Frasers Greencliff Developments Pty Ltd

Frasers Broadway Block 2

ESD PA Report

Issue 1

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1 Introduction

Arup has been commissioned by Frasers Greencliff Developments Pty Ltd to develop Environmentally Sustainable Design (ESD) Strategies for Block 2 of the Frasers Broadway precinct development in Chippendale, Sydney, NSW. This report gathers and presents all these initiatives for Block 2 that attempt to reduce environmental impacts caused by the design, construction and operation of the building, ensuring high levels of environmental performance.

The design of the project as a sustainable precinct relies on principles of shared infrastructure, primarily for energy, water and waste management. These services are being provided by others. Arup will provide ESD services for the above ground buildings with the site services strategy feeding into the building design and vice versa.

Block 2 involves the construction of a new thirty four (34) storey mixed use building designed by Ateliers Jean Nouvel. The total building GFA is approximately 67,000m² with 52,000m² residential and services apartments as well as 15,000m² retail above a four (4) level basement car park. The building will be constructed on the Frasers Broadway precinct development in Chippendale, Sydney, NSW.

1.1.1.1 Main Focus

The following areas were the main focus of the design team:

- Energy –reduce energy use and greenhouse gas emissions. The building envelope and services have been integrated to ensure the building is controlled to maintain the desired conditions whilst optimising the energy efficiency of the building. Special focus on natural ventilation where possible was adopted as an effective way of delivering thermal comfort with energy efficiency.
- Indoor Environmental Quality – design the building to maximize occupant comfort addressing issues of thermal and visual comfort and indoor air quality.
- Water –minimize potable water consumption and optimise the water efficiency of the development.
- Material – minimize waste, encourage reuse and recycling of materials and use low environmental impact materials.
- Transport – encourage more energy efficient and less polluting forms of transport to and from the site

2 Background

This section introduces a background on environmental, social and financial benefits that sustainable initiatives can deliver to a building and its occupants.

Arup recognizes and emphasises the importance of green buildings in terms of environmental preservation, occupant's health, safety and well being, as well as in terms of greenhouse gases emissions reduction. Moreover, based on experience, Arup also identifies the high potential for green buildings to reduce operational costs, representing models of environmental and economic sustainability.

The building industry accounts nowadays for more than 40% of total greenhouse gas emissions (The Department of the Environment and Heritage, Australian Greenhouse Office Design, 2005) partially due to the manufacture of high embodied energy materials and building components, and mainly as a result of poor passive design that usually doesn't consider natural elements as the sun and winds to promote higher levels of energy efficiency.

Conventional buildings are likely to waste and spend more energy on artificial cooling and heating to restore thermal comfort to their occupants. In that sense, operational costs are increased, and not only environmental, but economic sustainability goals are not achieved. This scenario ultimately represents wastage of economic resources in the long term. Passive design strategies that could improve efficiency of Heating Ventilation and Air Conditioning (HVAC) systems are key aspects of a green building design.

Green buildings are known to provide healthier, thermally comfortable and safer indoor environments ultimately leading to an increment in occupant's health and satisfaction.

3 ESD Strategy

Aiming at leading practice in energy and environmental targets, the design team focused on the following strategies for the proposed building:

- Energy efficiency
- Improved Indoor Environmental Quality
- Water strategies to minimize potable water consumption
- Use of reused or recycled materials to reduce embodied energy
- Effective transport strategies to reduce vehicular emissions
- Environmental benchmarking –

- Basix (Building Sustainability Index) Certificate;
- An equivalent of 5 Stars Green Star Multi Unit Residential rating and 5 Stars Green Star Retail Centre;
- 5 Stars Green Star Mixed Use Rating, in accordance with Green Building Council of Australia including application of Multi Unit Residential v1 and Retail v1;

The following are some design technologies that have been considered and will typically improve the environmental performance of a building, delivering long term financial benefits:

3.1 Building Envelope

The building envelope is essential in the design of buildings to guarantee the delivery of an appropriate environment to respond to the brief requirements. The role of the envelope is to block solar gains from penetrating the building fabric in summer while optimising daylight and minimizing glare. The appropriate design of openings will also allow an effective functioning of natural ventilation strategies to restore thermal comfort with reduced energy consumption.

The proposed building is intended to be a mixed mode building, being capable of operating on the naturally ventilated mode when outside conditions are favourable which was demonstrated to be for most of the year. The building envelope will be designed to achieve maximum benefits from both operation modes. The glazing performance will be optimised to ensure that thermal comfort is achieved and solar gains are adequate for the efficient operation of the mechanical and the natural ventilation strategy. This includes extensive use of double glazing.

The building envelope will be treated with appropriate levels of thermal insulation to reduce heat gains in hot days and to minimize heat losses in cold days through conduction. This will have significant impact on reducing energy consumption.

3.2 Mechanical System Mode

When outside conditions are not favourable for the natural ventilation mode of operation, the mechanical system shall deliver thermal comfort when spaces are occupied. Manually operable windows will allow bedrooms and living rooms to be naturally ventilated when external temperature conditions are favourable. Other strategies that have been considered include:

- Right sizing of the mechanical plant can ensure the plant is working at its peak efficiency and will typically reduce the capital cost of the plant;
- Building Management System (BMS) commissioning involves the commissioning of all building systems to ensure their correct operation;

3.3 Water Strategy

To ensure potable water consumption is minimized within the building, water efficient appliances and low water plant types will be incorporated into Block 2. Sewer and rainwater harvested from buildings will be treated by a central black water treatment plant to produce Grade A water for the non potable water is to be used for WC flushing, irrigation of green wall and extent of landscaping, cooling towers located on site, laundries for washing machine plus any cleaning down of the site areas

The development does not increase peak stormwater flows for rainfall events of up to a 1-in 2 year storm;

And all stormwater leaving the site, at any time up to a 1-in-100 year storm event, is treated or filtered in accordance with either:

- CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines, OR
- Australian and New Zealand Environment Conservation Council (ANZECC)'s Guidelines for Urban Stormwater Management.

3.4 Energy

It is essential to ensure the building is designed and built to minimize energy consumption and reduce or eliminate greenhouse gas emission to the atmosphere. Energy performance is considered by the design team as a crucial issue.

The provision of a central trigeneration energy plant which supplies electricity, heating and cooling for the site will contribute to high energy performance.

Catering for peak cooling loads associated with façade and internal heat gains are significant causes of energy waste. The high level of energy performance can also be attributed to the mixed mode strategy.

On the other hand, high efficient lighting for rooms and common areas are also expected to contribute to energy savings.

3.5 IEQ – Indoor Environmental Quality

Indoor Air Quality is proposed to be addressed through the performance glazing; efficient mechanical system and natural ventilation.

The following IEQ aspects have been considered:

- Indoor Air Quality – high fresh air rates provided through the use of natural ventilation
- Thermal Comfort

- Daylight

3.6 Transport

The use of transport (both private and commercial) has been a major contribution to environmental pollution and the excessive consumption of natural resources.

The development has the opportunity to create an environment where pedestrian access is crucial and the use of private car is avoided by:

- Encouraging walking and cycling by ensuring provision of bicycle facilities for building users.
- The building is located in the CBD which provides access to a comprehensive network of public transport within close proximity to the site.

3.7 Operational Issues

3.7.1 Energy Savings Action Plan

To ensure that the estimated energy use is realised in the operation of the building an Energy Savings Action Plan will be developed and updated at design, construction and post occupancy stage in line with the guidelines provided by the Department of Energy Utilities and Sustainability NSW. The plan will deal with the following 5 areas.

- Determining Energy use – Metering will be provided to identify baseline energy use. This will be developed during the design phase of the project.
- Planning and management. An energy management review will be carried out by Management before the implementation of the plan.
- Metering and monitoring – Breakdown of energy use will be provided by the metering plan developed during the detailed design phase and actual energy use will be monitored against expected use.
- Putting the plan together – Operational energy savings measures will be identified during the operational phase and prioritised for possible implementation.
- Implementation – Targets will be set looking four year ahead and an annual report will be compiled to track implementation.

4 Green Star

4.1 Objectives

The Green Star rating scheme, a voluntary holistic sustainable design rating tool, set up and managed by the Green Building Council of Australia, is used to guide the design process. This rating scheme addresses a wide spectrum of environmental performance measures dealing with social, economic, and environmental issues.

4.1.1 Green Star Targets

Generally the Office, Retail and Apartments will target a 5 Star Green Star rating using the appropriate Green Star rating tool for the building type as illustrated in the following table:

Green Star Tool	Base	Block
Multi Unit Residential v1	5 Star	2
Retail Centre Design v1	5 Star	2
Mixed Use v1	5 Star	2

Requirements for achieving the above Green Star targets are dependant on both the building and site wide services design. A strategy document entitled “Site Environmental Design Guidelines – Green Star Strategy Report” draft Rev A has been prepared by Lincoln Scott describing how this will be achieved. Arup are basing the Block 2 designs on this strategy document.

It is noted that where “v1” tools are not available pilot tools will be used in the interim to inform the design.

4.1.2 Green Star – Mixed Use PILOT

The Green Star - Mixed Use PILOT tool assesses the environmental attributes of new and refurbished mixed use buildings with at least 80% of their GFA or NLA comprising any combination of multi unit residential and retail centre (BCA Classes 2 and 6).

Each eligible building class is assessed separately. In order to get a final rating for the mixed use building development, two separate assessments (one for each building class) are required. Documentation for credits common to both two may be submitted once. The Green Star - Mixed Use PILOT tool brings together the rating results of these separate assessments and calculates a final weighted score for the mixed use development.

The Green Star – Mixed Use PILOT process differs from all previous PILOT tools that the GBCA has launched in the past in that the GBCA does not accept any expression of interest and no projects are going to be selected and assessed during this stage. The Pilot tool was launched to allow industry to carry out self-assessments and trials to test the tool. The tool is experimental and when released, the official version (version 1) of the tool may significantly differ from the current PILOT tool.

When the Green Star - Mixed Use v1 rating tool is released it will not incorporate any PILOT tools. It will use the most current version of the Green Star - Multi Unit Residential and Green Star - Retail Centre (formerly Shopping Centre Design PILOT) rating tools. The Green Star - Retail Centre v1 rating tool was released at the end of August 2008. The release of Green Star - Mixed Use v1 rating tool is scheduled for approximately March 2009.

The proposed process for Block 2 is to use the Green Star - Mixed Use PILOT rating tool to guide the design process. The Green Star - Mixed Use PILOT rating tool shall be based on a combination of the following Green Star rating tools during design development until the v1 tools are released:

- Green Star - Multi Unit Residential PILOT
- Green Star - Retail Centre (formerly Shopping Centre Design PILOT)

4.2 Green Star – Environmental Initiatives

The following main environmental initiatives will be adopted to produce a building equivalent to a five star rated. This list of initiatives is to be finalized during the design development stage.

4.2.1 Management

These initiatives are targeted to reduce environmental impacts at construction and operational stages as well as to maximize building performance at commissioning.

- **Green Star Accredited Professional:** To include a Green Star Accredited Professional in the design team to provide sustainability advice throughout every part of the design and construction phases and in the compilation of the documentation submission. The ESD consultant from Arup is a Green Star Accredited Professional;

- **Commissioning Clauses:** To adopt commissioning and handover initiatives that ensure that all building services can operate to optimal design potential, such as: Comprehensive pre-commissioning, commissioning, and quality monitoring to be contractually required to be performed for all building services (BMS, mechanical, electrical and hydraulic);
- **Building Tuning:** After handover, the building owner is expected to implement tuning of all building systems and undertake full re-commissioning 12 months after practical completion;
- **Independent Commissioning Agent:** To appoint an independent commissioning agent to provide commissioning advice to the building owner and the design team and to monitor and verify the commissioning of all building systems;
- **Building User's Guide:** To produce a Building User's/ occupant's Guide, information management that enables building users / occupants to optimise the building's environmental performance during its operation;
- **Environmental Management Plan:** The contractor is expected to adhere to a comprehensive Environmental Management Plan (EMP) for the works. Contractors are recommended to be ISO 14001:2004 certified;
- **Waste Management - Construction:** The contractor is expected to implement a waste management plan, retain waste records and submit quarterly reports to the building owner, and ensure that 80% of waste is reused or recycled;

4.2.2 Indoor Environmental Quality

These initiatives are targeted to deliver a healthier built environment with improved thermal, acoustic and visual comfort for occupants.

- **Ventilation Rates:** Provision of trickle ventilation inlets in the facade equivalent to more than 0.05% of the floor area of each apartment;
- **Air Change Effectiveness:** To provide dual aspect design so that effective natural ventilation can be achieved for 70% of the dwellings;
- **Thermal Comfort:** To achieve an average heating and cooling load of not more than 36MJ/m2;
- **Hazardous Materials:** To carry out a comprehensive hazardous material survey for the project site, as defined by the relevant environmental and Occupational Health and Safety (OH&S) legislation;
- **Acoustics:** Building services noise meets the satisfactory design sound levels. Improved acoustic insulation, especially between studios, and between studios and kitchens. Improve external glazing acoustic properties;
- **Volatile Organic Compounds:** Low VOC for walls/ ceiling finishes and/ or carpets, and/or adhesives and sealants;
- **Formaldehyde Minimisation:** All composite wood to be low formaldehyde;
- **Electric lighting levels:** Ensure a minimum of 320Lux on the surface (nominally 900mm above floor level) of Kitchen Sink, Cooktop or Stove; and Vanity Basins in Bathrooms and Ensuites;
- **External Views:** The design allows unobstructed external views for the majority of occupied spaces.

4.2.3 Energy

These initiatives are targeted to reduce energy consumption through passive building design and efficient use of technology.

- **Energy improvement:** It is estimated that through performance glazing and insulated building envelope and by not having to use the HVAC system at all times (due to natural ventilation strategy) energy associated with cooling, heating, fans and pump will be reduced by approximately 70% when compared to a similar conventional building;
- **Efficient Appliances:** Installation of efficient appliances as part of the base building works (refrigerators, clothes washers, clothes dryers and dishwashers);
- **Energy Sub-metering:** To facilitate ongoing management of energy consumption for all major uses (> 10kVa), to be connected with the BMS;

4.2.4 Transport

These initiatives are targeted to reduce dependence on motorised vehicles, encouraging walking, cycling and the use of mass public transport:

- **Fuel Efficient Transport:** To provide carpark spaces for small vehicles, in accordance with AS/NZS 2890,1 2004 and motorbikes, as well as integrate a formal car sharing scheme;
- **Cyclist facilities:** provision of bicycle racks (1 per apartment);
- **Public Transport:** The building is close to public transport with abundant number of bus routes served and train stations;
- **Trip Reduction:** The development is integrated with and/or located adjacent to a number of local amenities, reducing the need for trips.

4.2.5 Water

These initiatives are targeted to reduce potable water consumption:

- **Occupant Amenity Water:** To reduce potable water consumption for sanitary use through the maximization of water sources, use of a black water recycling plant and use of efficient water fittings and appliances;
- **Efficient Appliances:** Washing machines with a minimum 4 star rated under the WELS scheme are to be supplied as part of the base building works;
- **Water meters:** To both monitor and manage major water uses. Water meter should be installed to laundry room, main building supply, irrigation systems, and each floor supply. Plus, an adequate monitoring strategy to be identified;
- **Rainwater harvesting:** to account for toilet flushing and irrigation;
- **Fire System Water Consumption:** All fire test water will be discharged to the rainwater tank to avoid water waste;
- **Swimming Pool/Spa Water consumption:** Backwash water is to be collected and treated for reuse on site.

4.2.6 Materials

These initiatives are targeted to reduce embodied energy and environmental impacts caused by the whole life cycle of building materials:

- **Recycling Waste Storage:** Recycling waste storage area is to be provided for the separation, collection and recycling of waste with good access for all building occupants and for collection by recycling companies;
- **Concrete:** Reduction on the absolute quantity of Portland cement by substituting it with industrial waste product(s) or oversized aggregate to a certain percentage to be defined;
- **PVC Minimization:** To reduce the PVC content through replacement with alternative materials;

- **Sustainable Timber:** To demonstrate that a large percentage of the timber and composite timber products used in the building and construction works are sourced from either or a combination of post consumer re-used timber or Forest Stewardship Council certified;
- **Recycled Content & Reused Products and Materials:** To maximize the post-consumer recycled content and reused products in the selection of materials;
- **Floor Covering:** Selection of low environmental impact covering for floors in comparison to traditional materials;
- **Universal Design:** To provide adaptable housing for a significant amount of dwellings.

4.2.7 Land Use and Ecology

These initiatives are targeted to enhance the ecological value of the site:

- **Reuse of Land/ Change of Ecological Value:** The site has been previously built on (car park building), and is not a Greenfield. The new development will enhance permeable area (currently zero) and vegetation enhancing the ecological value of the site;

4.2.8 Emissions

These initiatives are adopted to minimise emissions that would harm the atmosphere, human and wildlife health and wellbeing:

- **Refrigerant ODP:** refrigerants will have zero Ozone Depletion Potential;
- **Refrigerant Leak Detection:** To reduced the risk of refrigerant loss to the atmosphere;
- **Reduced Flow to Sewer:** With the use of black water plant, it can be demonstrated that the building outflows to the sewerage system due to building occupants' usage have been reduced;
- **Light Pollution:** No light beam will be directed upwards or outside the building, not interfering/ disturbing neighbouring properties and wildlife such as nocturnal birds, bats and insects;
- **Watercourse Pollution:** Design that minimises stormwater run-off to and the pollution of the natural watercourses;
- **Insulant ODP:** Specified thermal insulants that avoid the use of ozone-depleting substances in either manufacture or composition.

5 BASIX

5.1 Introduction

A BASIX Certificate is required to form part of any new development application for a residential building in NSW. A BASIX Certificate demonstrates compliance with the NSW Government's reduction targets for potable water consumption and greenhouse gas emissions in new residential buildings.

BASIX is the NSW State Government's regulatory device through which all new residential dwellings and additions in NSW must achieve specified levels of water and energy savings. There are three input sections: Energy, Thermal Comfort, and Water. Each of these three categories is integrated and often influences each other.

Achievement of the specified targets is demonstrated through use of a web-based prediction tool. This tool requires input of several aspects of the dwelling's design, and produces a BASIX certificate and report listing all of the environmental initiatives proposed and required to achieve the mandatory performance.

The BASIX rating tool uses state average per capita consumption rates from information on existing dwellings as benchmarks for residential energy and water consumption.

Predicted water and energy consumption are compared against a database of water and energy consumption figures collected from over 2 million households state-wide. This analysis allows state-wide averages of energy and water consumption to be calculated against which predicted performance is compared.

Per capita figures are used to give a fair distribution of allowances to different dwelling types. The BASIX rating tool calculates how many people will inhabit a particular dwelling from information entered by the user.

These state average per capita figures are adjusted according to the geographical location of the project being assessed. Adjustments take into consideration environmental factors such as evaporation, rainfall, insulation, and heating and cooling loads.

5.2 BASIX Assessment

The target for the BASIX assessment is a pass on all three BASIX categories (water, thermal comfort and energy).

5.2.1 Water

The target for the water section is set to pass the BASIX benchmark (40%) for the location of this site.

This may be achieved by taking into account the following features proposed for the building:

- Site Wide Rainwater collection
- Central black water treatment plant
- High rated water appliances
- Use of indigenous plants / low water species

5.2.2 Thermal Comfort

The target for the thermal comfort section is set to achieve 7 stars NABERS, which will exceed the passing benchmark in BASIX.

5.2.3 Energy

The target for the thermal comfort section is set to achieve 7 stars NABERS, which will exceed the passing benchmark in BASIX.

This may be achieved by taking into account the following features proposed for the building:

- Tri-generation plant and chillers
- Low temperature chilled water reticulation to individual buildings
- Utilising waste hot water from the combined heat and power plant and reticulating it to individual buildings
- Electricity exported to the grid from central plant and provided to each building by connection to sub-station.
- Smart controls and metering for lighting and ventilation
- CO sensing in basement car parks

5.3 Conclusion

The building incorporates proposed features, technologies and design strategies equivalent to 5 stars Green Star Multi Unit Residential, 5 stars Green Star Retail Centre, and 5 stars Green Star Mixed Use.

The proposed ESD initiatives will be developed in more detail during future design stages by the design team to guarantee and assure that equivalent benchmark targets are achieved as expected.