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230-238 Sussex Street

Energy Efficiency & ESD Report

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Meriton Group Pty Ltd
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230-238 Sussex Street

Energy Efficiency & ESD Report

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Executive Summary

SLR Consulting Australian Pty Ltd (SLR) has been engaged by Meriton Apartments Pty Ltd (Meriton) to provide a qualitative Ecologically Sustainable Design (ESD) assessment, including energy efficiency, for the proposed mixed use development at 230-238 Sussex. The assessment forms part of the Development Application to the City of Sydney Council.

The site is within the 'York Street / Clarence Street / Kent Street' Special Character Area under LEP 2012. This special character area is recognised as an early warehousing area of Sydney.

The former Foley Bros Warehouse and courtyard and its laneway at 230-232 Sussex Street are listed together as a single heritage item on Schedule 5 of the Sydney Local Environment Plan 2012 (the LEP). The proposed re-development will comprise the following:

- The building facades will be retained;
- Ground floor with hotel lobby, retail tenancy and two units; and
- Level one and two with nine units.

The 234-238 Sussex Street site is presently occupied by a 13-storey commercial development with in-podium and basement public car park accessed from Druitt Place on 234-238 Sussex Street (Britannia House) which will be demolished. The proposed development will comprise a 31-storey building including:

- 4 levels of basement carparking;
- Ground Floor featuring retails, hotel and residential lobbies and BOH/Plant rooms;
- Level 1-3 for hotel rooms. A swimming pool facility is located on Level 2;
- Level 4 for recreational activities;
- Level 5 to Level 18 for hotel rooms;
- 89 residential apartments on Levels 19 to 30; and
- Level 31 for plant room.

The proposed building is located near multiple public transport options in the Sydney CBD. The proposed development will therefore encourage occupants, hotel guests and staff to use public transportation and minimise automobile use. Sufficient recreational opportunities are easily accessible to residents, eliminating the requirement for long-distance motorised transport for most recreational activities. This would be a positive feature of the development with regards to sustainability as this clearly avoids greenhouse gas emissions that would otherwise have been produced if residents had to travel long distances for recreational activity.

Overall, positive Ecologically Sustainable Design (ESD) and energy efficiency features are currently in place in a number of design areas, incorporating the following:

Executive Summary

230-232 Sussex Street Re-Development

- Re-use of the existing façade. Reuse of buildings can significantly reduce the demand for new construction materials. The re-use of the proposed re-development facades is required for heritage considerations, but also leads to a direct environmental benefit.

- Re-use of the existing major structure (eg floors, columns and beams). The re-use of the structure is required for heritage considerations, but also leads to a significant environmental benefit.

- Roof skylights to increase the access to natural lighting, reduce the use of artificial lighting, minimise the impact on the environment and reduce the annual energy consumption.

- Most timber framing of floors and roofs will be retained and conserved and left exposed to view. A construction management plan for the site stated that as a guide removal of more than 10-15% of the floorboards and joists on each level of the main warehouse and the rear warehouse's first floor would be unacceptable.

- The existing cobble stone paving for the cartway and the existing stone base for the courtyard will be retained. New cobble stone paving is proposed for the courtyard to match the existing design intent.

- Sensitive adaptation of the interior.

- Previously unpainted structural elements and wall surfaces will not be painted.

234 -238 Sussex Street Development

- The proposed development will incorporate passive and active energy saving measures such as operable windows to enhance natural ventilation through the residential apartments where appropriate.
- High levels of natural light to the residential apartments and hotel rooms.
- High levels of cross-ventilation. 86.5% of residential units are naturally cross-ventilated. The residential component development therefore complies with the SEPP 65 design code.
- Maximising solar exposure of most residential apartments. 68.5% of the residential apartments in the development will have at least 2 hours sunlight on the Winter Solstice between the hours of 9:00 am to 3:00 pm.
- Incorporation of thermal mass. Concrete slab construction is proposed for all floors throughout the development - concrete has amongst the highest thermal mass capacity of a range of common building products. External walls, structural internal walls and slabs of the proposed development should be predominantly concrete.

The following recommendations have been made to improve upon the existing key sustainability elements of the proposed 230-238 Sussex Street development:

- Line the inside of the roof with a minimum R3.5 insulation;
- External walls insulation in accordance with NCC 2015 (for the retail tenancies and hotel) and BASIX requirement (for the residential apartments);

Executive Summary

- Appropriate glazing selection in accordance with NCC 2015 requirements for the commercial component and BASIX requirements for the residential apartments to cut excess solar heat gains;
- Water efficient bathroom and kitchen fittings;
- Gas hot water systems;
- Light efficiency measures in the carparks using motion sensors;
- LED and Fluorescent lighting throughout the project;
- Energy efficient individual reverse cycle 1-phase air-conditioning system and/or Efficient VRV/VRF air conditioning system;
- Minimum 4-star energy efficient dishwashers, refrigerators, and washing machines;
- Electricity sub-metering for significant end uses that will consume more than 10,000 kWh/a;
- Water sub-metering for the swimming pool and other major uses;
- Low levels of volatile organic compounds (VOC) paints and floor coverings and low formaldehyde wood products where possible;
- Carspaces for small or low emission cars; and
- The provision of bicycle storage spaces within the development, although not a requirement of BASIX, will ensure the development become a more sustainable development in a holistic sense.

Recommendations regarding the mechanical ventilation system, domestic hot water, other appliance and operational waste, etc., have also been made within the body of the report.

These features will help to achieve significant reductions in the energy and water required by the development both in building and operation, as well as ensuring that the residential units are more pleasant spaces to reside.

It is recommended that ESD initiatives continue to be developed and implemented during the detailed design stage of the project.

A thermal comfort assessment of the proposed residential development will be carried out (using NatHERS second generation software and BASIX) during the Stage 2 Development Application to provide a quantitative estimate of the development's ESD performance.

A BCA Section J energy efficiency assessment of the commercial component will be carried out during the detailed design stage to reduce green gas emissions by efficiently using energy in the proposed development. A NCC compliance report should minimise any negative heritage on the 230-232 Sussex Street redevelopment site.

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1 INTRODUCTION

SLR Consulting Australian Pty Ltd (SLR) has been engaged by Meriton Apartments Pty Ltd (Meriton) to provide a qualitative Ecologically Sustainable Design (ESD) assessment, including energy efficiency, for the proposed mixed use development at 230-238 Sussex. The assessment forms part of the Development Application to the City of Sydney Council.

The site is within the 'York St / Clarence St / Kent St' Special Character Area under LEP 2012. This special character area is recognised as an early warehousing area of Sydney.

1.1 Site Description

The site is located in the CBD on the eastern Sussex Street just to the north Druitt Place.

- The former Foley Bros Warehouse and courtyard and its laneway at 230-232 Sussex Street are listed together as a single heritage item on Schedule 5 of the Sydney Local Environment Plan 2012 (the LEP).
- The 234-238 site's location at the corner of Sussex Street and Druitt Place provides it with two street frontages, with Sussex Street being the primary street frontage, and Druitt Place a secondary street frontage currently providing vehicle access into 234-238 Sussex Street. The key characteristics of the site are:
    - The site is roughly rectangular in shape but for an irregular eastern boundary shared with 439 and 443-451 Kent Street.
    - The site has a western frontage to Sussex Street, and a southern frontage to Druitt Place.
    - A cross-fall sloping from east to west.

The area surrounding the site contains a number of high-rise buildings as is typical of the Sydney CBD. Between these there are generally medium-rise buildings with little space between them. The site is somewhat more open to the west as there is only one block of buildings between the site and Cockle Bay.

Figure 1 Site Location

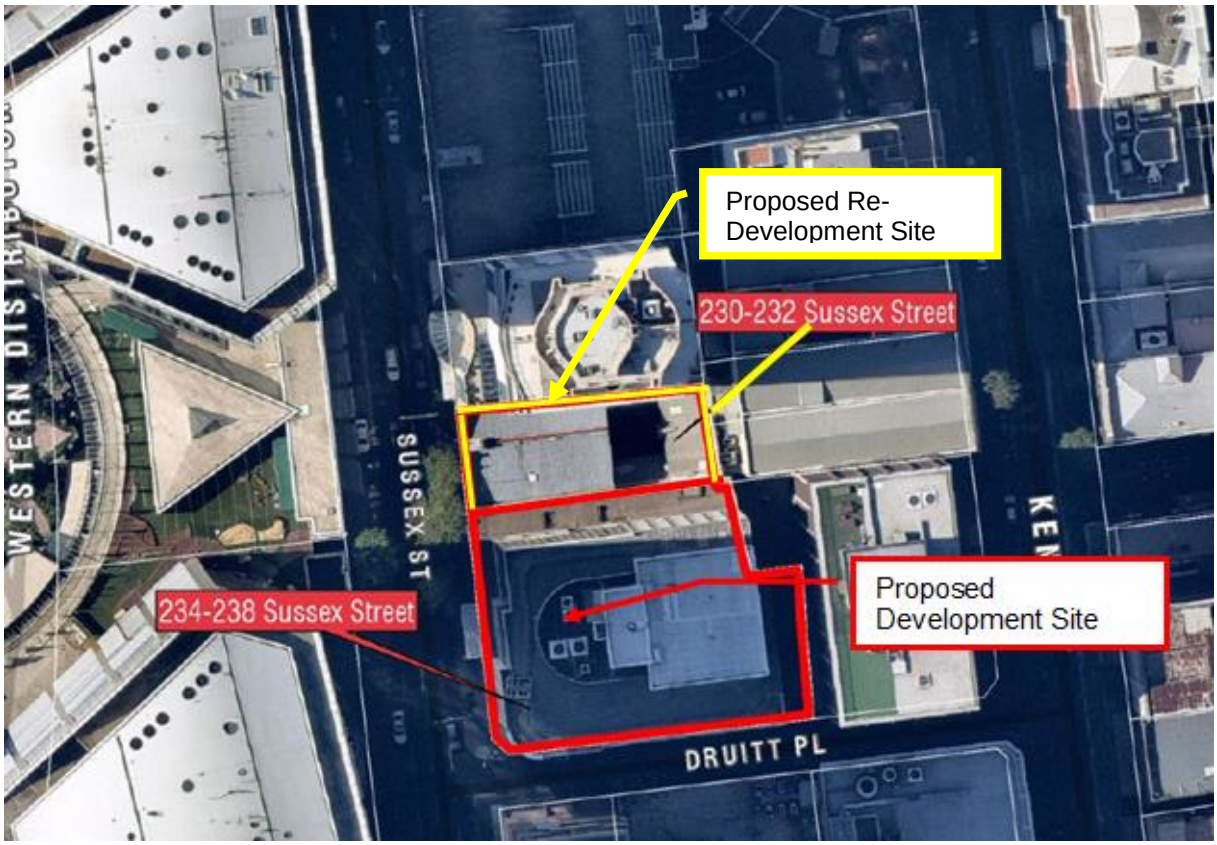


Image: Google

1.2 Development Description

1.2.1 230-232 Sussex Street Re-Development

It is proposed that the current 230-232 Sussex Street buildings will be redeveloped with the following features:

- The building facades will be retained
- Ground floor with hotel lobby, retail tenancy and two units
- Level one and two with nine units

The existing and proposed west elevations are shown in **Figure 2**.

Figure 2 Existing and Proposed West Elevations

Existing West Elevation	Proposed West Elevation
	

1.2.2 234-238 Sussex Street

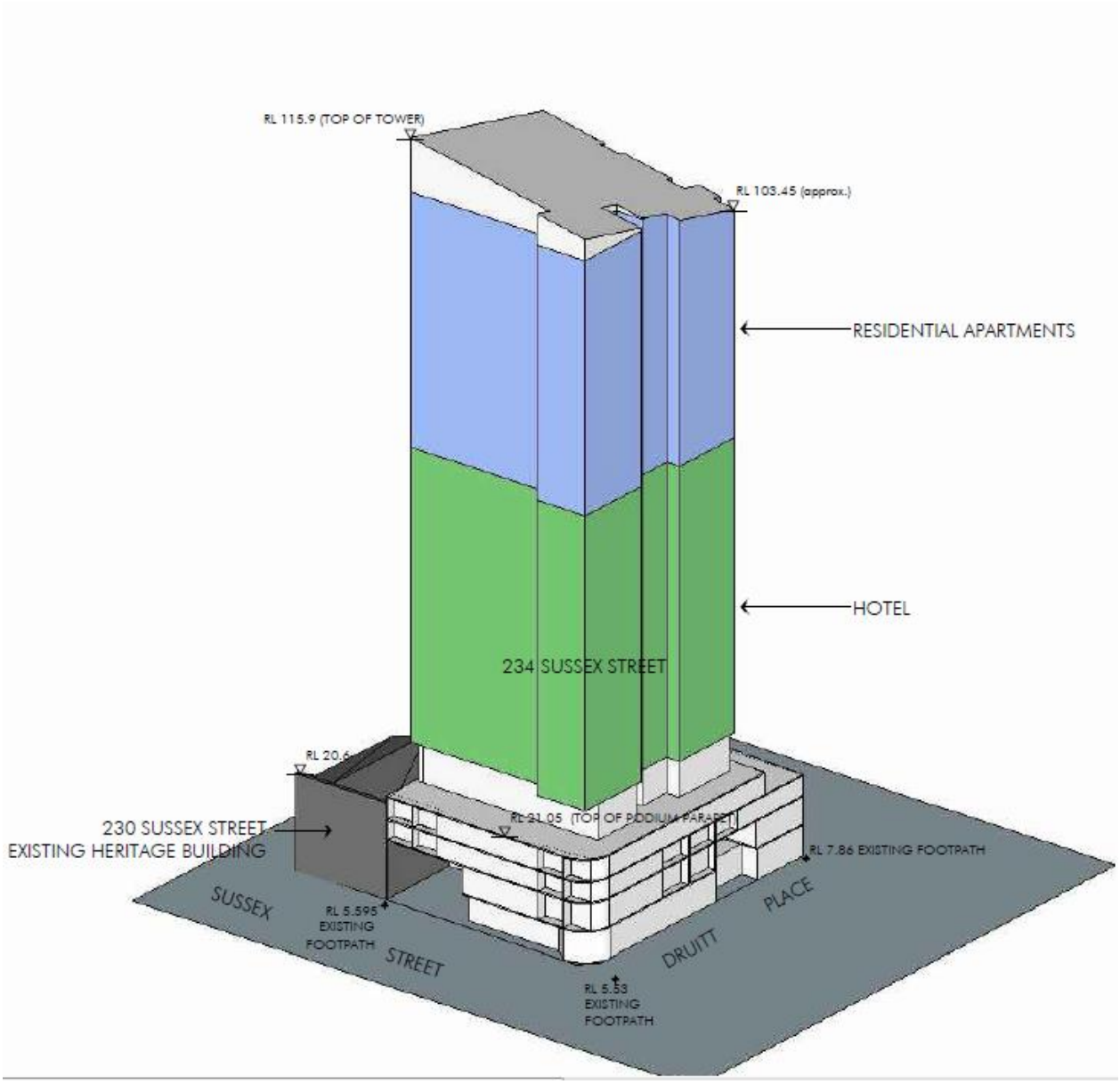
The site is presently occupied by a 13-storey commercial development with in-podium and basement public car park accessed from Druitt Place on 234-238 Sussex Street (Britannia House) which will be demolished. The proposed development will comprise an 18-storey building including:

- 4 levels of basement carparking;
- Ground Floor featuring retails, hotel and residential lobbies and BOH/Plant rooms;
- Level 1-3 for hotel rooms. A swimming pool facility is located on Level 2;
- Level 4 for recreational activities;
- Level 5 to Level 18 for hotel rooms;
- 89 residential apartments on Levels 19 to 30; and
- Level 31 for plant room.

Primary entry point to the retails, hotel lobby and residential Lift Lobby is from Sussex Street frontage.

A photomontage of the indicative scheme is shown in **Figure 3** below.

Figure 3 Photomontage of the Proposed Development – Indicative Scheme



The following report was prepared based upon the architectural plan set 150610.pdf dated 10th June 2015.

2 ECOLOGICALLY SUSTAINABLE DESIGN

2.1 Definitions of Key Concepts

2.1.1 Ecologically Sustainable Development (ESD)

The concept of Ecologically Sustainable Development (ESD) was outlined in "Our Common Future", the report of the 1987 United Nations World Commission on the Environment and Development (the Brundtland Commission). It defined Sustainable Development as

"Development that meets the needs of the present
without compromising the ability of future generation to meet their own needs".

This concept was adopted within Australia in 1990 when the Council of Australian Governments endorsed a National Strategy for Ecologically Sustainable Development. The Commonwealth Government suggested the following definition for ESD in Australia:

"Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased".

Put more simply, ESD is development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. To do this, it is necessary to develop ways of using those environmental resources which form the basis of our economy in a way which maintains and, where possible, improves their range, variety and quality.

The National Strategy for Ecologically Sustainable Development notes that there is no identifiable point where it can be said that ESD has been achieved. The strategy further states that there are two main features which distinguish an ecologically sustainable approach to development:

- we need to consider, in an integrated way, the wider economic, social and environmental implications of our decisions and actions for Australia, the international community and the biosphere; and
- we need to take a long-term rather than short-term view when taking those decisions and actions.

Ultimately ESD should lead to changes in our patterns of resource use, including improvements in the quality of our air, land and water, and in the development of new, environmentally friendly products and processes.

2.1.2 National Strategy for ESD Objectives and Guiding Principles

The National Strategy for ESD sets its core objectives as**:**

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- To provide for equity within and between generations.
- To protect biological diversity and maintain essential ecological processes and life-support systems.

The Guiding Principles of the National Strategy for ESD are documented as:

- Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.

- Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- The global dimension of environmental impacts of actions and policies should be recognised and considered.
- The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.
- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
- Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
- Decisions and actions should provide for broad community involvement on issues which affect them.

These guiding principles and core objectives need to be considered as a package. No objective or principle should predominate over the others. A balanced approach is required that takes into account all these objectives and principles to pursue the goal of ESD.

2.2 Specific Requirements for Compliance

Specifications for environmental design measures required for the proposed site are detailed in the following documents:

Mandatory ESD Measures for Consideration

- City of Sydney Council Energy Efficiency Development Control Plan (DCP), 2012.
- NSW Building Sustainability Index (BASIX) – Residential Component
- The State Environmental Planning Policy (SEPP) 65 supported by the Residential Flat Design Code – Residential Component
- National Construction Code (NCC) 2013 Section J – Commercial Components (Hotel, Retails and Recreational facility)

Voluntary ESD Measures

- Green Star Design and Built Rating Tool

City of Sydney Council encourages the use an environmental building rating tool, such as Green Star or any similar rating tool, to demonstrate the environmental performance of a proposed development.

City of Sydney (DCP) 2012 have produced a “Sustainable Design Principals, Energy Efficiency and Water Conservation” document, which covers ESD topics like energy efficiency, passive solar design, thermal mass, water conservation, etc. The document discusses important aspects of building design where there is the potential to increase the energy efficiency of a development during the Concept Design stages of a project by ecologically sustainable means. Note that many of the DCP 20122 and topics are also addressed by BASIX and the BCA Section J.

The current study proposes Ecologically Sustainable Design (ESD) measure to improve upon the existing key sustainability elements of the proposed development and comply with the energy performance requirements of the City of Sydney Council DCP where possible.

3 ESD INITIATIVES FOR THE PROPOSED 230-232 SUSSEX STREET DEVELOPMENT

The ESD initiatives to be committed for the proposed re-development are detailed in SLR report 610.15232 R2 dated 2nd June 2015 and summarised in the executive summary of the current study.

4 ESD INITIATIVES FOR THE PROPOSED 234-238 SUSSEX STREET DEVELOPMENT

In order to achieve a structured integrated approach to ESD, a series of indicators and strategic goals have been identified at the outset to be communicated to the design team. SLR Consulting's role, as the project's ESD consultant, has been to apply these principles to all aspects of the development ensuring a best possible ESD outcome.

ESD indicators identified for the proposed Concept Plan are:

- Site Layout and Building Design in terms of ESD;
- Energy efficiency;
- Water conservation;
- Transportation;
- Indoor environment quality;
- Materials;
- Land use and Ecology; and
- Emissions.

The ESD initiatives to be committed for the proposed development will be outlined in the following sections below.

4.1 Site Analysis and Layout

A key ESD objective should be to optimise site conditions and minimise energy consumed for cooling and heating loads through proper selection of building orientation and internal layout. The following points are noted with respect to the sitting of the proposed development.

- As opposed to new developments on the outer fringes of the city which require significant investment in new roads, sewage, lighting, power, etc, the proposed development site will have immediate access to all of these at very little additional regional infrastructure investment.

- Being in the CBD the site is surrounded by a large number of taller buildings. Only the Sussex Street facade could receive a significant amount of direct sunlight although this is greatly restricted by the tower to the north-west of the site.

1.1.1 Solar Access – Residential Apartments

One of the objectives of energy conservation is to minimise the heating and cooling requirements of buildings. Sunlight should preferably be able to penetrate the building in winter and be excluded from the building in summer. The form dictated by the site has been designed to maximise the solar access of residential units by:

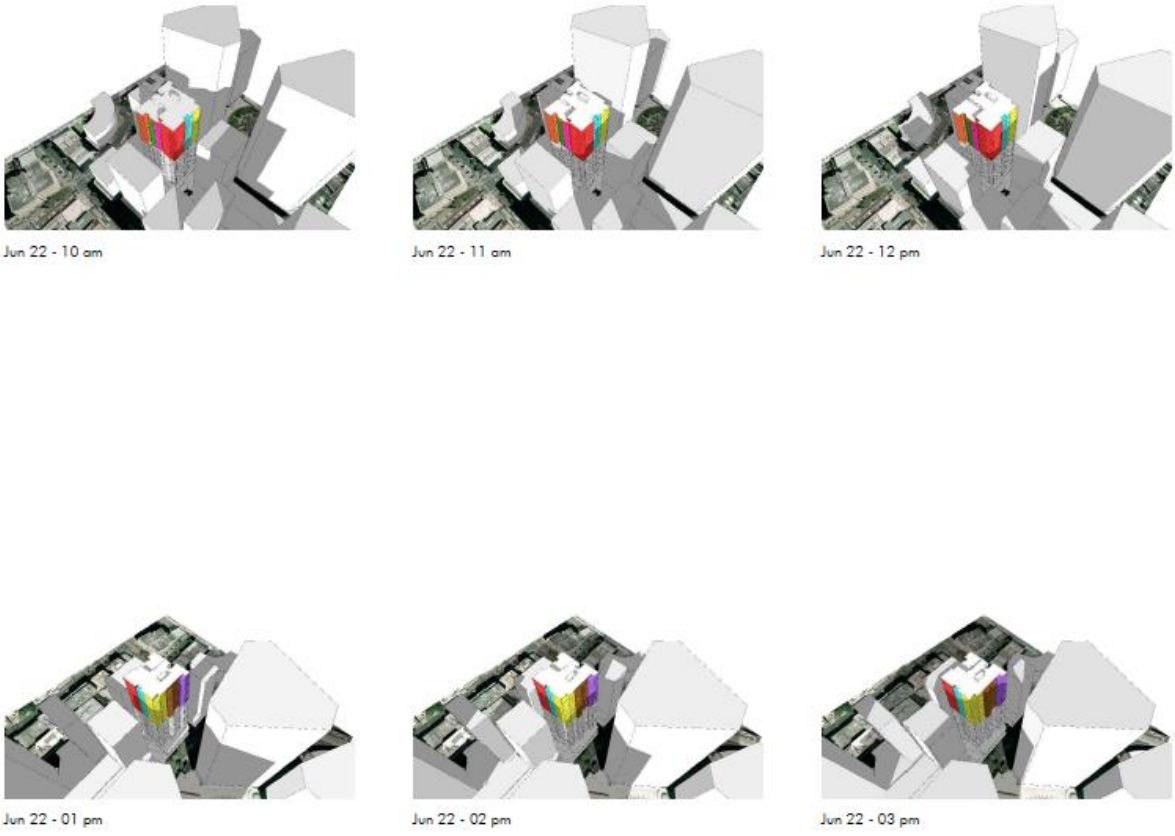
- Maximising solar exposure of every residential apartment. The height and units layouts will allow excellent solar exposure from north, east and west directions to 61 units out of 89 units for at least 2 hour solar access in mid winter.
- Ensuring that primary facade glazing is attached to all “living zone” rooms for all apartments (ie living room, bedrooms etc). With proper attention to design details (eg glazing seals), these rooms can act as highly efficient solar collectors especially during winter months.

nettletontribe Architects has conducted a preliminary solar access modelling for the residential apartments and the following conclusions have been reached from the solar diagrams shown in **Figure 4**:

- The proposed Plan was found to provide 68.5% of the residential apartments in the development with 2 hours sunlight on the Winter Solstice between the hours of 9:00 am to 3:00 pm.

SLRE recommend improving the solar access to at least 2 additional units to achieve compliance with the SEPP 65 design code.

Figure 4 Solar Access Results, June 22



4.2 Natural Ventilation - Residential Apartments

The most important role of natural ventilation in the context of the residential apartments is to remove accumulated heat gain during periods of overheating. In this case, ventilation is intended to achieve predicted rates of volumetric air change. Also important during the summer months is the role of ventilation in directly improving the perception of thermal comfort by occupants of a space. This is achieved when moving air aids the evaporation of perspiration by passing over the skin. As long as there is some air movement, most people will tolerate somewhat higher temperatures.

Heat build-up within apartments through daytime summer temperatures can be quickly purged with the availability of suitable breezes at the site.

The City of Sydney *DCP* encourages cross ventilation to be assisted by the building design. Building design should enable ventilation to be controlled, where comfort levels are maintained for the occupants during the summer and winter extremes. Locations of windows and openings within each apartment are to be suitably in line where possible with each other on opposite sides of the room. It is recommended that building openings be designed such that cross-ventilation is maximised, to minimise heat gain in summer.

Ventilation of building is achieved by permanent openings, windows, doors or other devices which have an aggregate opening or openable size of not less than 5% of the floor area of the ventilated room. The provision of ceiling fans for use in summer months is also encouraged.

In winter it is important to close off heated areas that need warming. The opportunity to open and close balcony doors will allow adequate control to moderate the impact of any higher than comfortable winds. It is recommended that the following initiatives also be incorporated to minimise heat leakage from the building:

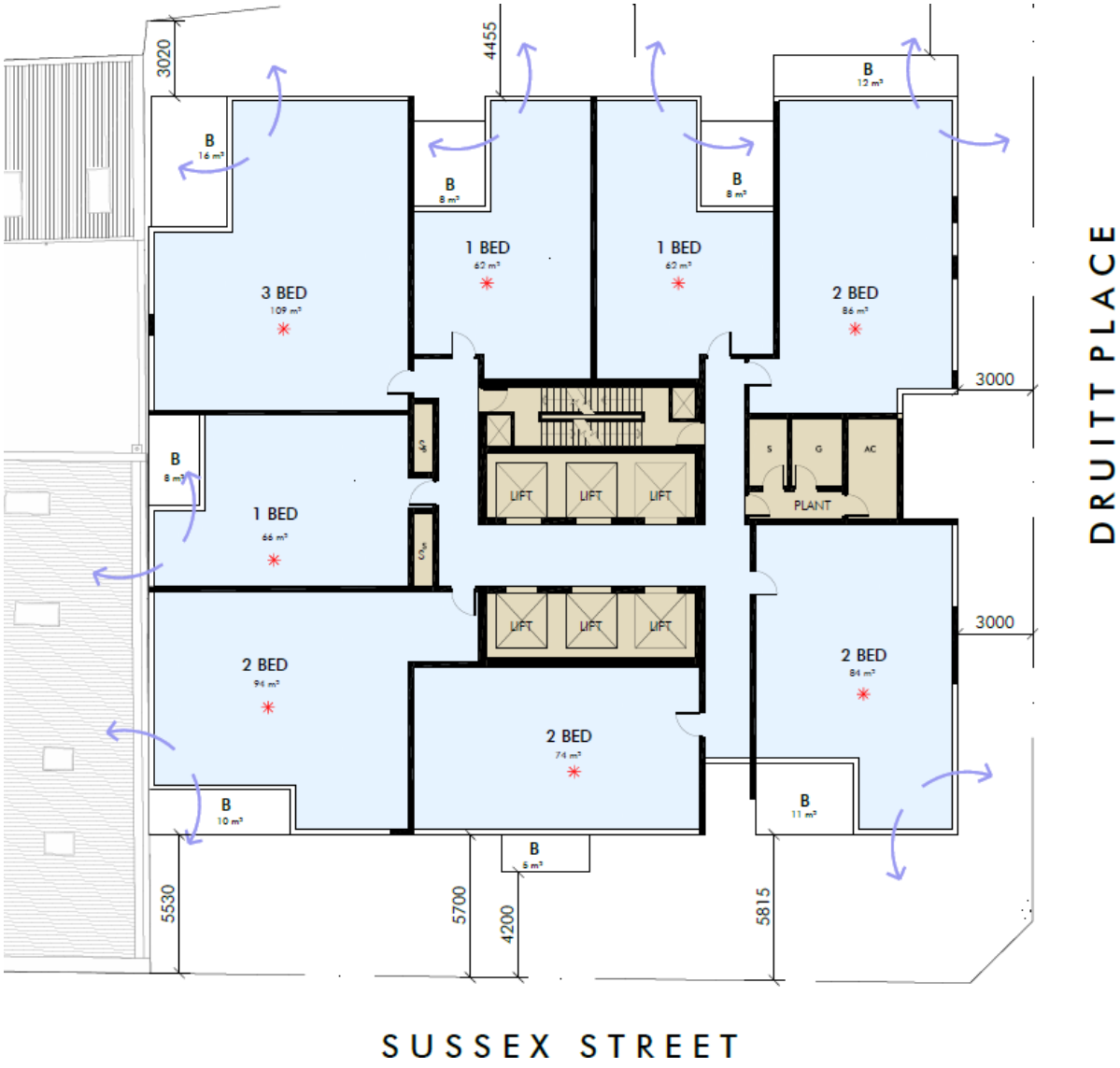
- Design detailing of the glazing interface to the window framing system and the provision of adequate sealing in accordance with the Building Code of Australia (BCA).
- Doors leading to hallways, stairwells and non-common use areas provided with draught excluders to limit heat losses during winter months.
- Doors located throughout the development in general-use areas, such as access ways to/from the building, fitted with door closers where it is deemed that their opening will have an adverse effect on heat loss during winter.

nettletontribe Architects has conducted a preliminary ventilation assessment of the proposed Plan to confirm that the site complies with relevant Flat Design Code Natural Ventilation (SEPP 65) 60% “Rule-of-thumb”. The following conclusions have been reached from Natural Ventilation Study Refer Plan Set 150610 dated 10th June 2015):

- 86.5% of residential units are naturally cross-ventilated.
- The development therefore complies with the SEPP 65 design code.

A Computational Fluid Dynamics (CFD) modelling can be utilised during the detailed design stage to enable the proper quantification of the proposed natural ventilation windflows through the residential apartments on both a seasonal and annual basis for all prevailing wind direction of interest. This approach offers a reliable means by which natural ventilation openings can be sized and located in a cost-effective manner.

Figure 5 Cross Ventilation to a Typical Residential Floor Plan



4.3 Building Construction

4.3.1 Building Massing

The proposed development will have a compact form requiring less heating and cooling than low-rise buildings that would tend to sprawl out over a site. Apartments will "share" heat with their adjacent neighbours and so gain and lose less heat to the external environment.

4.3.2 Building Materials

The minimum performance criteria for the building form and construction of the commercial tenancies and hotel rooms as per the NCC 2015 Section J- Energy Efficiency are:

- Insulation: Walls – R2.8
- Glazing as per Part J2 of the 2015 NCC and the BCA glazing calculator

The building construction materials of the residential apartments depend on the thermal comfort modelling for compliance with BASIX.

A thermal comfort assessment of the proposed residential development will be carried out (using NatHERS second generation software and BASIX) during the Stage 2 Development Application to provide a quantitative estimate of the development's ESD performance.

Walls

The R-values of common wall systems in Australia, is tabulated below, the higher the R-value, the better the insulation properties of the fabric.

Table 1 R-Value of Typical Wall Systems

Wall type	R-value
Brick Veneer	0.48
Cavity Brick	0.80
Concrete Block	0.48

As seen in **Table 1**, the cavity brick has the highest R-value among the three typical wall systems. While cavity brick is preferred, the subsequent project application design should aim to maximum the overall R-value for the proposed buildings.

The proposed development will consist of precast concrete for the external walls. Insulation for the external walls of the retail tenancies and hotel will be assessed in accordance with 2015 NCC Section J and will have to achieve R2.8. Subsequently, the external wall will require ***R2.5 insulation*** batts to be installed to the walls to comply with NCC Section J.

Insulation for the external walls of the residential units will be assessed in accordance with BASIX requirements during the Stage 2 DA application.

Internal walls are proposed to be Hebel Power Panels with acoustic insulation where required between apartments and lightweight plasterboard on stud construction within apartments. This is advantageous from a building life-cycle perspective, as it maximises the adaptive reuse potential when a building reaches the end of its intended use.

Roof

It is proposed to use concrete construction for the roof of the proposed development. SLR Consulting recommends R3.5 insulation blanket between the roof and ceiling to reduce the heat gain/loss through the roofs.

The proposed development will satisfy the NCC 2015 and BASIX requirements and a detailed NCC Section J compliance report will be prepared during the detailed design stage of the project when the design of the building services is progressed.

Glazing

The thermal performance of the glazing of the hotel will have to comply with NCC Section J Part J2 calculations.

The thermal performance of the glazing of the residential apartments will have to comply with the BASIX requirements.

SLR recommends LowE glazing for the proposed development.

Floor and Thermal Mass

Concrete slab construction is proposed for all floors throughout the development - concrete has amongst the highest thermal mass capacity of a range of common building products, as presented in **Table 2**. External walls, structural internal walls and slabs of the proposed development should be predominantly concrete.

Generally, more dense materials have higher mass which has the ability to store heat energy and then release it slowly to the room. This storage effectively smoothes out daily temperature variations within conditioned spaces, with corresponding reductions in both heating and cooling loadsConcrete has amongst the highest thermal mass capacity of a range of common building products, as presented in **Table 2**.

Table 2 Indicative Thermal Mass Values of Some Common Building and Reference Materials

Material	Thickness (mm)	Thermal Mass ($kJ/m^2.K$)
Dolerite (Rock / Stone)	200	433
10-31 Solid Brick	190	410
Concrete	100	221
Concrete block	90	194
10.01 regular brick	90	151
Clay brick (3.5 kg solid + 0.5 kg mortar)	110	142
Aerated concrete block	100	50
Fibre cement sheet (compressed)	18	32
Wood flooring (hardwood)	19	25
Weatherboard (softwood)	15	16
Fibre cement sheet	6	8
Plasterboard	10	8
Glass	3	6
Expanded polystyrene (EPS-class SL)	50	1.8
Cork	6	1.6

Material	Thickness (mm)	Thermal Mass ($kJ/m^2.K$)
Rockwool (batts)	50	1.5
Fibreglass (batts)	50	0.5
Air	50	0.5

4.3.3 Building Sealing

The purpose of this subsection is to ensure that additional heating and cooling loads will not be introduced through building leakage.

A seal to restrict air infiltration must be fitted to each edge of an external door, operable external window or the like when serving a conditioned space in the proposed residential development. The seal may be a foam or rubber compressible strip, fibrous seal or the like.

The bathroom/toilet exhaust fans in the proposed development must be fitted with a sealing device such as a self-closing damper or the like.

5 PASSIVE ENERGY EFFICIENCY

Passive energy efficiency refers to the choice of building materials, the placement of external facades and fenestration to effectively utilise solar energy for heating when required, and minimise solar gains when appropriate, thus 'passively' reducing the artificial heating and cooling requirements of the building. While high cooling and heating loads are typical in summer and winter months respectively, a good balance of heating and cooling load reduction techniques is required to produce a development with efficient passive design.

5.1 Rating System

5.1.1 Residential Apartments

In NSW, all new residential development proposals are required to achieve a '*PASS*' in the Thermal Comfort component of the BASIX rating scheme. When the areas of the apartments are input into BASIX, the maximum heating and cooling loads for each apartment and the overall development will be calculated. Each individual apartments and the overall development are to achieve heating and cooling loads of not more than the stated maximum load figures.

BASIX thermal comfort requirements for the proposed development (Zone 17 under BASIX) are as follow:

- Individual maximum heating and cooling loads of 41 MJ/m²/yr and 50 MJ/m²/yr respectively; and
- The whole development must have a maximum heating and cooling loads of 32 MJ/m²/yr and 40 MJ/m²/yr respectively.

A thermal comfort assessment of the proposed residential development will be carried out (using NatHERS second generation software and BASIX) during the Stage 2 Development Application to provide a quantitative estimate of the development's ESD performance.

5.1.2 Retail Tenancies and Hotel

The proposed commercial component of the proposed development will comply with 2015 NCC Section J – Energy Efficiency which is required for all retail and hotel developments.

A NCC Section J energy efficiency assessment of the proposed development will be carried out during the detailed design stage to reduce green gas emissions by efficiently using energy in the proposed development.

5.2 Mechanical Ventilation and Air Conditioning

5.2.1 Residential Apartments

At this stage the exact heating and cooling loads have not been determined for the residential apartments.

Where mechanical ventilation is required, the use of energy efficiency measures will be fully explored during the detailed design of the project. These measures include linking mechanical ventilation to manual switching where allowable under the BCA and using efficient individual reverse cycle 1-phase air-conditioning system rather than a common ducted ventilation system with constant operation. These initiatives will provide significant savings in energy use and associated operational energy costs of the development.

5.2.2 Retail Tenancies and Hotel

At this stage the exact heating and cooling loads have not been determined for the commercial component. SLR recommends investigating the use of efficient split system with a Coefficient of Performance (CoP) of 4.0 and/or VRV/VRF system to reduce the energy consumption for the proposed development.

The use of energy efficiency measures will be fully explored during detailed design.

5.3 Domestic Hot Water

As natural gas is abundant and more energy efficient than electricity, gas is recommended for hot water in NSW. The sole use of electricity as the energy source for conventional electric water heaters is inefficient because electricity is a secondary source, deriving its energy after burning coal. As coal based systems require expensive handling equipment and specialised pollution control systems, gas water systems are more energy efficient.

SLR recommends a central gas boiler hot water system with a star rating of above 3.5 for the proposed development.

5.4 Electrical Sub-Metering

Successful management of energy consumption of large uses within a building allows building managers to fine-tune operational procedures to minimise consumption and compare historical use. Sub-metering is recommended for all substantive (greater than 100kVa) energy uses within the future development. These uses may include air conditioning system, lifts and common areas (lighting and power). The Sydney DCP 2012 requires that Electricity sub-metering is provided for significant end uses that will consume more than 10,000 kWh/a.

5.5 Green Power Initiative

It is recommended that a certain percentage (approximately 10%) of “Greenpower” should be made available to residents, providing the opportunity to contribute to a reduction in total greenhouse gas emissions produced by the proposed Development. Greenpower is produced from environmentally friendly renewable energy sources such as solar, wind, water and biomass.

When a Greenpower product is selected by the owner, the energy supplier commits to buying a certain amount of electricity from approved new renewable energy sources. The financial accounts of Greenpower suppliers are audited independently. This makes a clear distinction between the services provided by standard energy suppliers and the more sustainable service offered through Greenpower options.

The National Greenpower website[1] states that *“Australian households generate almost one-fifth of Australia's greenhouse pollution through everyday activities such as transport and household energy use”*. The average household in Australia emits over seven to eight tonnes of greenhouse pollution each year through energy use alone. This is because most households source their electricity from burning coal and other fossil fuels. By choosing accredited Greenpower, up to 100% of a household's energy usage can be generated from renewable sources.

[1] http://www.greenpower.gov.au

5.6 Lighting

5.6.1 Natural Lighting

The proposed development maximises the north, east and west facing walls and will be implementing glazing areas to the residential apartment and hotel rooms to allow plenty of natural daylight access and therefore minimising the use of artificial lighting.

5.6.2 Artificial Lighting

Lighting installations require a design that properly considers the conservation of scarce energy resources. Sustainable lighting design ensures that illuminance is not excessive, that the switching arrangements are such that unnecessary illumination may be turned off and that the illumination is provided in an efficient manner.

There are additional energy losses associated with inefficient lamps and lighting losses associated with luminaries. Consequently a lighting design which uses the more efficient lamp types and the least number of luminaries for a given design illuminance will be more efficient and usually have a lower capital cost.

It is likely that the lighting to be used within the development will incorporate led lamps and compact fluorescents. It is recommended that the following lighting features be incorporated into the development to minimise energy consumption due to lighting:

- Maximise use of compact fluorescents or LED and minimise or where possible eliminate the use of halogen down lights, as compact fluorescents are much more efficient than halogen lighting.

- Light switches to be located at room exits to encourage switching lights off when leaving a room. Separate switches to be installed for special purpose lighting.

- Artificial lighting to the carpark and common hallways will be controlled by daylight sensors and time clock, to minimise unnecessary use of artificial lighting.

LED lamps are the most energy efficient form of lighting for commercial and residential developments. Fluorescent lamps are also very energy efficient form of lighting for hotels. They work by causing a phosphor coating in the inside of a glass tube to glow. Different types of phosphor give different colour light. Although more expensive to buy compared to incandescent bulbs, they are much cheaper to run and can last up to ten thousand hours. With careful design they can replace incandescent and halogen lights in most situations. Fluorescent lamps use only about one quarter of the energy used by incandescent bulbs to provide the same light level. Compact fluorescent lighting connected to daylight and motion sensors are recommended to the common hallways.

SLR recommends a maximum average lighting power density of 10 W/m^2 for the proposed development. A detailed NCC Section J Compliance report will be prepared during the detailed design stage of the project.

5.7 Appliances

It is not yet clear what new appliances will be required, however the following measures should be adopted if required:

- Minimum 4-star energy efficient dishwashers, refrigerators, and washing machines.
- The energy star feature should be enabled on all office equipment, such as computers, printers, photocopiers and fax machines.

6 WATER

Australians use more than one million litres of freshwater per person each year (*source:* Green Building Council of Australia 2006).

In addition to increased water use efficiency, new developments can reduce potable water demand by residents, tenants and visitors through the provision of an on-site alternative water supply. There are three principle forms of alternative water supply:

- Reticulation of reclaimed water to the site.
- Rainwater/storm water storage and reuse.
- Grey water storage and reuse.

The above water supply systems can be used for toilet flushing, landscape irrigation and fire services, reducing the demand on potable water supply.

No landscape is proposed as part of this project.

6.1 Water Efficiency

The minimum sustainable standard for water efficient water fixtures and fittings is 3A. To achieve greater than the standard level, the development will consider installing water efficient fixtures and fittings such as:

- 3 star showerhead with restricted flowrate of >6 but <=7.5 L/min
- 4 star toilet flushing systems
- 4 star kitchen taps
- 5 star bathroom taps
- 4 star water efficient dishwashers

The above measures are currently considered to be best practice in sustainable building design. Implementation of the above recommendations will assist in reducing the water consumption.

The water fixtures and fitting will be assessed in accordance with BASIX requirements during the Stage 2 Development Application.

The Sydney DCP 2012 requires the following:

- Separate water meters are installed for each individual tenancy in commercial or retail buildings over 5,000 m^2.
- Separate meters are to be installed for the make-up lines to cooling towers, swimming pools, on the water supply to outdoor irrigation, and other major uses.

Water sub-metering is recommended for the swimming pool and other major uses.

7 TRANSPORT

When designing a sustainable development, it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and environmental impact through reduced fossil fuel consumption and improved regional air quality. This can be achieved by encouraging the use of energy efficient public transport that is immediately at hand, reducing car parking facilities, and providing adequate bike storage facilities to minimise the requirement for individual motorised transport.

7.1 Provision of Car Parking

Transport emissions are one of the largest contributors of greenhouse gas emissions in Australia. The Green Building Council of Australia (GBCA) encourages the utilisation of alternative and mass transit forms of transport by limiting the availability of private vehicle spaces. Credits are awarded under the GBCA rating tools for car parking at least 25% less than the maximum residential planning allowance.

SLR consulting recommends providing carspaces for low emission or alternative fuel vehicles such as electrical cars; and car-sharing scheme.

7.2 Facilitation of Pedestrian and Non-Motorised Transport

When designing a sustainable development it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and reduce environmental impact through reduced fossil fuel consumption and improved regional air quality. This can be achieved by encouraging all users of the development to make use of the energy efficient public transport that is immediately at hand.

Sufficient recreational opportunities are easily accessible to residents, eliminating the requirement for long-distance motorised transport for most recreational activities. This would be a positive feature of the development with regards to sustainability as this clearly avoids greenhouse gas emissions that would otherwise have been produced if residents had to travel long distances for recreational activity.

The provision of bicycle storage spaces within the development, although not a requirement of BASIX, will ensure the development become a more sustainable development in a holistic sense.

7.3 Commuting Using Public Transport

Developments that are within close proximity of good transport nodes with frequent service should be encouraged. The proposed building is located near mass transit and will allow more people to take public transportation to keep their automobiles off the road.

8 INDOOR ENVIRONMENTAL QUALITY

Achieving enhanced Indoor Environment Quality (IEQ) ensures that the building and building services are designed and managed to benefit the health and well-being of building occupants and visitors.

8.1 Asbestos

It is recommended that Asbestos identification and removal procedures be included in the site Environmental Management Plan (EMP) where required.

8.2 Internal Noise Levels

Internal noise levels are a significant factor in determining occupant and customer satisfaction and well-being. The aim of controlling internal noise levels is to encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level. SLR Consulting recommends that all future development in the proposed site meet the recommended criteria and measures provided in accordance with the relevant Building Code of Australia (BCA) requirements.

8.3 Carbon Dioxide Monitoring and Control

Elevated carbon dioxide (CO_2) levels are indicative of inadequate ventilation, affecting the quality of air within an enclosed occupied space, and the health of the occupants. CO_2 monitoring systems can detect elevated concentrations of CO_2 and automatically adjust ventilation supply rates before indoor air quality becomes problematic.

SLR Consulting recommends incorporating a CO_2 monitoring system where appropriate to satisfy BCA requirements.

8.4 Paints and Floor Coverings

SLR recommends the use of low levels of volatile organic compounds (VOC) paints and floor coverings and low formaldehyde wood products where possible as per the City DCP 2012 requirements

9 OPERATIONAL WASTE MANAGEMENT

An operational Waste and Recycling Management Plan is a minimum requirement to meet sustainable building design best practice. As a guideline, the Waste and Recycling Management Plan should include:

- Separate waste and recycling streams.
- Transfer of material to common storage area.
- Communal storage areas.
- Frequency of collection.
- Signage and educational initiatives for occupants.

The proposed development will implement a waste management system that complies with the City of Sydney Council's requirement.

10 CONCLUSIONS

SLR Consulting Australian Pty Ltd (SLR) has been engaged by Meriton Apartments Pty Ltd (Meriton) to provide a qualitative Ecologically Sustainable Design (ESD) assessment, including energy efficiency, for the proposed mixed use development at 230-238 Sussex. The assessment forms part of the Development Application to the City of Sydney Council.

The proposed building is located near multiple public transport options in the Sydney CBD. The proposed development will therefore encourage occupants, hotel guests and staff to use public transportation and minimise automobile use. Sufficient recreational opportunities are easily accessible to residents, eliminating the requirement for long-distance motorised transport for most recreational activities. This would be a positive feature of the development with regards to sustainability as this clearly avoids greenhouse gas emissions that would otherwise have been produced if residents had to travel long distances for recreational activity.

Overall, positive Ecologically Sustainable Design (ESD) and energy efficiency features are currently in place in a number of design areas, incorporating the following:

<u>230-232 Sussex Street Re-Development</u>

- Re-use of the existing façade. Reuse of buildings can significantly reduce the demand for new construction materials. The re-use of the proposed re-development facades is required for heritage considerations, but also leads to a direct environmental benefit.
- Re-use of the existing major structure (eg floors, columns and beams). The re-use of the structure is required for heritage considerations, but also leads to a significant environmental benefit.
- Roof skylights to increase the access to natural lighting, reduce the use of artificial lighting, minimise the impact on the environment and reduce the annual energy consumption.
- Most timber framing of floors and roofs will be retained and conserved and left exposed to view. A construction management plan for the site stated that as a guide removal of more than 10-15% of the floorboards and joists on each level of the main warehouse and the rear warehouse's first floor would be unacceptable.
- The existing cobble stone paving for the cartway and the existing stone base for the courtyard will be retained. New cobble stone paving is proposed for the courtyard to match the existing design intent.
- Sensitive adaptation of the interior.
- Previously unpainted structural elements and wall surfaces will not be painted.

<u>234 -238 Sussex Street Development</u>

- The proposed development will incorporate passive and active energy saving measures such as operable windows to enhance natural ventilation through the residential apartments where appropriate.
- High levels of natural light to the residential apartments and hotel rooms.
- High levels of cross-ventilation. 86.5% of residential units are naturally cross-ventilated. The residential component development therefore complies with the SEPP 65 design code.

- Maximising solar exposure of most residential apartments. 68.5% of the residential apartments in the development will have at least 2 hours sunlight on the Winter Solstice between the hours of 9:00 am to 3:00 pm.
- Incorporation of thermal mass. Concrete slab construction is proposed for all floors throughout the development - concrete has amongst the highest thermal mass capacity of a range of common building products. External walls, structural internal walls and slabs of the proposed development should be predominantly concrete.

The following recommendations have been made to improve upon the existing key sustainability elements of the proposed 230-238 Sussex Street development:

- Line the inside of the roof with a minimum R3.5 insulation;
- External walls insulation in accordance with NCC 2015 (for the retail tenancies and hotel) and BASIX requirement (for the residential apartments);
- Appropriate glazing selection in accordance with NCC 2015 requirements for the commercial component and BASIX requirements for the residential apartments to cut excess solar heat gains;
- Water efficient bathroom and kitchen fittings;
- Gas hot water systems;
- Light efficiency measures in the carparks using motion sensors;
- LED and Fluorescent lighting throughout the project;
- Energy efficient individual reverse cycle 1-phase air-conditioning system and/or Efficient VRV/VRF air conditioning system;
- Minimum 4-star energy efficient dishwashers, refrigerators, and washing machines;
- Electricity sub-metering for significant end uses that will consume more than 10,000 kWh/a;
- Water sub-metering for the swimming pool and other major uses;
- Low levels of volatile organic compounds (VOC) paints and floor coverings and low formaldehyde wood products where possible;
- Carspaces for small or low emission cars; and
- The provision of bicycle storage spaces within the development, although not a requirement of BASIX, will ensure the development become a more sustainable development in a holistic sense.

Recommendations regarding the mechanical ventilation system, domestic hot water, other appliance and operational waste, etc., have also been made within the body of the report.

These features will help to achieve significant reductions in the energy and water required by the development both in building and operation, as well as ensuring that the residential units are more pleasant spaces to reside.

It is recommended that ESD initiatives continue to be developed and implemented during the detailed design stage of the project.

A thermal comfort assessment of the proposed residential development will be carried out (using NatHERS second generation software and BASIX) during the Stage 2 Development Application to provide a quantitative estimate of the development's ESD performance.

A BCA Section J energy efficiency assessment of the commercial component will be carried out during the detailed design stage to reduce green gas emissions by efficiently using energy in the proposed development. A NCC compliance report should minimise any negative heritage impact on the 230-232 Sussex Street redevelopment site.