heat gains in the summer and aim to reduce losses in the winter. Consideration will be given to incorporating effective shading features into the design to avoid the necessity for low shading coefficients in the glass, which usually also decrease the visible light transmission (VLT) of the glass. To maximise the natural daylight within the buildings, VLT should be as high as possible.

5.3 Energy Efficient Systems and Services

Energy consumption can be reduced through the efficient design of lighting, air-conditioning, hot water and ventilation systems. The following strategies will be investigated for improved energy efficiency in design and operation:

		Energy Conservation Strategies
Strategies Common Areas		• Variable Speed Drive (VSD) car park ventilation with carbon monoxide monitoring; • Fluorescent lighting to the car park, common areas, hallways and plants rooms • Efficiency controls including timers and motions sensors to car park and common areas • Localised light switching, with lighting zones to be ≤ 250m2 including plantrooms • Hallways have supply & extract ventilation with efficiency controls
Strategies Individual dwellings	**Services**	• Heat Pumps/Solar hot water and insulated pipework • Bathroom and laundry exhaust individually ducted to facade or roof (with on/off switch), kitchen exhaust recirculating (not ducted); • High COP Air-Conditioning in bedrooms and living areas • Fluorescent Lighting for bedrooms, bathrooms, laundries, toilets and hallways. 
	Appliances	• Gas cook top with electric oven • 2 Star rated clothes washer (TBC) • 2 Star rated clothes dryer (TBC)
Renewable Energy		• A 9.5kW photovoltaic system is required for Stage 2.

Lighting

An efficient lighting design and control strategy will be considered to reduce artificial lighting energy consumption and allow maximum advantage to be taken of daylight. Lighting power density will be required to meet BCA requirements. Initiatives include:

- Efficient light fittings such as compact fluorescent lamps
- Daylight dimming of external and streetscape perimeter lighting, as well as internal lighting adjacent to windows
- Efficiency controls including timers and motions sensors in car parks and common areas
- Localised light switching, with lighting zones to be ≤ 250m2 including plantrooms

Heating, Ventilation & Cooling (HVAC)

The following energy initiatives will be considered to help reduce air-conditioning and ventilation energy:

- Residential bathrooms and laundries will be individually ducted and controlled
- When air conditioning is provided it will be zoned so that only occupied areas are cooled, and spaces with different occupancy patterns or different cooling loads are zoned separately
- Supply & extract ventilation with efficiency controls to common spaces
- Enclosed car park areas will be designed with Variable Speed Drive (VSD) and carbon monoxide (CO) monitoring, as well as passive supply or passive exhaust where possible

Hot Water

A central gas fired hot water system will provide hot water for the domestic needs of the residential dwellings.

5.4 Tracking & Monitoring

To enable the effective monitoring and tracking of energy consumption, sub-metering should be provided to systems with major energy use, to help identify areas of inefficiency with potential for improvement. This will be achieved either via the Building Management System (BMS) where applicable or via a simple metering system as appropriate.

5.5 Indoor Environment Quality

Indoor Environmental Quality (IEQ) affects occupant amenity and incorporates thermal comfort, indoor air quality, daylight and acoustic quality. These are outlined below and will be developed further during detailed design.

Thermal Comfort

Passive heating and cooling strategies will be considered for incorporation into the design, which will improve occupant thermal comfort. These will include:

- Wall and roof insulation to reduce heat gain and loss and moderate radiant temperatures from the walls, floor and ceiling
- Building facades with large areas of glazing will have a combination of external shading to reduce heat transfer and radiant temperatures in proximity to the windows
- Balcony overhangs to provide effective external shading

Daylight, Glare and External Views

The level of natural light in buildings is primarily determined by the extent and type of glazing, and the depth of the building floor plate. Extent of glazing must be optimised to allow maximum daylight, views, and winter sun, while minimising uncomfortable glare and excessive solar heat gains in summer. Glazing should be selected with a high Visual Light Transmission to maximise daylight penetration.

5.6 Water Conservation & Management

Water conservation strategies proposed for this project include:

- Reducing the mains or potable water consumed within the development through demand management
- Substituting mains water required to meet this demand by utilising alternative sources such as rainwater and stormwater.

Demand Management

Strategies to minimise consumption include water-efficient fittings and fixtures, water-efficient appliances and low-water use air-conditioning and irrigation systems. In order to reduce the overall water consumption for this development, the following initiatives will be considered:

	Water Conservation Strategies
Fixtures	• 4 Star WELS rated Efficient wash hand basin taps • 4 Star WELS rated Efficient kitchen taps • 4 star WELS rated Efficient WC's • 3 Star WELS rated Showerheads • Efficient cleaner's taps
Appliances	• 3 Star water-efficient dishwashers • 2 Star water-efficient clothes washing machines.
Air-Conditioning	• Limited use of water cooled systems
Landscape Irrigation	• Water-efficient native species • Consider subsurface irrigation systems for non-native or drought resistant species

Rainwater Harvesting & Reuse

Harvested rainwater will be considered to supplement the following non-potable water uses:

- Common area landscape irrigation
- Private landscape irrigation
- Car-washing & waste area wash-down

Rainwater will be drained from the roofs of buildings and filtered, before storage in below-ground tanks for reuse. This approach is demonstrated in the figure below.

Landscape Selection

The use of native, drought-resistant planting will be considered to reduce water consumption used in irrigation. Sub-soil irrigation systems should be considered where non-native species are selected.

Tracking and Monitoring

Sub-metering via building management systems on major water usage can identify abnormal usage patterns usually associated with leaks, helping to reduce the considerable water lost in this way.

Groundwater & Stormwater management

In order to reduce the impacts of stormwater runoff from the site, the following stormwater management strategies will be considered:

- Rainwater capture from rooftops for reuse in buildings reducing stormwater runoff as well as mains potable water use
- Stormwater detention will be provided to minimise runoff quantities
- The use of permeable surfaces to be considered where suitable, allowing stormwater to seep directly into the earth and reducing stormwater flows off-site

5.7 Transport

To encourage residents to cycle, secure and accessible bicycle storage will be included for building residents and visitors.

5.8 Emissions

In addition to the reduction in greenhouse emissions as a result of lower on-site energy usage, a further reduction in emissions to land, air and water will be considered in the following ways:

- Where available, thermal insulation products will be selected which have a low Ozone Depletion Potential in their manufacture and composition, reducing the impacts of insulation on the atmosphere
- 100% of refrigerants by volume will have an Ozone Depletion Potential of zero
- Estimated wastewater discharge to sewer will be reduced relative to a standard building through the implementation of water efficiency measures

5.9 Materials Selection

Consideration will be given to sourcing environmentally responsible materials, strategies include:

- Avoidance of ecologically sensitive products
- Selection of materials with a low embodied energy & high recycled content;
- Low toxicity material selection;
- Low impact on the indoor environment;
- Durability, flexibility and recyclable;
- Waste reduction

6 Additional ESD Initiatives

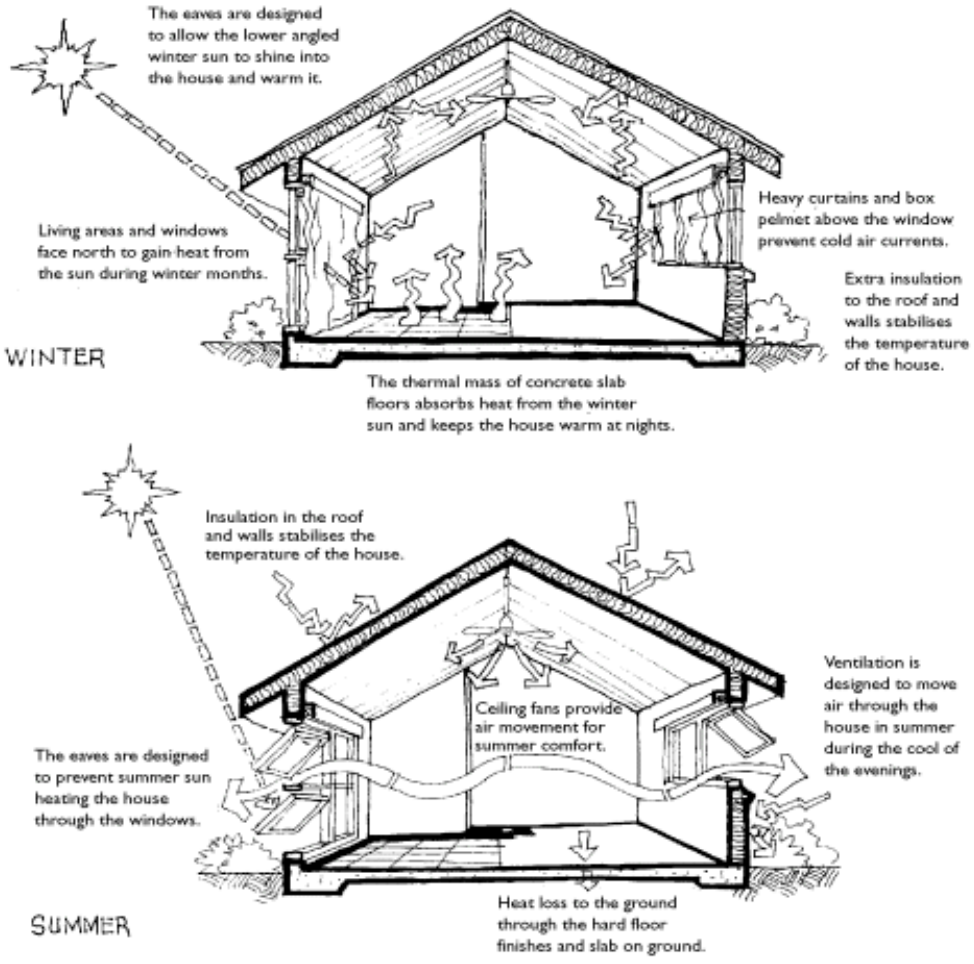
6.1 Building Form, Fabric & Orientation

The building's form, fabric and orientation will have a biggest influence on its thermal, comfort and environmental performance. A building with a carefully considered structure and orientation will perform far better than one where no consideration is given. The non-residential development will need to meet minimum requirements for BCA Section J for fabric and glazing.

Compensating poor building design using mechanical systems increases operating costs and does not necessarily provide adequate comfort, as occupants of many sealed glass buildings will testify.

The following factors should be considered in the design:

- Orientation
- Shading
- Structure
- Insulation
- Glazing



Structure & Insulation

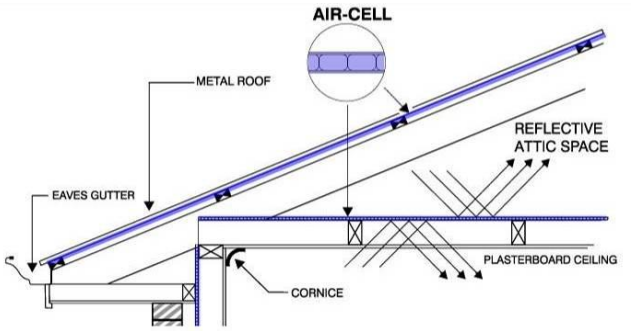
While the minimum BCA insulation requirements for retail development in Sydney are R3.2 for ceilings, R1.8 for walls, increasing these values will provide better comfort control and energy performance.

Options for insulation include:

- Hybrid roof insulation
- Styrofoam insulation
- Bulk insulation

Hybrid roof insulation technology is typically a low volume, high performance insulation medium that combines reflective foil with low emittance, enclosed air and a thermal conduction barrier.

Hybrid roof insulation technology such as AirCell is typically less than 10mm thick and can be installed beneath the roof material as per the roof diagram below. The two layers will give a combined R-value of approximately R3.5 provided there is a suitable air gap between the layers (~ 50mm).



Styrofoam insulation is an extruded polystyrene product which offers excellent insulation for low weight and thickness.

Styrofoam is also ideal for “green roofs”, protecting both the waterproof layer and the roof from moisture. It can be used with membranes such as Proctor Sisalkraft714 Vapour Barrier (or equivalent products) to reduce condensation within a roof or floor cavity, which may need to be considered given the exposed nature of the pods.

Bulk insulation includes standard batts used commonly in residential applications. Polystyrene batts are thicker and also low-irritant. There are bulk insulation batts containing recycled content which may be considered for this project.

Glazing

Choice of glazing appropriate to the orientation and local climate conditions will be vital in reducing heating and cooling energy consumption and maintaining occupant comfort.

Glazing may be described by the following properties:

- Visible Light Transmission (VLT) – the percentage of visible light transmitted by the glass. The higher the VLT, the more daylight will enter the space.
- Shading Coefficient (SC) – the percentage of solar radiation that is transmitted through the glass. The lower the value, the less solar heat gain into the space.
- U-Value (U) – a measure of how much heat is passed through the glass. The lower the U-Value, the less heat is transmitted and the higher the thermal performance of the glass.

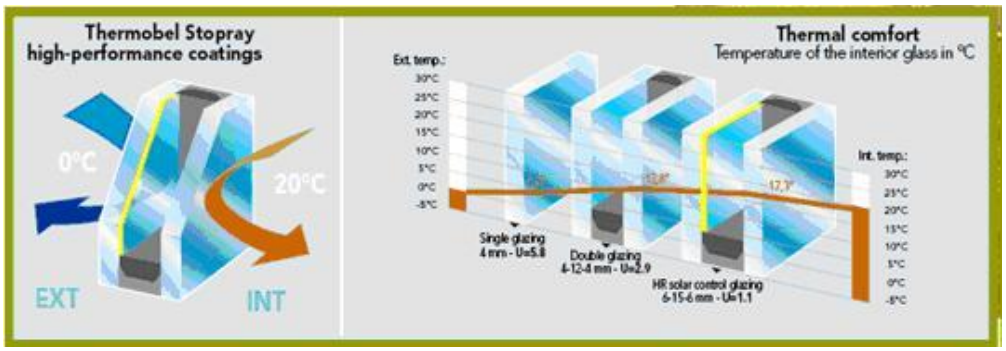
The use of glazing with a low SC will help to avoid heat gains in the summer, while glazing with a low U-value will reduce losses in the winter through the glass. Incorporating effective shading features into the design can avoid the

necessity for low shading coefficients in the glass, which usually also decrease the VLT of the glass. To maximise the natural daylight VLT should be as high as possible.

It is anticipated that the glass utilised on vertical glazing will have as high a VLT, as low a shading coefficient and as low a U-value as practically possible.

Double glazing will reduce heat loss through the glass, correspondingly reducing the heating energy required. Occupant comfort will also be improved, by reducing the internal surface temperature of the glass and helping to avoid the “cold zone” often experienced near glazing in cold weather.

Glazing is available with various “Low-E” coatings, which can help reduce the shading coefficient. However, when exposed, these coatings must be cleaned with specific chemicals and are not particularly durable. This may render low-E coated glass as impractical due to maintenance and longevity concerns.



The thermal performance of the window frame itself is an important consideration and the option of glazing with thermally improved frames should be analysed. A further improvement being investigated is the use of thermally broken frames, particularly if a large amount of framing is likely, to increase overall U-value performance.

Investigation of glazing performance requirements will take place during detailed design stage.

6.2 Indoor Environmental Quality

Daylight, Glare & External Views

Good daylight in combination with views to the external environment can greatly enhance the ambience of a space.

In addition, high levels of natural light reduce the need for artificial lighting, thereby reducing artificial lighting energy consumption.

To maximise daylight distribution within the building, there are several options which should be considered:

- Use glass with a high light transmission
- Use light coloured, reflective finishes on internal surfaces.

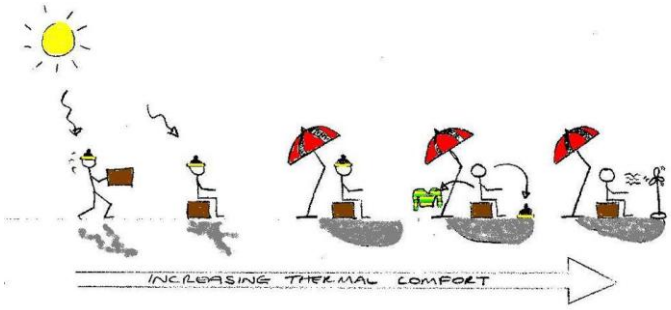
Glare control is also a factor which will be considered during detailed design stage

Thermal Comfort

Thermal comfort is a highly subjective thing; one person’s ‘comfort’ is another’s ‘too hot’ or ‘too cold’. A typical person’s perception of comfort is influenced by six factors:

- Radiant temperature – the temperature of the surfaces around you, or radiant heat from the sun etc (45% of net comfort effect)
- Air temperature and humidity (35% of net comfort effect)
- Air movement, clothing & activity (20% of net comfort effect).

Most buildings in Australia have design criteria for comfort specified only in terms of air temperature and humidity.



© CJP 2005

Activity:	Strenuous	Sitting
Radiant Temp:	Direct Sun	Shade
Clothing:	Warm clothing	Light Clothing
Air Speed:	Still Air	Pleasant breeze
Air Temp.	Constant (28˚C)	
Humidity	Constant (say 50%)	

Changing perception of comfort for constant temperature and humidity

Thermal comfort can either be provided by passive or mechanical means. Passive means should be optimised before mechanical systems are designed, reducing operational energy costs, with potential plant reductions and reduced ongoing maintenance. Passive heating and cooling begins with the building form. Good insulation and glazing will not only reduce heat gain and loss, but will also moderate radiant temperatures from the walls, floor and ceiling.

6.3 Energy Savings

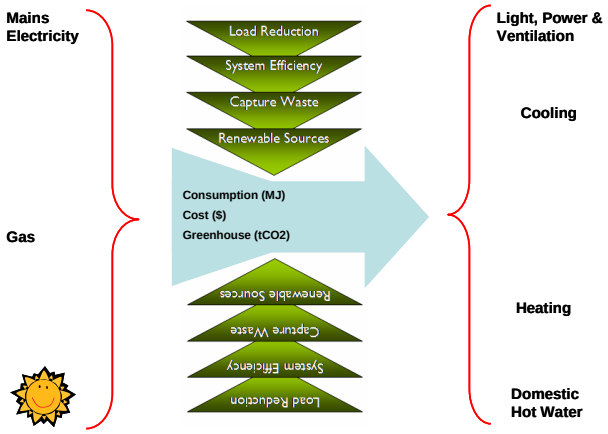
Greenhouse gas emissions are directly related to energy consumption. In Sydney, for every 1.1kWh of mains electricity consumed approximately1kg of CO_2 is released into the atmosphere.

Energy Efficiency Targets

The Building Code of Australia Section J sets minimum energy performance requirements for new retail development, which cover air-conditioning, ventilation, lighting, power and hot water, as well as building fabric considerations including thermal construction and insulation, building sealing, glazing and shading. The proposed design will be developed to meet or where possible exceed the BCA energy efficiency requirements.

The development will investigate the following strategies to reduce its component of energy consumption:

- Reduction in overall energy consumption through demand reduction and energy efficiency
- A reduction in electricity and gas utility consumption through the use of onsite generation.



Approach to Greenhouse reduction

6.4 Water Conservation

With many parts of Australia still in drought after 10 years, water conservation is a crucial aspect of sustainable design. Potable water use can be reduced by promoting a reduction in water consumption, installing highly efficient fittings and fixtures, and supplementing mains water use with alternative water sources.

Water conservation is achieved by:

- Reducing the inherent amount of mains or potable water consumed within the development through demand management
- Substituting mains water required to meet demand by harvesting and reusing rainwater.

Demand Reduction

In order to reduce the overall water consumption, the following initiatives can be investigated:

- High efficiency fittings and appliances to reduce mains potable water consumption. Note that the WELS Star rating scheme replaced the AAAAA scheme as of July 2006. A list of rated products can be found at http://www.waterrating.gov.au/
- Use of 3 / 4.5L dual flush toilets;
- Showers with a maximum flow rate of 7.5 L/min (e.g. Ecoshower);
- Wash hand basin faucets with a maximum flow rate of 4 L/min;
- Cleaners and kitchen taps with a maximum flow rate of 6L/min;
- Drought resistant (xeriscape) plants and grass for gardens and landscaping where appropriate;
- Installing watering systems with either a rain sensor or soil moisture sensor as part of the control system;
- Cleaning of paved areas with an alternative to water unless cleaning is required as a result of an accident, fire, health or safety hazard, or other emergency;
- Consideration of flow shut-off device for all hoses;

Groundwater & Stormwater management

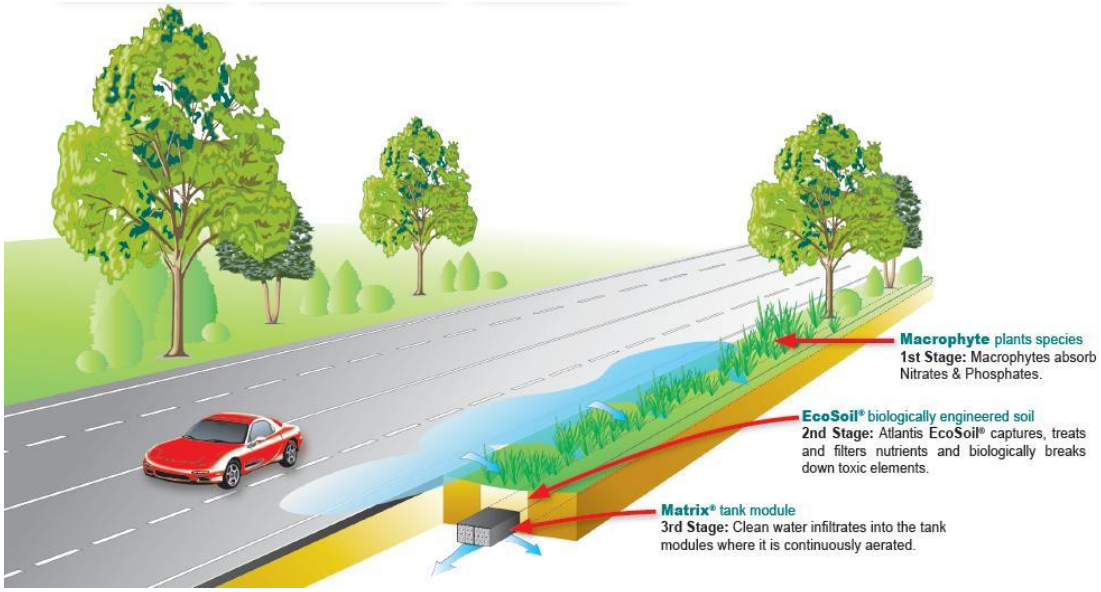
Stormwater run-off can have a major impact on the environment. Untreated stormwater from roads and other paved surfaces runs directly into the local stormwater drainage system, taking with it harsh chemicals and increasing the demand on an often already struggling system.

Reducing the amount of stormwater leaving the site can be quite easily accomplished through careful design of surface and run-off systems.

The use of pervious surfaces (in new landscaped areas) can allow stormwater to seep directly into the earth and help to recharge and dilute the saline watertable. The ground acts as a natural filter for any excess water before it enters the water table. Pervious surfaces could include carparks, walkways and traffic thoroughfares.

Roadside curbs can be made from pervious swales rather than the standard concrete drainage system. This allows water to seep directly into the earth, again reducing stormwater run-off from the site. Careful selection of plants and soils will filter the water from harmful chemicals and oils prior to the water dispersing into the surrounding earth.

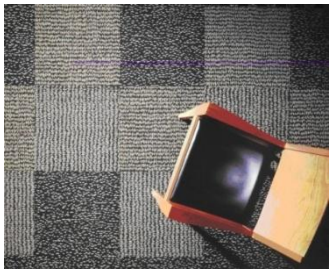
These types of swales for roads on the development will be investigated.



6.5 Sustainable Building Materials

In addition to fitness for purpose, economy, aesthetics and availability, the selection of construction materials should reflect upon the issues of the material's environmental credibility and impact on Indoor Environmental Quality (IEQ), including:

Resource Extraction	(e.g. ecological sensitivity? old-growth forest, scarce minerals?)
Future Recyclability	(e.g. Can it be dismantled, recycled, and survive churn?)
Recycled Content	(e.g. is primary resource consumption thereby reduced?)
Durability	(e.g. Will it last?)
Toxicity	(e.g. PVC use, VOC's, cleaning products & off-gassing)
Waste	(e.g. Standard dimensions used to minimise off-cuts?)
Cost	(e.g. capital, maintenance & life-cycle cost impacts?)
Emissions	(e.g. Greenhouse & Ozone impacting gases)
Embodied Energy	(e.g. energy consumed in manufacture and distribution)



It is recommended that as much construction as possible be prefabricated and installed to minimise construction work and material waste on site.

Sustainable Timber

All timber should be supplied from sustainable sources including Forestry Stewardship Council (FCS) certified plantation timbers and recycled products. No timber (either solid or veneer form) should be sourced from rainforests or old-growth forests. Tropical rainforest timbers, including species Meranti, Merbau, Philippine Mahogany and Chengel should not be used for construction or second fix purposes. The following are accepted plantation timber species:

- Pinus radiata (exotic)
- Pinus elliotii (slash pine, exotic)
- Arakaria cunninhamii (hoop pine, native)
- Cypressus macrocarpa (Monterey Pine, exotic)
- Sydney Blue Gum (NZ grown only)
- Eucalyptus Cladocalyx (Sugar Gum, native, available through Smart Timber, Colac)
- Eucalyptus Globulus (Tasmanian Blue Gum when sourced from mainland plantation)

If the species of timber used is not on this list, the following evidence should be sought:

- Certification from the supplier that the timber is post-consumer recycled, with the source identified, preferably certified by the Forest Stewardship Council
- If the timber is native to and grown in Australia, chain-of-custody certification shall be provided from the place of harvesting to the point of sale.
- Certification as to the plantation status of the timber.

Additionally, the utilisation of reconstituted timber veneer products should be considered.

Plasterboard

Products containing high-recycled content should be considered for all plasterboard installations.

MDF

Products containing little or no formaldehyde (i.e. E1 or E0 board) should be considered for all MDF installations.

Paints and Adhesives

Use of low VOC and water-based products is preferred to oil based paints, stains or sealants, to reduce the need for the use of mineral based solvents and unwanted off-gassing.

Steel

Steel used in the project should seek to be sourced from recycled suppliers according to the following criteria:

- 60% of all steel used (by mass) to have a recycled component of 50% or more.

Concrete

Concrete used in the project should seek to be sourced from recycled suppliers according to the following criteria:

- 20% of cement used for in-situ concrete and 15% of cement used for pre-cast concrete is replaced with industrial waste product; and
- 20% of aggregate to be used is recycled aggregate (classified as Class RCA in accordance with HB 155-2002).