February 2010

14 -18 Boondah Road
Warriewood
ESD Report

Prepared for

Meriton Apartments Pty Ltd

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A	Preliminary Issue – for comment	12.02.2010
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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.

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1 Executive Summary

14-18 Boondah St is located in Warriewood 400m from Warriewood Centro Shopping centre and 1km west of Warriewood beach. The site currently contains a few small individual residential houses and the remainder is green field site.

The development is to be assessed by the Department of Planning Concept Plan together with Stage 1 Project Application for 300 apartments. The proposed development comprises a mixture of 3 storey residential buildings as well as the provision for roads, open spaces, gymnasium, childcare centre and 1 to 2 small shops.

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 section 11 of the DGR and highlights the ESD initiatives that will be investigated under the stage 1 development. The report also highlights environmental requirements to meet Pittwater DCP, LEP and Director General Requirements.

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

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

Director General Requirements (DGR)

- Retain private and public open spaces
- Sustainable public transport initiatives including reduced car parking facilities and increased pedestrian/bicycle facilities
- Incorporate ESD principles in the design, construction and ongoing operation phases of the development including waste management
- Incorporate Water Sensitive Urban Design (WSUD) measures to ensure minimal impact on the ground water during construction and operation

Pittwater Development Control Plan (DCP)

- Enhance existing streetscapes, promote building scale and density below height of the trees of the natural environment, ensure reasonable level of privacy, amenity and solar access
- Effective management of all water and wastewater resources and protection of receiving environments downstream of all water management systems
- Effective management of sewage and waste water systems and disposal to central reticulation system and ensure environmental and public health protection
- Minimise quantity of stormwater runoff, minimise surcharge from existing drainage systems, reduce water consumption and waste in new developments

- Ensure identification and remediation of any contaminated land
- Flood management incorporating the impacts of seal level rise and increased rainfall volumes in flood planing levels considering impacts of sea level rise only and combined with increased rainfall.
- Sustainable, non motorised modes of transport are utilised
- Unified off road pedestrian and cyclist network in Warriewood Valley for transportation and recreation providing access to key activity generators both within and outside the land release (including public transport nodes, retail and commercial centres, and areas of public open space)
- An ecologically sustainable environment is developed and maintained and should be designed and located with consideration to orientation, topography, vegetation, microclimate and adjoining development and landscape.
- Use of renewable energy is encouraged and fossil fuel use minimised
- New dwellings must have maximum solar access, adequate daylight ad ventilation to habitable rooms and adequate sunlight to private open spaces.
- New multi-unit housing development must achieve a minimum 3.6 star NatHers rating for typical units and must comply with the provision of BASIX. *(Please note these ratings have been superseded with new rating methodologies and will be updated accordingly)*
- Water conservation devices with an AAA rating including tap flow regulators, shower head roses, dual flush toilets, front loading washing machines and AAA rated dishwashing should be used. *(Please note these ratings have been superseded with new rating methodologies and will be updated accordingly)*
- Recycling facilities, composting, reuse of roof water and low energy and low water consumption appliances should be incorporated into the building design
- Adverse impacts upon air quality are minimised
- Energy and water in and around the development are conserved
- Costs to residents for energy and water usage are reduced
- Use of air conditioners is minimised
- Low impact, environmentally sustainable building materials are used
- Implement the principles of Water Sensitive Urban Design (WSUD) of drainage, on site detention, landscaping and orientation of the development.
- More efficient use of resources in Pittwater
- All new hot water systems must be either solar, heat pump or gas and must have a minium rating of 3.5 stars

Pittwater Local Environment Plan (LEP)

- Identification and management of any limitations to urban development and associated works created by slope, soil structure, geotechnical instability , flooding or the like
- Conservation and protection of any significant vegetation, fauna and associated plant communities
- Identification and remediation of any contaminated land
- Management of urban stormwater
- Management and provision of traffic networks and facilities

BASIX

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 ≤ 250m^2 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

14-18 Boondah St is located in Warriewood 400m from Warriewood Centro Shopping centre and 1km west of Warriewood beach. The site currently contains a few small individual residential houses and the remainder is green field site.

The development is to be assessed by the Department of planning Concept Plan together with Stage 1 Project Application for 300 apartments. The proposed development comprises a mixture of 3 storey residential buildings as well as the provision for roads, open spaces, gymnasium, childcare centre and 1 to 2 small shops.

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

Proposed development site

This report highlights the ESD initiatives that will be investigated for the new proposed development. The report also highlights environmental requirements to meet Pittwater DCP, LEP, and 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:

- NSW State Plan,
- Draft North East Sub-regional Strategy;
- NSW Ground Water Policy Framework Policy
- NSW Groundwater Quality Management and Protection Policy
- NSW State Rivers and Estuaries Policy
- NSW Wetlands Management Policy
- NSW Children Service Regulation 2004
- State Sea Level Rise Policy
- SEPP 55 Remediation of Land;
- SEPP (Infrastructure) 2007;
- SEPP(Building Sustainability Index; BASIX)2004
- SEEP 65 –Design Quality of Residential Flat Development and Residential Flat design Code (RFDC)
- Pittwater Local Environmental Plan 1993 incl provisions of AMENDMENT No 71 relevant Development Control Plans including Pittwater 21 DCP;
- Warriewood Valley Planning Framework 1997 and the STP Buffer Sector Planning Framework (September 2001)
- Warriewood Valley Landscape Master plan and Design Guidelines
- Nature and extent of any non-compliance with relevant environmental planning instruments, plans and guidelines and justification for any non-compliance.

The above regulations must be addressed by the relevant members of the design team. This report has been written in response to item 11 of the DGR only.

3.1 Built Form

- The EA shall address the height, bulk and scale of stage 1 and future stages, within the context of the adjacent streetscapes and the general locality.
- The EA shall include options for the height, siting and layout of the building envelopes, open space and the road/pedestrian network and demonstrate appropriate separation between individual buildings, setbacks to roads and footpaths and environmental zones.

3.2 Urban Design

- The EA shall address the design quality with specific consideration of the facade treatment and design, massing, setbacks, building articulation, roof form design, use of appropriate colours, materials/finishes, landscaping, safety by design and public domain.
- The EA shall consider how the design, layout and pubic domain areas proposed in the Stage 1 will integrate with the concept plan.
- The EA shall address the provision of private and public open space areas including any connection to local/regional cycleway/pedestrian paths to meet demand from increased density.
- The EA must identify the range of land uses proposed and demonstrate the objectives of the 2(f) Urban Purposes – Mixed Residential) zone and should justify the intensity of non-residential uses proposed for stage 1
- The EA must address solar access, acoustic privacy, visual privacy, view loss and achieve a high level of environmental and residential amenity for surrounding residential occupiers.
- The EA should seek to amalgamate with the adjacent properties known as 5 and 7 Macpherson Street so that there is a more appropriate and reasonable relationship with future developments in the locality including details of any negotiations with owners of affected properties and development potential of the isolated sites if they cannot be amalgamated.

3.3 Transport & Accessibility Impacts (Construction and Operational)

The EA shall incorporate a Transport Management and Accessibility Plan and provide Traffic and Accessibility Impact Study prepared in accordance with the RTA's Guide to Traffic Generating Developments, considering the following issues:

- Traffic generation including daily and peak traffic movements likely to be generated by the proposed development and the impact on nearby intersections
- Access, loading dock(s) and service vehicle movements
- Car parking arrangements including reducing car parking facilities and increasing cyclist/pedestrian facilities
- Measures to promote sustainable means of transport including public transport usage and pedestrian and bicycle linkages in addition to addressing the potential for implementing a location specific sustainable travel plan
- Demonstrate how users of the development will be able to make travel choices that support the achievement of the Warriewood Valley Roads Masterplan
- Identify and resolve barriers to efficient and safe pedestrian and cycle access and identify all possible options for pedestrian and cycle connections. Links to/from Warriewood should be specifically addressed with any necessary infrastructure upgrades identified

3.4 Ecologically Sustainable Development (ESD)

The EA shall detail how the development will incorporate ESD principles in the design, construction and ongoing operation phases of the development including waste management and demonstrate that the proposal has been addressed against a suitably accredited rating scheme to meet industry best practise.

3.5 Contributions

The EA shall address the provision of public benefit, services and infrastructure having regard to Council's Section 94 Contribution Plan for Warriewood, and provide details of any Planning Agreement or other legally binding instrument proposed to facilitate this development addressing the demands arising from the increase in density, relevant arrangements with Sydney Water to contribute to upgrading the Sewage Treatment Plant and any state infrastructure levy requirements.

3.6 Consultation

Undertake an appropriate and justified level of consultation in accordance with the Department's Major Project Community Consultation Guidelines October 2007.

3.7 Flooding, Drainage and Surface Water Management

The EA shall address drainage/flooding issues associated with the development/site, including: stormwater, drainage infrastructure and incorporation of Water Sensitive Urban Design measures. The EA shall identify any water management structures such as dams, swales or detention basins. The EA shall provide an assessment of any flood risk on site in consideration of any relevant provisions of the NSW Floodplain Development Manual (2005) including the potential effects of climate change, sea level rise and an increase in rainfall intensity.

3.8 Groundwater

The EA shall address any impacts upon groundwater resources, and when impacts are identified, provide contingency measures to remediate, reduce or manage potential impacts.

3.9 Statement of Commitments

The EA must include a draft Statement of Commitments detailing measures for environmental management, mitigation measures and monitoring for the project.

4 Pittwater DCP requirements

The area is covered by Pittwater 21 DCP Part B and Part D16 for the Warriewood locality.

The main objectives and requirements of the DCP from an environmental standpoint are:

4.1 Flood Management and Climate Change (Sea Level Rise and Increased Rainfall Volume)

- To protect people, natural environment, private and public infrastructure and assets from the implications of rising sea levels especially areas prone to flooding and coastal developments
- Flood management incorporating the impacts of seal level rise and increased rainfall volumes in flood planing levels considering impacts of sea level rise only and combined with increased rainfall data.
- All development and activities must be designed and constructed to ensure there is no additional adverse flood impact on surrounding properties or flooding processes for any event up to the Probable Maximum Flood Event and there is no net decrease floodplain volume of a floodway or Flood Storage Area within the property for any flood event
- All structures must be designed and constructed to ensure that if the structure is to be relied upon for “shelter in place” evacuation then structural integrity must be ensured up to the level of the probable maximum flood level. To ensure the recommended flood evacuation strategy of “shelter-in-place” it will need to be demonstrated that there is pedestrian access via a low flood hazard area to a “safe haven.”

4.2 Pedestrian and Cyclist Network

- Sustainable, non motorised modes of transport are utilised
- Drainage corridors and nominated buffer areas are used as dual use corridors
- Unified off road pedestrian and cyclist network in Warriewood Valley for transportation and recreation providing access to key activity generators both within and outside the land release (including public transport nodes, retail and commercial centres, and areas of public open space)

4.3 Ecologically Sustainable Development

- An ecologically sustainable environment is developed and maintained and should be designed and located with consideration to orientation, topography, vegetation, microclimate and adjoining development and landscape
- Encourage use of renewable energy and minimise use of fossil fuels
- New dwellings must have maximum solar access, adequate daylight ad ventilation to habitable rooms and adequate sunlight to private open spaces
- Rooms capable of being used as living areas should be located on the north side of the dwelling and sunshine used for lighting and water heating
- Windows within the building should be sized, located and shadowed to reduce summer heat and allow entry of winter sun. Horizontal or vertical screening can be provided by recessed windows or overhanging balconies, eaves, verandas, pergolas, shutters and louvres, windows may also be shaded by the planting of large trees including deciduous species which lock out the summer sun and let in the warm winter sun

- New multi-unit housing development must achieve a minimum 3.6 star NatHers rating for typical units and must comply with the provision of BASIX. *(Please note these ratings have been superseded with new rating methodologies and will be updated accordingly)*
- Insulation should be provided to walls and roof cavities and appropriate window shading such as wide eaves and /or cross ventilation incorporated.
- New open solid fuel or wood burning fireplaces and stoves must comply with Australian Standards AS4013-1992 or any subsequent amending standard
- The selection of building materials should be based on renewable sources, safety and amount of processing, waste output of production, emission of toxic substance or gases into the interior. Timber should be reused or come from sustainable forestry practises
- Buildings and housing should be designed for ease and flexibility of use and adaptive reuse and longevity of the building
- Water conservation devices with an AAA rating including tap flow regulators, shower head roses, dual flush toilets, front loading washing machines and AAA rated dishwashing should be used. *(Please note these ratings have been superseded with new rating methodologies and will be updated accordingly)*
- Recycling facilities, composting, reuse of roof water and low energy and low water consumption appliances should be incorporated into the building design
- Within the curtilage of each dwelling there must be a waste cupboard or other appropriate space which is capable of temporality storing a single day's source separated garbage, recyclables and/or compostable material.
- Adverse impacts upon air quality are minimised
- Energy and water in and around the development are conserved
- Costs to residents for energy and water usage are reduced
- Use of air conditioners is minimised
- Low impact, environmentally sustainable building materials are used

4.4 Water Management

- Effective management of all water and wastewater resources and protection of receiving environments downstream of all water management systems
- An integrated water management approach is required encompassing rainwater, stormwater and waste water in accordance with SEPP (Building Sustainability index: BASIX)
- A water management plan is to be developed setting out the water treatment systems, on site detention, infiltration, easements and any site constraints.

Waste Water Disposal

- Effective management of sewage and waste water systems and disposal to a central reticulation system
- Effective management of on-site sewage and effluent systems to ensure environmental and public health protection
- All premises must be connected to Sydney Water centralised sewage waste disposal system whenever possible.

Grey water Reuse

- Effective management of grey water treatment systems which maintain disposal to Sydney Water reticulation system.
- The grey water treatment and re-use system shall have a current NSW Health Accreditation

4.5 Stormwater Harvesting

- Minimise quantity of stormwater draining from the development site and facilitating water re-use through the use of rainwater tanks and on site detention
- Reduction of water consumption and waste through the provision of re-use devices, conservation practises and recycling runoff
- Minimise surcharge from the existing drainage systems
- Reduce water consumption and waste in new development
- Implement the principles of Water Sensitive Urban Design (WSUD) of drainage, on site detention, landscaping and orientation of the development

4.6 Building Envelope

- Enhance the existing streetscapes and promote a building scale and density that is below the height of the tress of the natural environment
- Ensure new development responds to, reinforces and sensitively relates to spatial characteristics of the existing natural environment
- Bulk and scale of the built form is minimised
- Ensure reasonable level of privacy, amenity and solar access is provided within the development site and maintained to residential properties

4.7 Energy and Water Conservation

- More efficient use of resources in Pittwater
- The orientation, design, and sitting of buildings make the best use of natural ventilation, daylight and solar energy
- All new hot water systems must be either solar, heat pump or gas and must have a minium rating of 3.5 stars
- Buildings are to be designed to maximise ventilation in the summer. This can be achieved by positioning openings to prevailing summer winds to encourage cross ventilation and the installation of fans, roof vents and high level windows.
- Buildings are to be constructed of materials which best minimise winter heat losses and summer heat gain

5 Pittwater LEP requirements

The following outlines the requirements of the Pittwater LEP:

- Identification and management of any limitations to urban development and associated works created by slope soil structure, geotechnical instability, flooding or the like
- Conservation and protection of any significant vegetation, fauna and associated plant communities
- Identification and remediation of any contaminated lands
- Enhancement and protection of any significant visual elements within the landscape and its setting
- Management of urban stormwater
- Management and provision of traffic networks and facilities Ensure Identification and remediation of any contaminated land

6 Regulatory Framework

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)

6.1 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

6.2 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 3.6 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.

6.3 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.

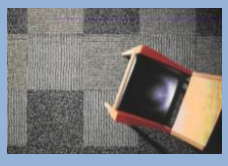
The Deemed-to-Satisfy Provisions in Section J of the BCA 2009 are defined in eight parts:

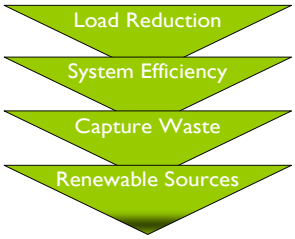
Part J1 – Building Fabric	Part J5 – HVAC Systems
Part J2 – External Glazing	Part J6 – Artificial Light & Power
Part J3 – Building Sealing	Part J7 – Hot Water Supply
Part J4 – Air Movement	Part J8 – Access for Maintenance

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

6.4 Statement of ESD Principles and Commitments

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



7 ESD considerations

7.1 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

7.2 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.

7.3 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 ≤ 250m^2 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 3 Star rated clothes washer *(TBC)* 2 Star rated clothes dryer *(TBC)*

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 ≤ 250m^2 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 with consideration to a heat pump system or solar hot water panels to assist with energy reduction.

7.4 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.

7.5 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.

7.6 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*(TBC)* 4 Star WELS rated Efficient kitchen taps*(TBC)* Efficient WC's 3 Star WELS rated Showerheads*(TBC)* Efficient cleaner's taps 
Appliances	*3* Star water-efficient dishwashers*(TBC)* *2* Star water-efficient clothes washing machines.*(TBC)* 
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

7.7 Transport

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

7.8 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

7.9 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

8 Additional ESD Initiatives

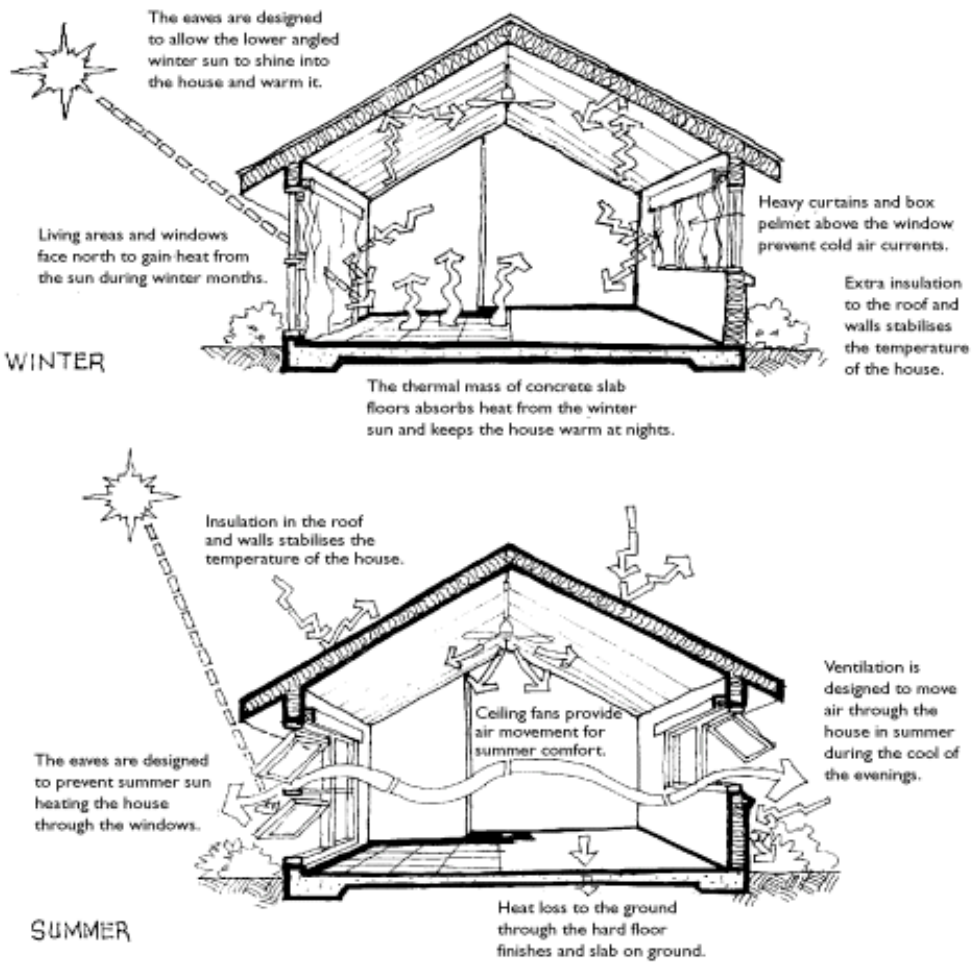
8.1 Building Form, Fabric & Orientation

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



Principles of Sustainable Design

Structure & Insulation

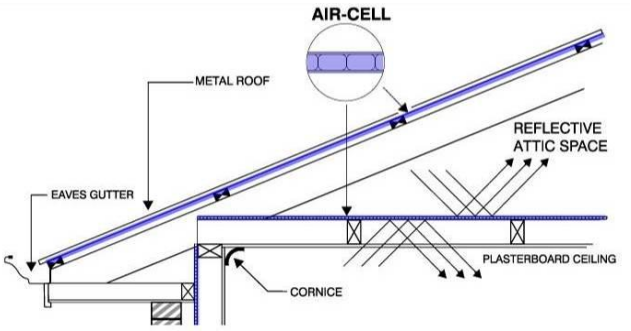
While the minimum BCA insulation requirements for retail development in Sydney are R3.2 for ceilings, R1.8 for walls, increasing these values will provide better comfort control and energy performance.

Options for insulation include:

- Hybrid roof insulation
- Styrofoam insulation
- Bulk insulation

a) 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).



Typical section showing hybrid roof insulation

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

Installation of Styrofoam Insulation System

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 Barrie*r (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.

c) 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:

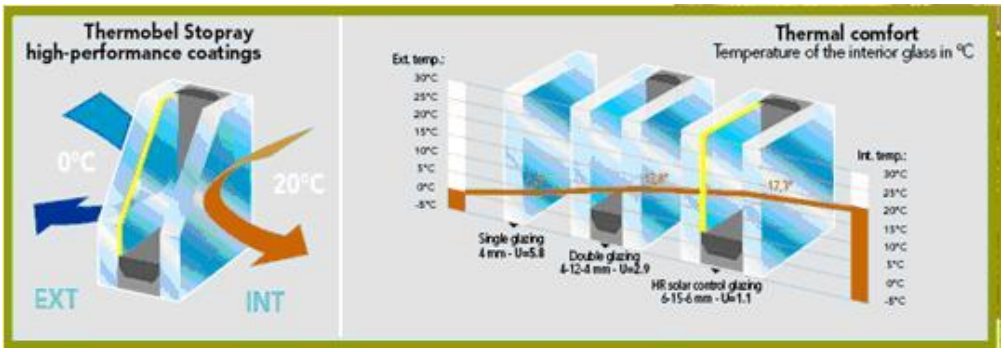
- Visible Light Transmission (VLT) – the percentage of visible light transmitted by the glass. The higher the VLT, the more daylight will enter the space.
- Shading Coefficient (SC) – the percentage of solar radiation that is transmitted through the glass. The lower the value, the less solar heat gain 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.



How performance double glazing works (image courtesy of Glaverbel)

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.

8.2 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.

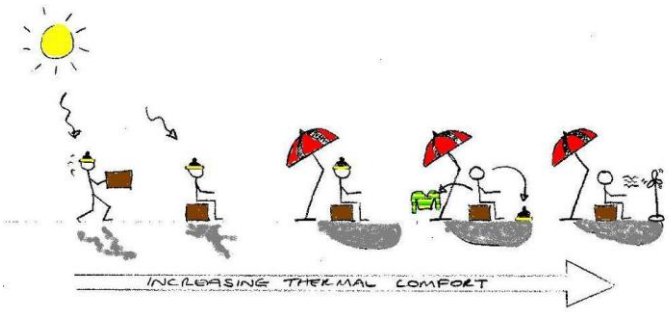
Glare control is also a factor which will be considered during detailed design stage

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.

8.3 Energy Savings

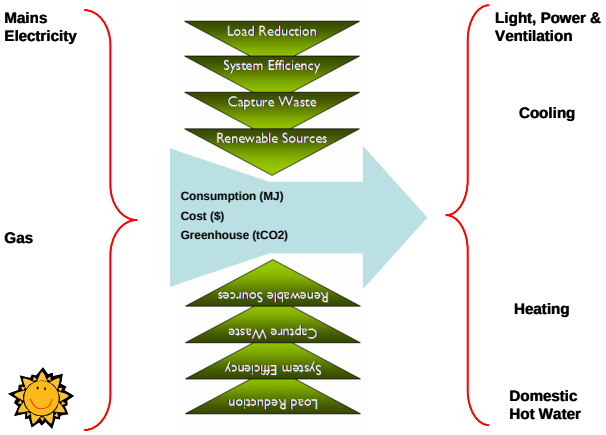
Greenhouse gas emissions are directly related to energy consumption. In Sydney, for every 1.1kWh of mains electricity consumed approximately1kg of CO_2 is released into the atmosphere.

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

8.4 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.

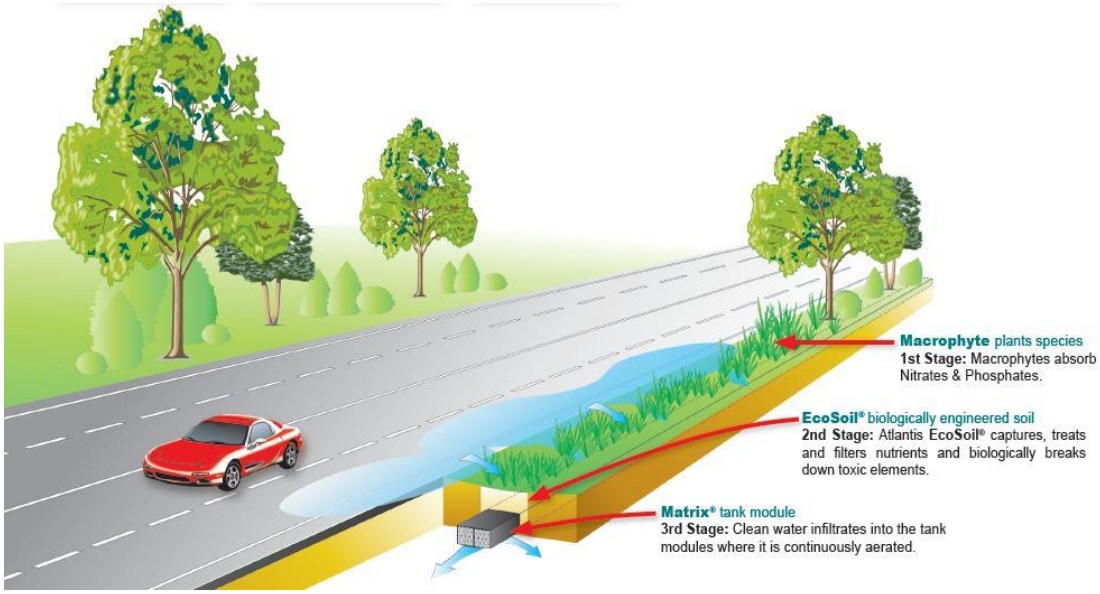
Reducing the amount of stormwater leaving the site can be quite easily accomplished through careful design of surface and run-off systems.

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.

Permeable surfaces. Image courtesy of Atlantis

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.

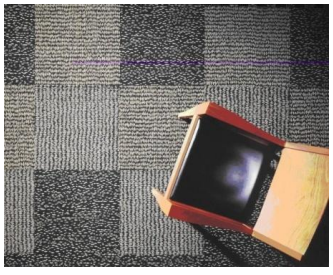


Roadside water retention system (Image courtesy of *Atlantis*)

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).