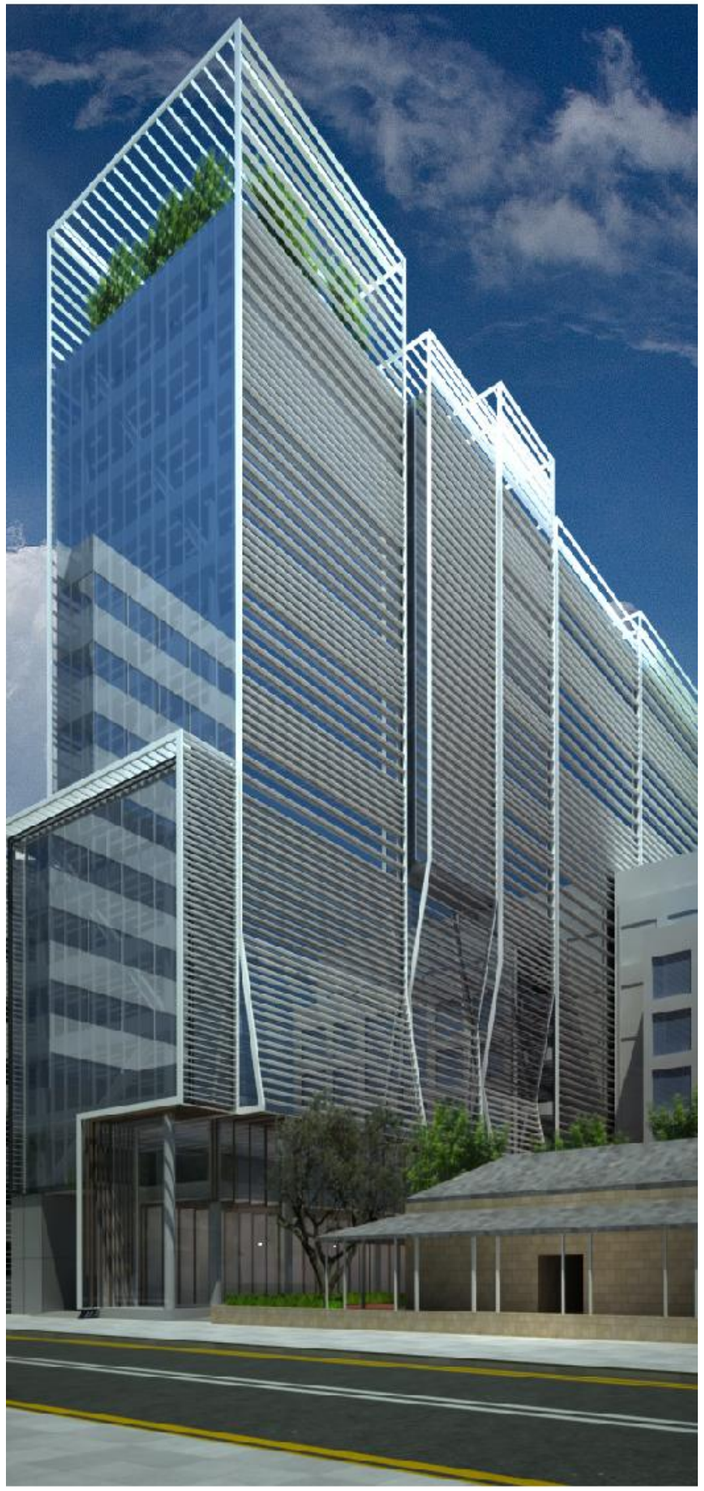
89 George St

Environmental DA Report



Introduction

This report provides an overview of the environmentally sustainable design (ESD) goals for the base building design of the proposed development of 89 George St, Parramatta.

It is proposed that the building will achieve a 5 Star Green Star rating through the implementation of initiatives which will:

- Minimise its energy consumption through smart façade design, efficient air conditioning selection, efficient lighting design and good management of building systems;
- Minimise its water consumption through water recycling and efficient fittings;
- Reduce materials consumption and focus on using low-emission materials; and
- Provide healthier, more comfortable internal conditions for the building occupants.

The key proposed ESD initiatives for this building are:

- Mechanical Initiatives
  - Chilled Beam HVAC System
- Electrical Initiatives
  - Efficient T5 Lighting System design
  - Energy Monitoring
- Hydraulic initiatives
  - Efficient fittings
  - Water recycling
- Management and Planning Initiatives
  - Environmentally Sustainable and Low Emission Building Materials
  - Good Risk Management
  - Good Building Planning
  - Best Practice Construction

It is currently estimated that these strategies would make the building eligible for 5 Star Green Star accreditation, recognising it as an example of “Australian Excellence” in green design.

Green Star Summary

The Green Star Office Design rating tool is a holistic environmental rating scheme for Australian commercial buildings developed by the Green Building Council of Australia (GBCA). It measures environmental performance over a wide range of issues, including water, energy, materials, indoor environmental quality, site considerations and emissions.

A 4-star Green Star Office Design rating represents “Best Practice” placing a development within the top quartile of the industry. 5 star generally describes Australian Excellence, whilst 6 star describes a World Leader in environmental building design.

Following is a summary of the Green Star assessment for the development at 89 George Street. The proposed initiatives are to deliver a building with an aim to achieve a 5 star Green Star rating under Green Star Office Design v2.

Due to the diverse range of topics covered by the Green Star Office Design Rating Tool, it is possible to achieve a Green Star Rating in a wide variety of ways. There are many different combinations of ESD initiatives that could be adopted to achieve a 5 star rating.

The current strategy involves headline initiatives of a chilled beam air conditioning system, rainwater collection for reuse, water efficiency and efficient lighting design incorporating maximum natural daylight use.

A breakdown of the Green star assessment is provided below followed by a summary of the credits targeted and initiatives to achieve those credits.

	Title	Credit No.	Points Available	Points Achieved
Management	Green Star Accredited Professional	Man-1	2	**2**
	Commissioning - Clauses	Man-2	2	**2**
	Commissioning - Building Tuning	Man-3	1	**1**
	Commissioning - Commissioning Agent	Man-4	1	**1**
	Building Users' Guide	Man-5	1	**1**
	Environmental Management	Man-6	3	**3**
	Waste Management	Man-7	2	**2**
		TOTAL	**12**	**12**
Indoor Environment Quality	Ventilation Rates	IEQ-1	3	**2**
	Air Change Effectiveness	IEQ-2	2	**2**
	Carbon Dioxide Monitoring and Control	IEQ-3	1	**1**
	Daylight	IEQ-4	3	**2**
	Daylight Glare Control	IEQ-5	1	**1**
	High Frequency Ballasts	IEQ-6	1	**1**
	Electric Lighting Levels	IEQ-7	1	**0**
	External Views	IEQ-8	2	**1**
	Thermal Comfort	IEQ-9	2	**2**
	Individual Comfort Control	IEQ-10	2	**0**
	Asbestos	IEQ -11	0	**na**
	Internal Noise Levels	IEQ-12	2	**2**
	Volatile Organic Compounds	IEQ-13	3	**3**
	Formaldehyde Minimisation	IEQ-14	1	**1**
	Mould Prevention	IEQ-15	1	**0**
	Tenant Exhaust Riser	IEQ-16	1	**1**
		TOTAL	**26**	**19**
Energy	Energy	Ene-1	Conditional Reqmt	**yes**
	Energy Improvement	Ene-2	15	**9**
	Electrical Sub-metering	Ene-3	1	**1**
	Tenancy Sub-metering	Ene-4	1	**1**
	Office Lighting Power Density	Ene-5	4	**3**
	Office Lighting Zoning	Ene-6	1	**1**
	Peak Energy Demand Reduction	Ene-7	2	**0**
		TOTAL	**24**	**15**
Transport	Provision of Car Parking	Tra-1	2	**0**
	Small Parking Spaces	Tra-2	1	**1**
	Cyclist Facilities	Tra-3	3	**3**
	Commuting Public Transport	Tra-4	5	**4**
		TOTAL	**11**	**8**

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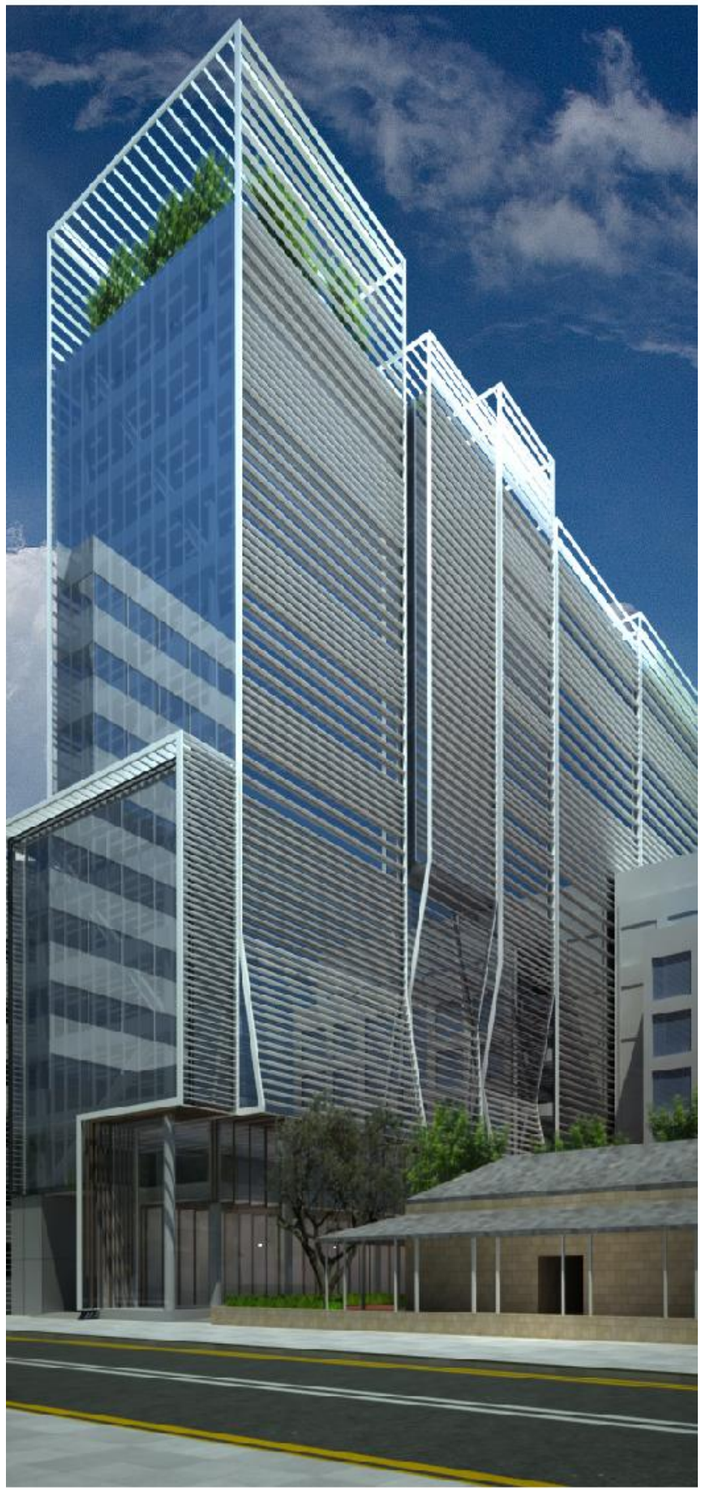

Water	Occupant Amenity Potable Water Efficiency	Wat-1	5	**5**
	Water Meters	Wat-2	2	**2**
	Landscape Irrigation Water Efficiency	Wat-3	1	**1**
	Cooling Tower Water Consumption	Wat-4	4	**2**
	Fire System Water Consumption	Wat-5	1	**1**
		TOTAL	**13**	**11**
Materials	Recycling Waste Storage	Mat-1	2	**2**
	Re-use of Façade	Mat-2	0	**na**
	Re-use of Structure	Mat-3	0	**na**
	Shell and Core or Integrated Fitout	Mat-4	3	**0**
	Recycled Content of Concrete	Mat-5	3	**2**
	Recycled Content of Steel	Mat-6	2	**1**
	PVC Minimisation	Mat-7	2	**1**
	Sustainable Timber	Mat-8	2	**0**
		TOTAL	**14**	**6**
Land Use & Ecology	Ecological Value of Site	Eco-1	Conditional Reqmt	**yes**
	Re-use of Land	Eco-2	1	**1**
	Reclaimed Contaminated Land	Eco-3	2	**0**
	Change of Ecological Value	Eco-4	4	**1**
	Topsoil and Fill Removal from Site	Eco-5	1	**0**
		TOTAL	**8**	**2**
Emissions	Refrigerant ODP	Emi-1	2	**2**
	Refrigerant GWP	Emi-2	1	**0**
	Refrigerant Leak Detection	Emi-3	1	**1**
	Refrigerant Recovery	Emi-4	1	**1**
	Watercourse Pollution	Emi-5	2	**2**
	Reduced Flow to Sewer	Emi-6	4	**2**
	Light Pollution	Emi-7	1	**1**
	Cooling Towers	Emi-8	1	**0**
	Insulant ODP	Emi-9	1	**1**
		TOTAL	**14**	**10**
TOTAL CREDITS			**122**	**83**
Innovation	Innovative Strategies and Technologies	Inn-1	5 points in total for Inn-1,2&3	**0**
	Exceeding Green Star Benchmarks	Inn-2		**0**
	Environmental Design Initiatives	Inn-3		**0**
		Total	**5**	**0**
OVERALL WEIGHTED SCORE:				**66**

Notable inclusions within the 5 star scheme include:

100% Management credits targeted:

- Full commissioning clauses
- Building tuning every 12 months after quarterly reviews

Indoor Environmental Quality

- 150% improvement on outdoor air quantities
- Access to views
- High levels of thermal comfort
- Low levels of internal noise from mechanical systems
- Use of shading elements to mitigate glare
- Low/no levels of VOC in all paints, carpets, adhesives and sealants
- Inherent CO_2 control and mould prevention through chilled beam system

Energy

- 5 Star + 20% ABGR energy performance with passive chilled beams, efficient lighting and use of daylight
- 2 watts/m^2/100 Lux lighting levels provided by efficient T5 lighting systems
- Cogeneration

Transport

- Secure bicycle parking provided for 10% of building staff and visitors
- Promotion of public transport through proximity to public transport hubs
- Provision of small parking spaces

Water

- Use of water efficient fittings
- Use treated rain water for toilet flushing
- Operating cooling towers at 6 cycles of concentration
- Fire System water re-use
- Low flow irrigation where applicable

Materials

- Recycling waste storage area
- Use recycled aggregate in concrete
- Use of steel with recycled content greater than 50% for 60% of total steel
- 60% (by cost) reduction of PVC materials
- Use of sustainable timber in all building and construction works

Land Use & Ecology

- Re-use of previously developed site
- Cut and fill requirements balanced on site with no exportation of top soil from site
- No decrease in the ecological value of the site

Emissions

- No Ozone Depleting Potential (ODP) substances used within the building
- Refrigerant leak detection
- Provision for automatic refrigerant pump down
- Light pollution to be eliminated from the site
- Collection, detention and treatment of stormwater
- Flow to sewer reduced by efficient fittings and black water treatment

Advanced Environmental

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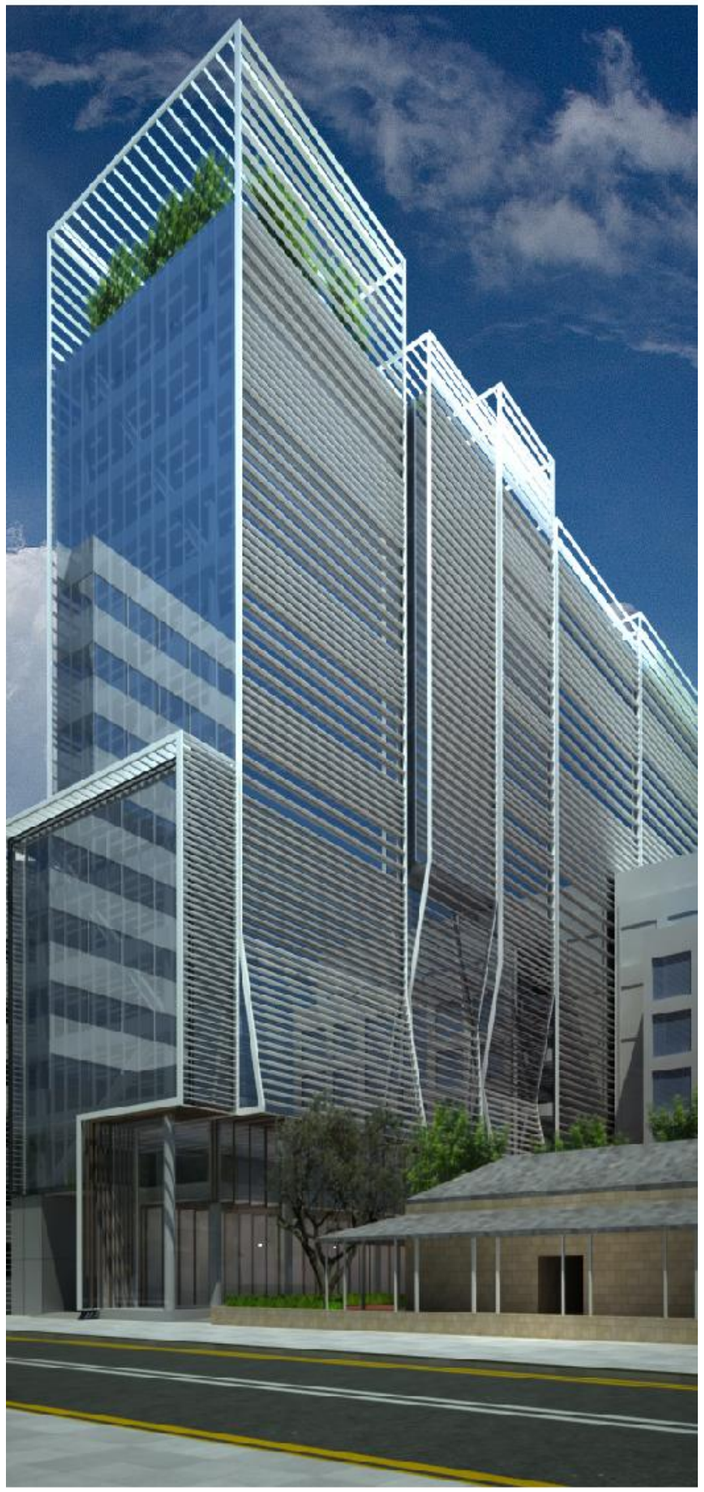


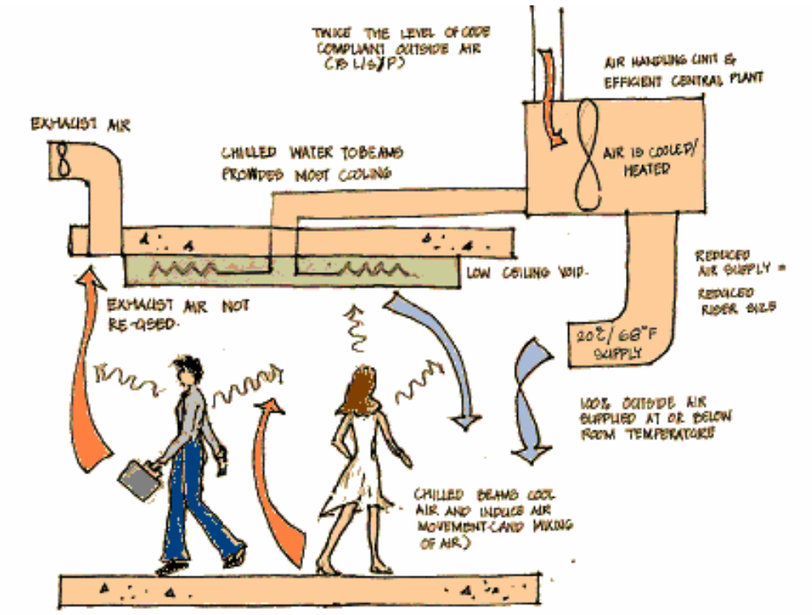
Mechanical Initiatives

Chilled Beams HVAC System

The passive chilled beam system recommended for 89 George Street is an air conditioning system that supplies *cooling* to the space separately from the *fresh air requirements*.

Cooling is supplied through ceiling suspended chilled beams. The chilled beams are supplied with chilled water allowing them to act as a cooling element. The cooling is transmitted by natural convection currents established by the direct cooling of the air near the ceiling.

The air supplied to the space is 100% outside air (there is no recirculation). In a system that cools the supply air (like VAV), this would provide a major energy loss. However as chilled beams provide cooling directly to the space, this is feasible. As a result of the increased outside air rates humidity control is required for chilled beam systems to avoid condensation.



Conventional VAV A/C systems provide cool air that is then mixed into the warm air in the space to achieve a final comfortable temperature. The cooling required of the chilled beams is not diluted in this manner, so the chilled water required to generate the cooling can be at a higher temperature in chilled beam systems compared to a conventional VAV systems. The provision of higher temperature chilled water creates the potential for significant chiller energy savings.The principle benefits of a chilled beam system as opposed to a VAV system are:

- Potential HVAC energy savings of up to 30% due to the higher chilled water temperature and reduced fan energy requirements
- Improved thermal comfort in the space
- Better ventilation rates within the space (no air recirculation)
- Excellent air change effectiveness
- Reduced riser space requirements
- Reduced ceiling void requirements (meaning a smaller floor to floor height requirement)

Efficient plant

Further to the system selection, the plant and component parts of the system will be selected for their energy efficiency. One of the benefits of a chilled beam system is that it enables the use of two chillers – a high temperature chiller to provide chilled water to the beams, and a low temperature chiller to provide cooling to the air and for dehumidification requirements.

The high temperature chiller can achieve a relatively high COP compared to the low temperature chiller, reducing energy consumption of that component of the system.

High efficiency motors and variable speed drives on pumps and air handling plants will further reduce energy consumption.

Green Star Credits

The use of a well designed chilled beams system implicitly satisfies a number of credits under the Green Star Office Design v2 Rating Tool.

A brief description of the credits follows.

IEQ – 1: Ventilation Rates: Chilled beams can provide a 100% improvement on AS 1668.2-1991 requirements for outside air provision.

IEQ – 2: Air Change Effectiveness (ACE): Chilled beams can provide an ACE of greater than 0.95 for 90% of the NLA.

IEQ – 3: CO_2 monitoring and Control: Chilled beams will make use of 100% outside air with no recirculation.

IEQ – 9: Thermal Comfort: A predictive Mean Vote of between -1.0 and 1.0 could be maintained for 98% of the occupied hours of the year.

IEQ – 15: Mould Prevention: Humidity will be actively controlled in the space (60% RH) and the supply ductwork (80% RH).

ENE – 1 & 2: Energy & Energy Improvement: The building has the potential to exceed the minimum ABGR rating of 4 stars.

The provision of a chilled beam HVAC system is a major ESD initiative for 89 George Street.

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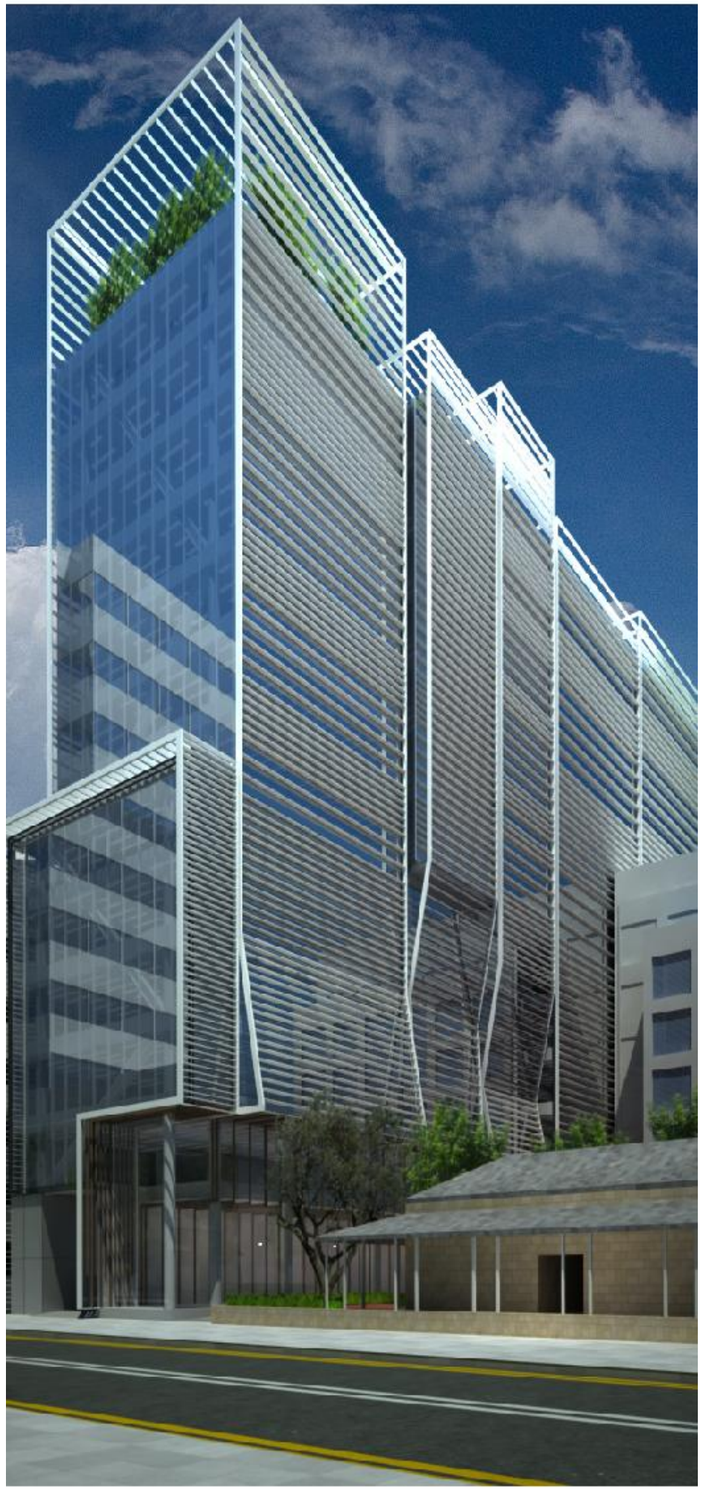


Electrical Initiatives

Efficient T5 Lighting System Design

The lighting system design has significant impacts on the indoor environmental quality as well as the energy consumption of the building. A T5 system would make use of T5 lamps (instead of conventional T8 lamps), high frequency ballasts and be optimally zoned for each 100m² of NLA.

The major benefits of a T5 lighting system are:

- Improved energy efficiency
- Reduced power density (kW/100 lux)
- Improved indoor environmental quality

Green Star Credits

A well designed lighting system can improve the building ABGR performance while also making the building eligible for other points under the Green Star Office Design v2 rating Tool.

ENE – 1: Energy: The building has the potential to achieve a 4 star ABGR CO_2 reduction.

ENE – 2: Energy Improvement: The building has the potential to exceed the minimum ABGR rating of 4 stars.

ENE – 5: Office Lighting Power Density: the provision of a suitably designed T5 lighting system is standard practice for modern commercial buildings.

ENE – 6: Office Lighting Zoning: Standard provisions in a suitably design modern lighting system include lighting zones of less than 100m².

IEQ – 6: High Frequency Ballasts: Typical for commercial office T5 lighting systems.

Energy Monitoring

Electrical energy consumption is the biggest contributor of greenhouse gas emissions from commercial office buildings. To effectively manage electrical consumption, it is essential for building managers to have sufficient data to monitor consumption and compare it to historical values.

Electrical metering for all large uses (greater than 100kVa) and all tenancies will allow effective energy monitoring of the building. This will allow building managers to fine tune operational procedures and link tenant facilities charges to consumption.

Green Star Credits

There are two credits which reward energy monitoring in the Office Design v2 Rating Tool:

ENE – 3: Electrical Sub-Metering: Effective energy monitoring is essential in effectively tracking the ABGR performance of the building and identifying operational issues.

ENE – 4: Tenancy Sub-metering: Effective tenancy monitoring allows facilities charges to be linked to use, providing a financial incentive to reduce energy consumption.

Hydraulic initiatives

Water Efficiency

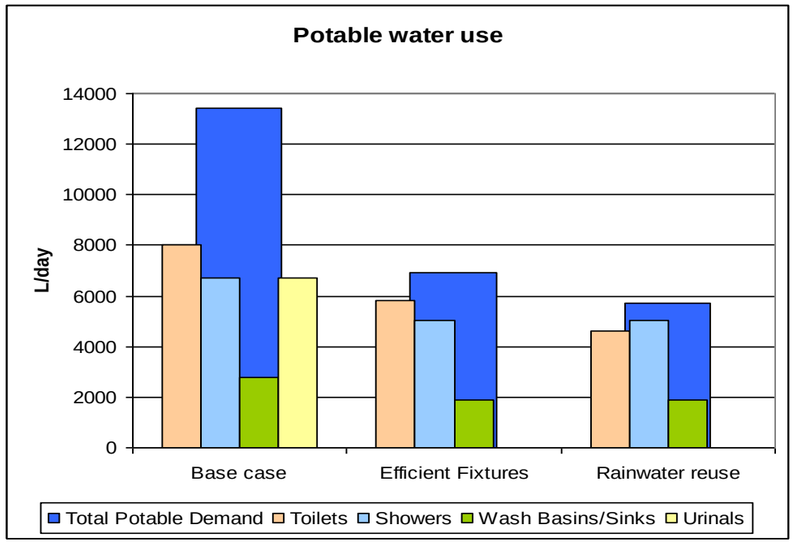
A general approach to water efficiency is critical in achieving a Green Star Office Design 5 Star rating. There are three main areas of focus in reducing potable water consumption of a building.

The first is to reduce the demand for water for all occupant amenities and building services. The second is to have a leak detection system that will help reduce wastage of potable water. The third is to look at alternative water supplies that can replace potable water for applications where non-potable water is sufficient (e.g. flushing toilets).

The initiatives described in the Green Star Office Design technical manual are aimed at achieving better water efficiency by attending to these areas of potential saving.

The proposed components of a water saving strategy for 89 George Street are:

- Use of water efficient fittings (4A rated fittings, 5A rated showers and dual flush toilets as well as waterless urinals) to reduce the daily demand for potable water
- Installation of water metering for all major users linked to the BMS to provide leak detection
- Efficient drip irrigation system to reduce water use on landscaped areas
- Rainwater collection providing toilets in the building to supplement the supply of potable water for toilet flushing
- Installation of a fire test water system that allows the collection and re-use of the water.



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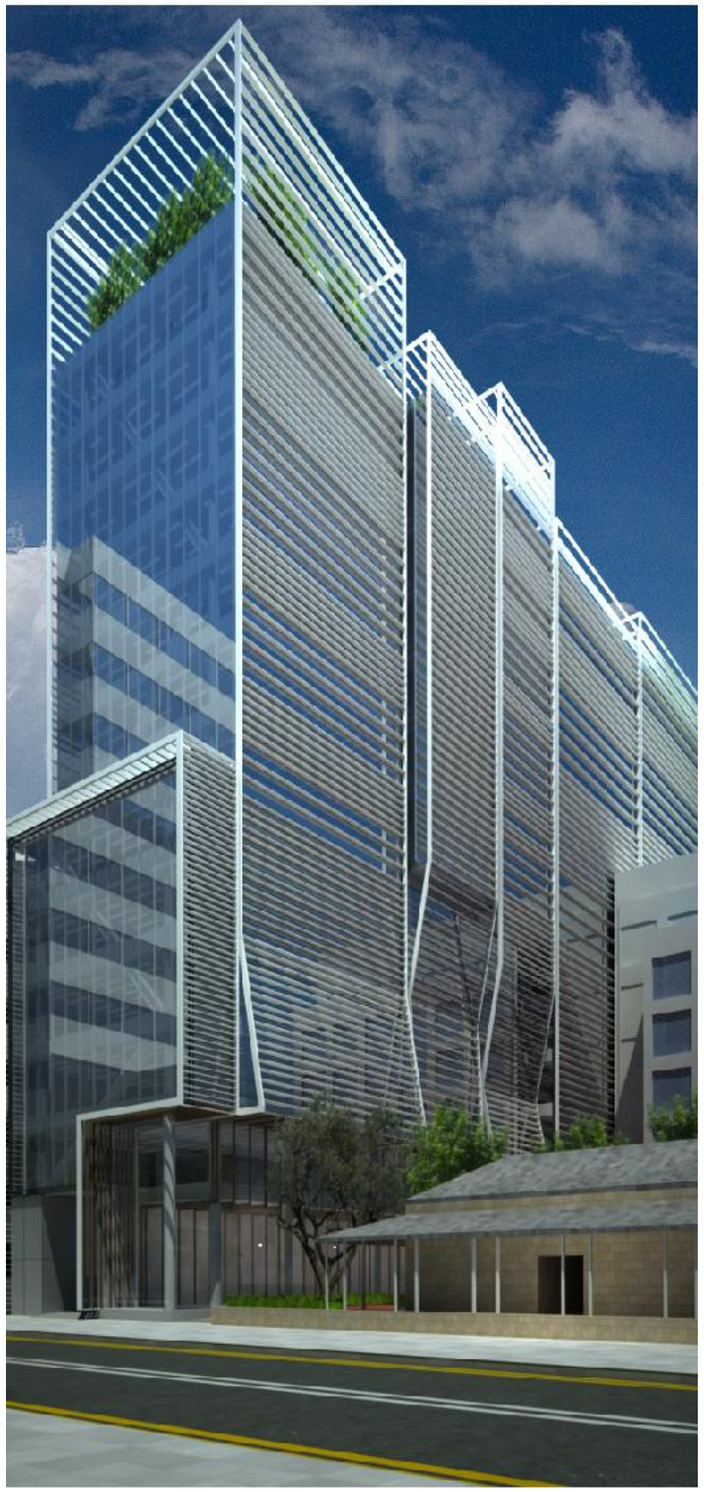

Rainwater Harvesting System

A rainwater harvesting system may be installed to supply treated rain water to all non-potable applications throughout the building, including though not limited to:

- Toilets
- Irrigation systems

Our preliminary water balance indicates that from our available catchment it would be practical to reticulate non potable water to toilets.

The rainwater harvesting system would incorporate the following components:

- A storage tank would be located below ground level, with direct emergency relief overflow to the site stormwater drainage system. Access hatches should have unrestricted entry.
- Treatment and pressurisation plant. Including in-line filtration and ultra violet disinfection equipment, located within a dedicated basement area plant room 4m x 3m in size.
- Reticulation to non potable. An additional 500mm x 200mm riser shaft would be required.

Water Metering

Installation of water sub-meters on all major water uses in the building and include as a minimum cooling towers, wash down and irrigation, fire hydrant and sprinkler services, all retail tenancies and hot water services. These meters must be linked to a BMS or monitoring system to provide a leak detection system.

Tenancy meters may be installed in riser cabinets.

Metering of major plant item or equipment would require a spatial allowance 1m x 2m each. Meters should be installed within plant areas.

Fire System Water Consumption

Fire water supply used for periodic test procedures to be collected and reintroduced into fire systems. Specifically, discharge from fire hydrant and sprinkler remote test drains and pumps shall be piped into the fire water storage tanks.

There are no foreseeable additional spatial requirements for this component. Pipe routes would need to be coordinated with other services.

Green Star Credits

The reduction in use of potable water is rewarded in the Green Star Office Design v2 Rating Tool. Points are available under a number of credits that make ESD initiatives for reducing potable water consumption valuable when applying for a Green Star Rating.

WAT– 1: Occupant Amenity Potable Water Efficiency: To encourage the provision of systems that reduce the potable water consumption of building occupants

WAT – 2: Water Metering: To encourage the provision of systems that monitor water use and provide a leak detection system.

WAT – 3: Landscape irrigation Water Efficiency: To encourage the design of systems that reduce potable water consumption for landscape irrigation.

WAT – 5: Fire System Water Consumption: To reduce the use of potable water for the building's fire protection systems.

EMI – 6: Reduced Flow to Sewer: By virtue of WAT-1 potable water flow to sewer is reduced.

Management and Planning Initiatives

Environmentally Sustainable and Low Emission Building Materials

The choice of materials offers an opportunity to implement ESD strategies. It has a significant impact of the environmental sustainability and the internal environment of the building.

Many materials used in building interiors (generally paints, carpets, sealants or composite wood products) release volatile organic chemicals (VOC) or formaldehyde into the air in the building, reducing the quality of the internal environment.

The choice of materials can also have a sustainability impact. Some materials used as insulation release gasses with Ozone Depleting Potential (ODP). Further deterioration of the ozone layer has the potential for significant environmental damage.

The choice of timber is also important as much timber is produced in an unsustainable manner.

The initiatives recommended for 89 George Street are aimed at improving the indoor environmental quality of the building and ensuring that unsustainable practices are discouraged.

Specifically:

- The specification of low-VOC paint, carpet and adhesives
- The specification of low emission formaldehyde composite wood
- The specification of FSC certified or recycled timber
- The specification of zero ODP insulation
- Minimisation of PVC usage in mechanical and hydraulic systems

Green Star Credits

Green Star Office Design rewards the use of environmentally sustainable and low emission materials in the building construction.

IEQ – 13: Volatile Organic Chemicals: To encourage the use of paints, carpets and sealants that are low VOC. Low VOC paints, carpets and sealants shall be used internally to the base building.

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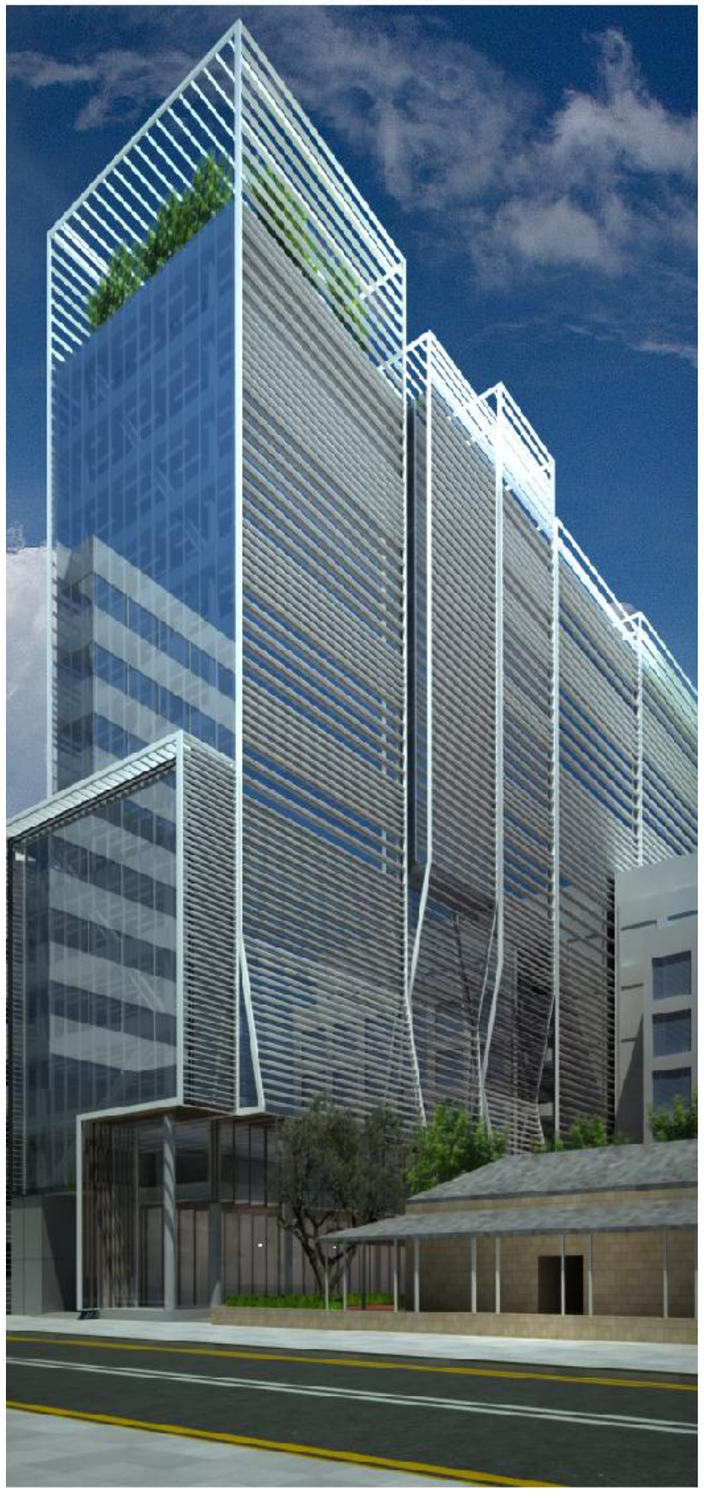

IEQ – 14: Formaldehyde Minimisation: To encourage the use of composite wood products that are low emission formaldehyde. There is typically little composite wood in the base building; however any that is used must be low emission formaldehyde.

MAT – 7: PVC Minimisation: To encourage the reduction of PVC products. The specification of alternatives to PVC for pipes, cable conduits, finishes etc.

MAT – 8: Sustainable Timber: To encourage the use of recycled or sustainable timber. The provision of Forest Stewardship Council (FSC) certified or recycled timber should be specified.

EMI – 9: Insulant ODP: To encourage the use of insulation materials that do not contain ozone depleting substances. Insulation must be specified not to contain substances with an ozone depleting potential.

Building Commissioning

Building commissioning is a critical factor in the planning and design of any new development. A number of ESD initiatives are aimed at improving the overall management process.

These generally relate to the commissioning of the building at the end of the construction phase and to the provision of information for occupants and tenants to run the building inline with its design intent.

Good management allows the design potential of the building to be realised. It means that the design initiatives are more likely to work at their optimum efficiency. This is critical in terms of ensuring the performance of the building in the future. It is also an important step if an “As Built” Green Star rating is to be pursued.

Green Star Credits

The manner in which these initiatives are eligible for points under the Green Star Office Design v2 Rating Tool is shown below.

MAN – 2: Commissioning Clauses: Rigour during commissioning is recommended due to the unique nature of the services design.

MAN – 3: Commissioning – Building Tuning: A 12 month building tuning period is recommended as part of the ABGR rating process

MAN – 4: Commissioning Agent: Ensuring the person supervising commissioning is an objective 3rd party is recommended to provide objective advice due to the unique nature of the services.

MAN – 5: Building Users Guide: This is a simple guide for the users, occupants and tenants of the building containing information on the energy and environmental strategy, monitoring and targeting, building services, transport facilities, materials and waste policy, and expansion/re-fit information. It is important in satisfying ABGR energy requirements and a potential Green Star Rating of the completed asset.

Good Building Planning

There are a number of ESD initiatives that are all part of good building planning. The site position, floor plate design, landscaping and transport facilities are all areas where significant energy, water, waste management and indoor environmental quality improvements can be made.

The internal environment of the building is largely affected by the degree of connectivity that occupants have with the outside. The design of the façade has major impacts on the natural lighting and external views experienced by occupants. The removal of internal pollutants from printing and copy areas must be a consideration in maintaining the indoor environmental quality. The internal noise levels are also an important consideration for the indoor environmental quality of the building.

The provision of cyclist facilities for occupants and visitors and the proximity of the building to public transport are important in reducing the dependence of building users on cars as their mode of transport. Encouraging alternative means of transport can mean a significant reduction in air pollution and greenhouse gas emissions from private motor vehicles.

Recycling within commercial buildings is a key ESD initiative. Sufficient dedicated space that has adequate access for recycling companies to retrieve the waste is an important consideration when planning the building layout.

The development site also has an environmental impact. By building on a site that has already been developed and not further increasing the environmental impact of the site, the building fulfils ESD development initiatives. This is rewarded in the Green Star Office Design v2 technical manual.

Finally emissions of the building into the surrounding environment should also be considered when planning the building. Light pollution should be reduced by not allowing any light beam to be directed onto neighbouring properties or into the sky without falling on a surface that is intended to be lit.

Stormwater flowing off the site will pick up any pollutants that are present on the ground (such as oil) and introduce them into the water system. A stormwater treatment system is recommended to treat any stormwater leaving the site before it enters the stormwater system.

Green Star Credits

The Office Design v2 Rating Tool rewards the following planning initiatives:

MAN – 1: Green Star Accredited Professional: The presence of a Green Star Accredited professional on the design team.

IEQ – 4: Daylighting: The provision of a Daylight Factor of greater than 2.5% for 30% of the NLA.

IEQ – 5: Daylight Glare Control: Providing fixed external shading to reduce the glare from direct sunlight through the façade.

IEQ – 8: External Views: Ensuring that 30% of the NLA is within 8m of vision glazing.

IEQ – 12: Internal Noise Levels: Ensuring that internal noise is within acceptable levels. Services are expected to comply. Acoustic confirmation is required for general noise levels.

IEQ – 16: Tenant Exhaust Riser: Providing an exhaust riser for the removal of indoor air pollutants from printing and photocopy areas.

TRA – 1: Provision of Car Parking: There is no car parking planned, so the building has less than 50% of the minimum local planning allowances.

TRA – 3: Cyclist Facilities: The provision of cyclist facilities (bicycle storage, lockers and showers) for occupants and visitors.

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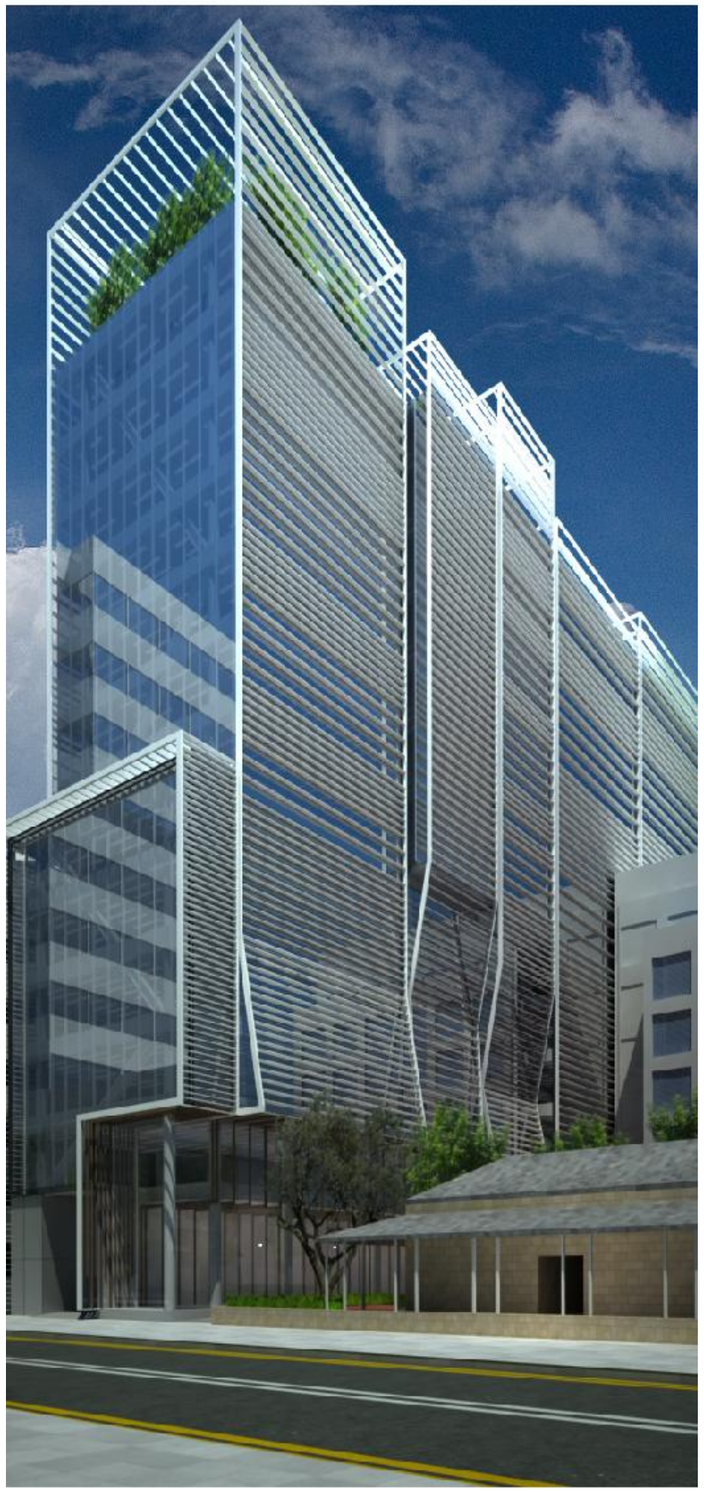


TRA – 4: Commuting Public Transport: The building site is close to transport hubs in the CBD, encouraging the use of public transport.

MAT – 1: Recycled Waste Storage: The inclusion of storage space specifically for the sorting and storage of recyclable waste from the building.

ECO – 2: Reuse of Land: Encouraging the use of land that has already been previously developed.

ECO – 4: Change in Ecological Value: Minimisation of ecological impact arising from the development.

EMI – 7: Light Pollution: Encourage design that reduces the dispersion of unnecessary dispersion of light into the night sky or onto neighbouring property.

EMI – 5: Watercourse Pollution: To reduce the chance of natural watercourses being polluted by run-off from impermeable surfaces on the building site during high rainfall periods.

ESD initiatives that are satisfied by the planning of the building are critical in that they must be committed to early in the design process.

Best Practice Construction

ESD initiatives that indicate best practice construction are recommended for 89 George Street. Waste management, building materials, choice of refrigerants and the provision of an Environmental Management Plan are all eligible for points under the Green Star Office Design v2 rating Tool.

The key components of best practice construction from an ESD perspective are:

- ISO14001 certified contractors
- On-site waste recycling
- Installation of refrigerant leak detection and recovery on chillers
- Use of chillers with zero ODP refrigerant
- Ensuring that structural steel and concrete have a significant recycled component

Green Star Credits

The Green Star Office Design v2 Rating Tool gives credit for the initiatives mentioned above under the following credits.

MAN – 6: Environmental Management Plan: Ensure that contractors are ISO 14001 certified and apply a compliant EMP.

MAN – 7: The recycling of 80% of construction and demolition waste

MAT – 6: Recycled content of structural steel: Concrete re-enforcement typically has a high percentage of recycled content. Provided the structure is substantially concrete (not post-tensioned), we expect this credit to be satisfied.

MAT – 5: Recycled content of structural concrete: 20% of structural concrete must make use of industrial waste product for cement.

EMI – 1: Refrigerant ODP: Ensure all refrigerants have an ozone depleting potential of zero. A large chilled water plant as nominated for this building normally complies.

ESD Principles in each building stage

There are a number of initiatives which can be considered to be specifically associated with different stages of the building. The section below summarises the Principles applied in each stage.

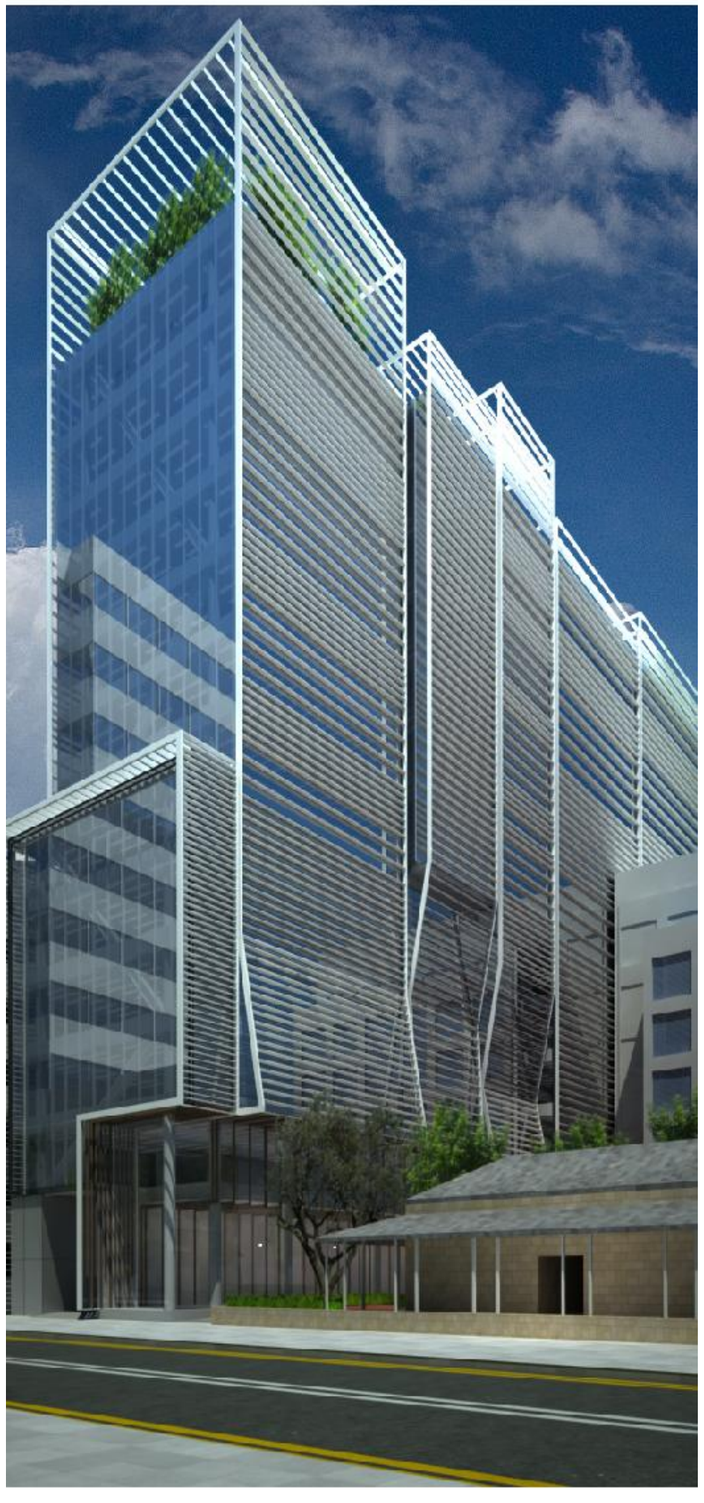
ESD Principles – Design Stage

The design stage is the most critical stage for ensuring potential ESD initiatives are incorporated. This is when considerations for building form and system selection can be made to enhance energy and water efficiency and good indoor environment quality can be promoted.

Principles to be employed during the design stage are shown in the table below:

Building form and orientation for passive design	controlling solar gain through the use of shading elements on the facade
	allowing good indirect daylight penetration through narrow floor plates
	Promoting efficient system selection. Only if the passive design of the building maintains cooling loads below a certain level can an efficient chilled beams system be employed. This involves initiatives such as shading, orientation, glazing selection
Mechanical Design	Selection and design of the chilled beam system and selection of efficient plant components
Electrical Design	Selection of light fittings to reduce energy consumption
	Design of lighting system to enable efficient controls
	Design of electrical system to enable monitoring of electrical consumption and water use in the building
Hydraulic design	Efficient fixtures and fittings specification will reduce potable water consumption
	Design of water reuse systems to further reduce potable water consumption
	Design of efficient monitoring and metering of water to find leaks and unnecessary uses
Transport	Promotion of alternative forms of transport by providing bike parking and showering facilities, preferred parking for fuel efficient vehicles and proximity to public transport through site selection

89 George St
Environmental DA Report



Construction stage

During the construction stage there are a number of ESD principles which will be employed to reduce materials consumption, improve the indoor environment quality of the finished building and ensure efficient operation of the systems. These principles are summarised in the following table.

Commissioning	Comprehensive pre-commissioning, commissioning and quality monitoring will be carried out to ensure efficient operation of building hydraulic, electrical and mechanical systems
Waste Management	An EMP will be prepared for the site and 80% of all construction waste will be reused or recycled
Materials selection	Materials installed in the building during construction will be low VOC, low ODP and low emission formaldehyde to improve the indoor air quality of the finished building
	Industrial waste product will replace some of the Portland Cement in all concrete mixes and recycled aggregate will be used to reduce materials consumption
	60% of steel will have a recycled content of 50% or greater to reduce materials consumption
	PVC use will be reduced by 30%

Operational stage

The operational stage of the building is when the careful design and construction initiatives will be actioned to achieve reductions in resource consumption and improvements in indoor environment quality. The initiatives employed in 89 George St include:

Building Tuning	After project handover all building systems will be tuned and monitored monthly to ensure proper running and operation
Building Users Guide	A building users guide will be provided to the building operator and the occupants to explain the correct management of the building
Improved ventilation	Ventilation rates are increased 100% above the minimum requirement of the standard to improve indoor air quality of the occupied building. The mechanical system is designed to provide good air change effectiveness throughout the entire floor plate and only 100% outdoor air will be provided to ensure good air quality
Lighting	High frequency ballasts included in the electrical design to reduce eye strain on the occupants. Dimmer switching on perimeter lights linked to daylight sensors will reduce energy consumption by lighting when sufficient daylight is available
Reduced energy consumption	Efficient operation of the air conditioning and electrical systems will lead to reduced energy consumption compared to the current average. The building aims to achieve a Green Star energy rating equivalent to a 5 Star NABERS energy rating.
	Electrical sub-metering will enable detailed monitoring of all energy consumption to assist efficient operation
	Lighting power density is reduced to minimise energy consumption
Recycling Waste	A dedicated recycling waste storage area is provided to facilitate ease of recycling during the operational stages of the building

Conclusion

Projected Green Star Performance

The initiatives described above achieve 66 points under the Green Star Office Design v2 Rating Tool. The breakdown of where the points are awarded is shown in the table on the following page.

A summary of the performance of the building under each of the Green Star categories is:

Management: 12 points

Indoor Environmental Quality: 19 points

Energy: 15 points

Transport: 8 points

Water: 11 points

Materials: 6 points

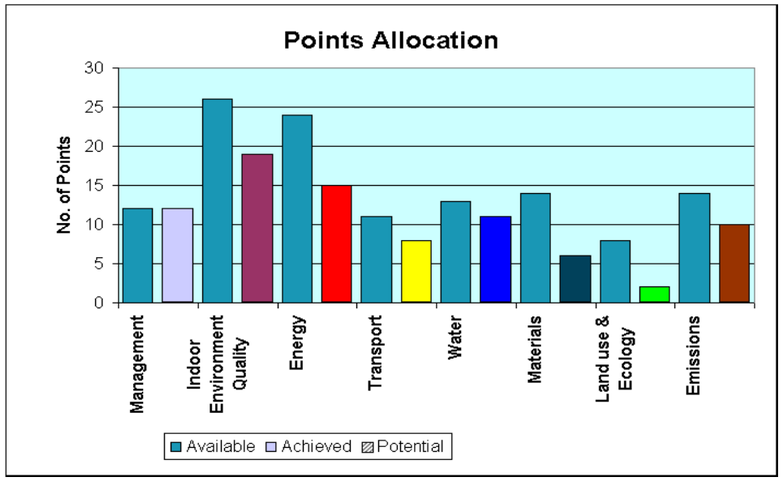
Land Use and Ecology: 2 points

Emissions: 10 points

Total (unweighted): 83 points

Total: 66 points

A total of 66 points means that the building is eligible for a 5 star Green Star Rating under the Green Star Office Design v2 Rating Tool including a 10% safety margin.



A 5 Star Green Star Rating for the building will provide a best practice level of sustainability

Advanced Environmental