CUNDALL

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Nepean Green Project

ESD Environmental Application Report

Prepared for

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-	DRAFT report for comment	16/07/2012
A	Revised for EA	19/07/2012
B	Updated climate summary	29/08/2012

The success and realisation of the proposed initiatives will be dependent 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. The use of computer simulation is by its nature predictive with output based on historic weather data and standard assumptions. The results of any computer simulations within this report do not guarantee future performance.

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Contents

1 Introduction

This report identifies the Ecologically Sustainable Design (ESD) initiatives proposed for the Nepean Green project at 164 Station Street, Penrith NSW.

The development is required to comply with minimum regulatory requirements for sustainability, including the Building and Sustainability Index (BASIX) and the Building Code of Australia (BCA) Section J for Energy Efficiency.

In addition, the following Director Generals Requirements (DGRs) apply to the project:

> *'Ecologically Sustainable Development (ESD): The EA shall detail how the development will incorporate ESD principles in the design, construction & operation phases of the development'.*
>
> *'The EA must demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.'*

The proposed development comprises a mixture of retail, residential and public space proposed to be delivered over seven stages. Figure 1 shows an aerial photograph of the proposed site:

Figure 1: Proposed Nepean Green Development

The following objectives will form the basis of evaluation and decision making with regards to sustainability:

- Reduce greenhouse gas emissions through energy efficiency of infrastructure, building services and building façades;
- Provide a high quality internal and external environments in terms of internal air quality, light and comfort;
- Reduce potable water use and flows to sewer;
- Improve quality of stormwater, minimising peak runoff quantities and preserving natural waterways;
- Minimise natural resource consumption, waste, pollution and toxicity during construction and operation;
- Preserve the ecology of the site and surrounds;
- Engage and respect the community;
- Implement ESD solutions that reduce operating costs for residents, staff and visitors.

This report outlines the design principles and targets that will be further developed throughout detailed design and construction, in order to meet the ESD requirements for the project.

2 Summary of ESD Requirements

The following ESD requirements apply to this site:

- Building and Sustainability Index (BASIX);
- Building Code of Australia (BCA) Section J for Energy Efficiency;
- State Environmental Planning Policy (SEPP) 65.

In addition, the Director General's Requirements (DGR's) require that the development is assessed against a suitably accredited rating scheme to meet industry best practice

The rating tools that have been applied for each part of the development are outlined in the following table.

Development Type	Minimum regulatory requirement	Rating tool
Residential buildings	BASIX, SEPP65	BASIX
Woolworths Masters	Building Code of Australia (BCA) Section J	Woolworths Home Improvement Sustainability Scorecard (WHIS).
Tavern & Public plaza	Building Code of Australia (BCA) Section J	No accredited rating tool exists for these spaces however Green Star principles will be applied.

Each of the ESD requirements are summarised in this section.

2.1 BASIX

New residential developments in NSW must reduce their energy and water use, according to BASIX requirements developed by the Department of Planning and Infrastructure. The objectives of the BASIX scheme are relative to an average development in NSW. The following targets apply to the Nepean Green project.

Environmental Impact Category	Nepean Green BASIX Minimum Target
Potable water consumption	40% reduction
Greenhouse gas (GHG) emissions	20-30% reduction
Thermal Comfort	144MJ/m^2 annual heating & cooling load (combined)

A detailed BASIX assessment will be carried out for the project applications for each stage. For the Environmental Application, a preliminary analysis has been conducted in order to determine how compliance will be achieved. The results of this analysis can be found in Section 5.

2.2 Building Code of Australia Section J

The Building Code of Australia (BCA) Section J for energy efficiency sets minimum energy performance requirements for all new 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 development will be developed to meet the BCA energy efficiency requirements.

2.3 State Environmental Planning Policy SEPP65

SEPP 65 planning guidelines which apply to the site development set minimum requirements for cross ventilation and solar access in new multi-unit residential developments.

These requirements are:

- Living rooms and private open spaces should receive a minimum of 2 hours direct sunlight between 9am-3pm in mid-winter, for at least 70% of apartments (in dense urban areas);
- Maximum number of southerly single-aspect apartments is 10%;
- 60% of units should be naturally cross-ventilated with recommended maximum building depth: 10-18m (unless natural ventilation can be otherwise demonstrated).

Compliance with SEPP65 has been assessed by the project architect and the requirements have been deemed to be met. Please see the Turner + Associates SEPP 65 Statement for further detail.

2.4 Woolworths Home Improvement Sustainability Scorecard (WHIS)

Woolworths has developed a specific rating tool applicable to Masters stores based on well recognised industry rating tools including Green Star, LEED and BREEAM. This tool is organised in the same format and covers the same range of environmental impacts, including management, energy, water, transport, ecology, materials, emissions, Indoor Environmental Quality and Innovation. The Masters store has been assessed against this rating tool to demonstrate industry best practice.

A separate consultant has been appointed to undertake an assessment of the Masters Home Improvement store in accordance with the Woolworths Home Improvement Sustainability (WHIS) scorecard. A full report has been provided detailing the ESD strategies proposed for the Masters store, to order to demonstrate industry best practice as required by the DGR's.

Please see Appendix B for a copy of this report - 'Masters Penrith: ESD Initiatives Report' (July 2012).

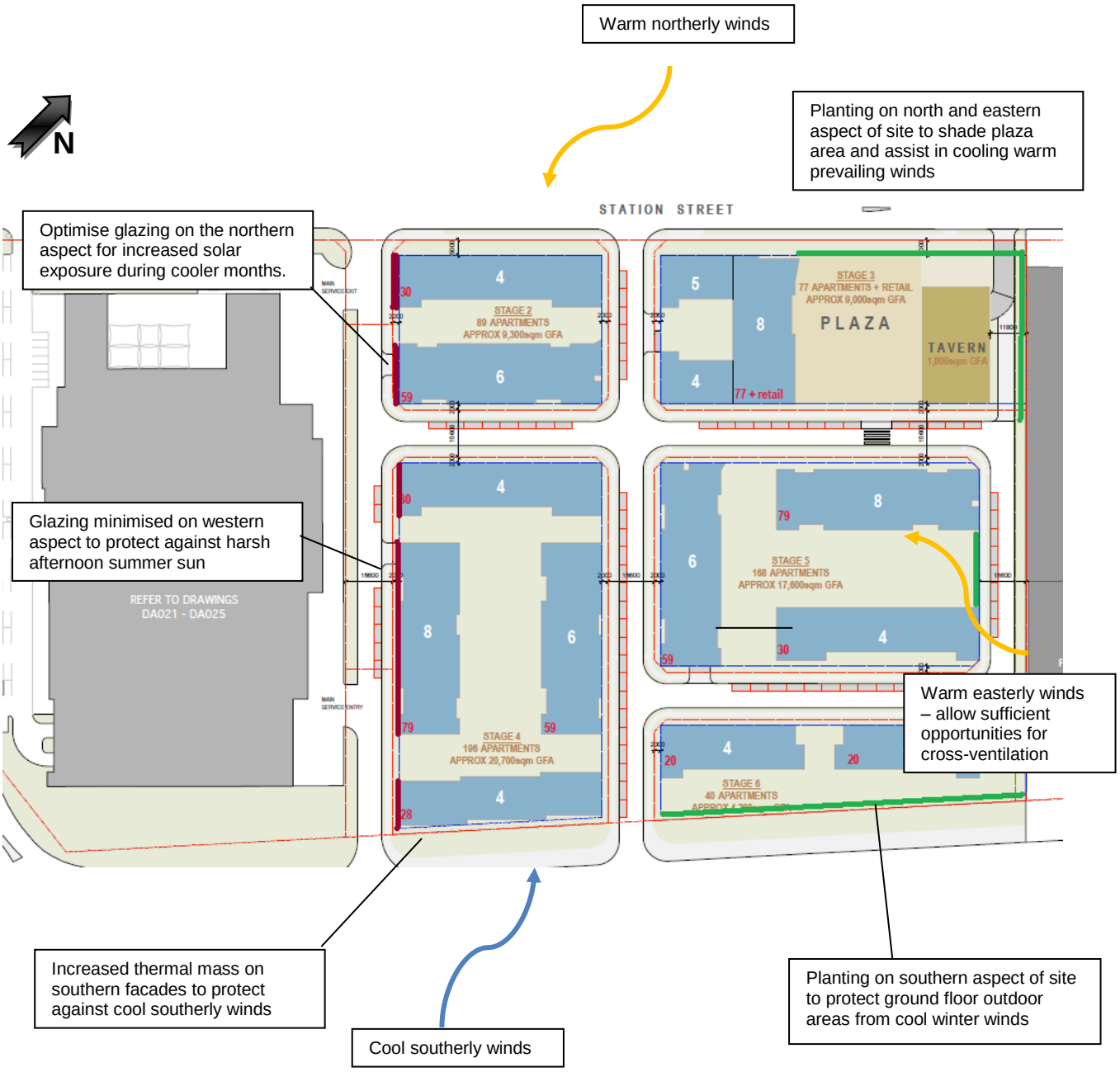
3 ESD Strategies

3.1 Passive Design

Effective passive design reduces the amount of air-conditioning required and improves internal comfort and amenity. A building's form, fabric and orientation will have the biggest influence on its thermal comfort and environmental performance. Passive design will be further developed during the Project Applications for the future residential stages.

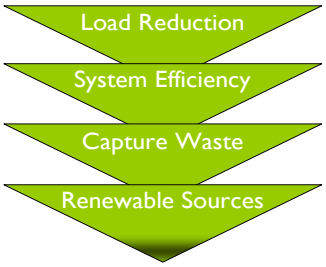
A climate analysis has been prepared to investigate passive design opportunities for the site. A summary is provided overleaf. Please see Appendix A for the full report.

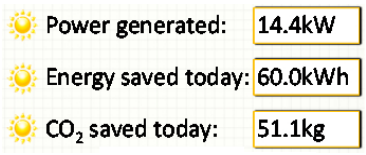
Element	*Passive Design Strategies*
Orientation	Windows and ventilation openings will be located to take advantage of prevailing winds for cooling while providing protection from the wind during cold winter periods.
Shading	Building facades with large areas of glazing will have a combination of external shading and high-performance glass to reduce heat transfer and radiant temperatures in proximity to the windows. Shading will be developed to minimise excessive solar gains in summer yet allow passive solar heating in winter.
Insulation	Heating and cooling loads will be reduced by the incorporation of appropriate levels of insulation for the Penrith climate zone, moderating radiant temperatures from internal surfaces to improve comfort and reducing ongoing operating costs.
Glazing	Selecting glazing with a low shading co-efficient will help to avoid heat gains in the summer, while glazing with a low U-value will reduce losses in the winter. To maximise daylight levels within the buildings, glazing will be selected with a high Visual Light Transmission (VLT).
Thermal Mass	Thermally massive construction and exposed internal finishes will assist with stabilising temperatures by absorbing heat slowly throughout the day, and releasing it gradually throughout the night
Finishes	Light-coloured reflective external finishes will keep buildings cool and minimise the heat island effect of the development. Light-coloured internal finishes will improve light levels within the building.


Warm northerly winds
Planting on north and eastern aspect of site to shade plaza area and assist in cooling warm prevailing winds
N
STATION STREET
Optimise glazing on the northern aspect for increased solar exposure during cooler months.
STAGE 2
89 APARTMENTS
APPROX 9,300sqm GFA
STAGE 3
77 APARTMENTS + RETAIL
APPROX 9,000sqm GFA
PLAZA
TAVERN
1,800sqm GFA
77 + retail
Glazing minimised on western aspect to protect against harsh afternoon summer sun
REFER TO DRAWINGS
DA021 - DA025
STAGE 5
168 APARTMENTS
APPROX 17,600sqm GFA
Warm easterly winds – allow sufficient opportunities for cross-ventilation
STAGE 4
196 APARTMENTS
APPROX 20,700sqm GFA
STAGE 6
40 APARTMENTS
Increased thermal mass on southern facades to protect against cool southerly winds
Cool southerly winds
Planting on southern aspect of site to protect ground floor outdoor areas from cool winter winds

3.2 Energy Efficient Systems and Services

Energy consumption can be reduced through the efficient design of lighting, air-conditioning and ventilation systems, as well as water heating and other services. The following table outlines the specific initiatives that will reduce services energy consumption at Nepean Green.

System	*GHG Emissions Reduction Strategies*
Artificial Lighting 	Efficiency controls will be provided including timers and motions sensors in car parks, common areas and infrequently used areas such as plant rooms; Efficient light fittings will be specified, such as fluorescent or LED lamps; Lighting zones will be limited in area to reduce the occurrence of unnecessarily lighting unoccupied areas such as plant rooms and stairways. Light-coloured finishes will be selected to maximise reflectivity and distribute light internally, more efficiently; Photo-electric cells installed in the Masters store will allow up to 1/3rd of light fittings to be automatically switched off when daylight levels are sufficient, taking advantage of daylight provision through skylights. The lighting systems will also be linked to a Building Management System (BMS) to ensure that lighting is only operated when occupied.
Heating, Cooling & Ventilation  	**<u>Residential</u>** Residential bathrooms and laundries will be individually ducted to the façade, with efficiency controls and individual fans, reducing central fan energy; Residential AC units will be installed with day/night zoning and a minimum energy- efficiency rating of 4-Stars; Car parks will have passive supply and/or exhaust (depending on floorplate and location). Any mechanical ventilation will incorporate CO monitoring and Variable Speed Drives (VSD). **<u>Masters Store</u>** The Masters store HVAC system incorporates a number of efficiency measures including: • Economy cycle which deactivates mechanical cooling when outside conditions are comfortable; • Electronic expansion valves in packaged units; • Digital scroll compressor to reduce cycling and 'overcooling'; • Night purge using operable louvers or roof-mounted ventilators to take advantage of passive cooling. Air conditioning will be zoned so that only occupied areas are cooled, and spaces with different occupancy patterns or different cooling loads are zoned separately. To achieve this, CO_2 sensors and timers should be used to automatically switch off when parts of the centre will be unoccupied (Absence-off control). VSD will be installed on water pressure pumps.

System	GHG Emissions Reduction Strategies
Domestic Hot Water 	**Residential** High-efficiency individual instantaneous gas hot water units will be provided to all apartments; **Masters Store** A solar hot water system will provide around 35-40% of water heating requirements for the Master's store, with electrical back-up for security of supply during night-time or cloudy periods.
Metering 	Sub-metering will be provided for major energy uses (greater than 100kVa), to help identify areas of inefficiency with potential for improvement. Power factor correction will be installed.
Education 	Promotion of sustainability through education and information enables tenants of buildings and consumers to make more informed decisions; Incorporate sustainability, cultural and community interpretation into finishes, design, features, art and furniture; Energy savings strategies will be incorporated into the building user's guide to encourage maximum savings; Way-finding which incorporates green travel, community and services signage and information;

3.3 Sustainable Water Management

Mains/potable water consumption will be minimised as much as possible on-site, initially through demand management, then using alternative sources such as rainwater or treated wastewater.

System	*Water-saving Strategies*
Fittings & Fixtures 	All fittings and fixtures will be best-practice water rated with options on control to minimise total consumption. The following minimum efficiency ratings will be applied to the development: • Wash hand basin and kitchen taps - 4-Star or better; • WC's – 3-Star or better; • Showerheads – 3-Star or better; • Efficient cleaners taps; • Low-flush urinals (0.8L/flush).
Appliances & Equipment	Water-efficient dishwashers will be installed in residential apartments.
Cooling Towers 	Cooling towers should be designed to have 6 cycles of concentration or greater, reducing water consumed in air-conditioning by up to 50%, as well as reducing chemical use in treatment; Cooling towers will be maintained to minimise water loss through leaks, overflow, evaporation, bleed, drift and splash.
Fire System Test Water	Fire test & maintenance drain-down water will be captured and stored for reuse on-site, so that no mains water will be used for pump testing.
Landscape 	The use of native, drought-resistant planting will reduce water consumption used in irrigation. Sub-soil irrigation systems with moisture sensors will be considered where non-native species are selected.
Rainwater harvesting & reuse	Rainwater will be harvesting for reuse in throughout the developments. This will include: • Common area landscape irrigation;

System	*Water-saving Strategies*
	• Private residential landscape irrigation; • Car-washing & wash-down; • Toilet-flushing for the Masters store; • Nursery irrigation for the Masters store.
Flows to Sewer	Estimated wastewater discharge to sewer will be significantly reduced relative to a standard building through the implementation of water efficiency measures.
Metering 	Sub-metering will be provided for major water uses, to identify abnormal usage patterns usually associated with leaks, helping to reduce the considerable water lost in this way. In addition, they will allow water efficiency measures to be monitored and tracked. Residential units will be individually metered. The following major water uses will be metered for the Masters store: • Bathrooms; • Irrigation systems; • Washdown systems; • Rainwater harvesting supply.
Education	Water-saving initiatives will be publicised to residents, visitors and staff.
Water Sensitive Urban Design (WSUD)	Gross Pollutant Traps will filter stormwater runoff and reduce contamination of local waterways. Secondary treatment will be provided targeting oils and grease, nutrients and fine sediments, further improving runoff quality. Rainwater collection on-site will minimise peak- runoff quantities and minimise strain on existing drainage systems.

3.4 Indoor Environmental Quality

Indoor Environmental Quality (IEQ) affects occupant amenity and comprises thermal comfort, indoor air quality, views, daylight, visual and acoustic quality. These factors are outlined below with respect to the Environmental Application, and will be further developed during detailed design.

Item	*Strategies to improve IEQ*
Daylight, glare and views 	Glazing will be selected with a high Visual Light Transmission to maximise daylight penetration and views, while mitigating glare and excessive solar heat gains in summer. Extensive use of translucent skylights in the Masters store will maximise daylight levels and reduce the need for artificial lighting.
Air quality 	Careful consideration of significant ventilation openings to maximise natural cross-ventilation and reduce AC energy; Contamination of indoor air will be removed at source through: - Specification of finishes with low Volatile Organic Compound (VOC) emissions, including carpets, paints, adhesives and sealants; - Specify low-formaldehyde joinery and engineered wood products; - Kitchens, bathrooms and other high-contamination areas will be separately exhausted without recirculation - Fresh air intakes will be located to minimise external contamination.
High frequency ballasts	Fluorescent lighting will be provided with high frequency ballasts to minimise visual discomfort from artificial lighting 'flicker'.
Thermal Comfort	Comfort within the buildings will be improved by well-considered passive design including insulation, shading, natural ventilation and adequate ventilation openings, in order to minimise heat losses/gains and improve thermal performance.

3.5 Transport

Item	*Strategies*
Cycling Facilities 	Clearly signposted, secure bicycle facilities will be provided to the residential buildings and Masters store. Good access and path networks will help to encourage residents, staff and visitors to cycle, improving health and reducing greenhouse gas emissions from transport.
Public Transport 	The proposed site is within 20 minutes walk of the train station, from which frequent services are available on the following train lines: - Western line; - Blue Mountains line. There are also twenty five bus services available within walking distance.
Education	A comprehensive Transport plan will be made available to all residents, staff and visitors, outlining alternative forms of transport to private vehicle use.

3.6 Materials & Waste

Preference will be given to environmentally responsible materials during the selection process, according to the principles outlined in the following table.

Item	*Materials Strategies*
Preferred Eco-content 	Ecologically sensitive products (such as scarce minerals and old-growth forest) will be avoided. Preference will be given to materials with a high recycled content and preferred source, including: • Steel products that are reused, recycled or certified Best Practice; • Timber will be supplied from sustainable sources including Forestry Stewardship Council (FCS) certified plantation timbers and recycled products. No timber (either solid or veneer form) shall be sourced from rainforests or old-growth forests; • Concrete with a proportion of cement replacement (with industrial waste product) and recycled aggregate be will specified.
Durability & Product Stewardship	Material selections should be durable, flexible and recyclable. Selected manufacturers should implement Environmental Management Plans to minimise the impact of their operations. Manufacturers and suppliers will be encouraged to take full responsibility for the life cycle impact of products including ownership at end of life.
Ozone Depleting Materials 	Thermal insulation products will be specified with a zero Ozone Depletion Potential in their manufacture and composition, reducing the impact of insulation on the atmosphere. All refrigerants used will have an Ozone Depletion Potential (ODP) of zero.
Waste Management 	A dedicated and accessible storage area will be provided on-site for the separation and storage of recyclable waste during operation, allowing for the different operational waste streams to be separated. Principles of resource recovery will be applied where practical during the project lifetime, to reduce volume of waste to landfill as well as resource costs. The development will target a minimum rate of 80% construction waste (by mass) to be diverted from landfill.

3.7 Environmental Management

Effective environmental and waste management should be implemented throughout the demolition, construction and operational stages of development.

Item	*Management Strategies*
Environmental Management Plan	Prior to construction, an Environmental Management Plan (EMP) will be developed to regulate the environmental impacts of the development during construction. This will identify potential environmental impacts and strategies to mitigate these impacts, as well as outlining methods for auditing and tracking the impacts and responsible parties.
Waste Management Plan	The EMP will include a Waste Management Plan, specifying recycling targets for demolition and construction waste. Purchasing policy should minimise waste from products and packaging and encourage the use of products which have minimum environmental impact. Preference should be given to prefabricated materials, in order to reduce the amount of on-site construction waste. The construction contract could include commitments for the following: • Establishment of a waste management area on site for the sorting and segregation of waste; • Identification of appropriate waste sub-contractors for recycling; • Participation in waste minimisation training for contractors and sub-contractors; • Published waste minimisation plan to reduce site waste to landfill; • Provision of separate waste skips for cardboard, timber, metal, soft plastic, polystyrene, insulation, concrete, glass and bricks.
Handover & Education	In recognition of effective handover being critical to the success of a building in achieving its environmental aspirations, a simple and concise building users' guide will be developed to inform and educate building users, residents and tenants on how to capture and promote strong on-going environmental performance.

4 BASIX Assessment

Strategies proposed to meet the BASIX requirements for the residential development are outlined in the following sections. These may be modified and developed in further detail for the Project Application, as the design progresses.

4.1 Greenhouse gas emission reductions

Strategies to achieve the BASIX energy target of 20%-30% reduction in greenhouse gas (GHG) emissions are outlined in the following table:

BASIX Base Case	Energy Conservation Strategies
Common Areas	Variable Speed Drive (VSD) car park ventilation (exhaust only)and carbon monoxide sensors; Thermostatically controlled ventilation to service/plant rooms, exhaust only; Fluorescent/LED lighting to all common areas including car park, garbage rooms, lobby/stairways, service and plant rooms; Lighting efficiency controls including timers and motions sensors to car park, common areas, lifts and plant rooms; Lift light connection to lift call button, geared traction with VVAC motor for lifts; Lobby and hallway/stairway ventilation is mechanical exhaust only (with time clock or BMS efficiency control).
Appliances	Gas cooktop and electric oven; 4-Star energy efficient dishwashers; 2.5-Star energy efficient clothes dryers and indoor clothes drying line; Well-ventilated refrigerator space.
Domestic Hot Water	Individual gas instantaneous units with 6-Star energy-efficiency rating.
Air-conditioning and ventilation	Minimum 4-Star energy efficiency rated individual reverse cycle AC units in living areas and bedrooms, day/night zoning; Ceiling fans in living rooms and bedrooms; Kitchen, bathroom and laundry exhausts have individual fans ducted to façade.
Lighting	Dedicated LED or Fluorescent lighting throughout dwellings.
BASIX Energy Savings Achieved[1]	**20% (for > 6 stories) - 30% (for4-5 stories)**
Pass?	✓

1 These figures may vary slightly after the thermal performance modelling has been finalised, as the energy score is affected by the thermal performance of apartments

4.2 Potable water savings;

Proposed strategies to achieve the BASIX water target of 40% reduction in potable water consumption are outlined in the table below:

BASIX Base Case	Water Conservation Strategies
Common Areas	At least 50% of garden area planted with native low water-use species; Fire Sprinkler test water is contained in a closed loop.
Dwelling Fixtures2	Water-efficient fixtures including: • 3-Star WELS rated showerheads (<7.5L/min); • 5-Star kitchen and wash-hand basin mixers, • 4-Star dual-flush toilets.
Dwelling Appliances	Water-efficient appliance including: • 4 Star WELS rated dishwashers.
Central Systems	Rainwater storage tank for landscape irrigation and car washing.
Water Savings Achieved	**40%**
Pass?	✓

[2] More information on water efficient appliances can be found at www.waterrating.gov.au

4.3 Thermal Comfort Targets

To satisfy BASIX, each dwelling must achieve the following objectives:

- 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.

Thermal loads must be assessed using Accurate, second generation software approved by the National House Energy Rating Scheme (NatHERS), which predicts annual heating and cooling loads for the specific climate of the site. Thermal modelling must be undertaken on all units for a Project Application. For the Masterplan, the following guidance is provided:

	Base Case Building Envelope Requirements
BASIX Target	Average Thermal Load: Heating 74MJ/m^2 , Cooling 70 MJ/m^2
Construction & shading	Varies depending on orientation
External Walls	Insulate to a minimum value of R2.8
Exposed roof areas	Insulate to a minimum value of R3.2
Ground Floor	Insulate to a minimum value of R1
Glazing	As required by BASIX.

Appendix A: Climate Analysis

Appendix B: Masters Penrith ESD Initiatives Report