If a building becomes architecture, then it is art. Clearly, if a building is not functionally and technically in order, then it isn't architecture either – it's just a building.
Arne Jacobsen

Mechanical Engineering
Lighting Design
Sustainable Design
Electrical Engineering

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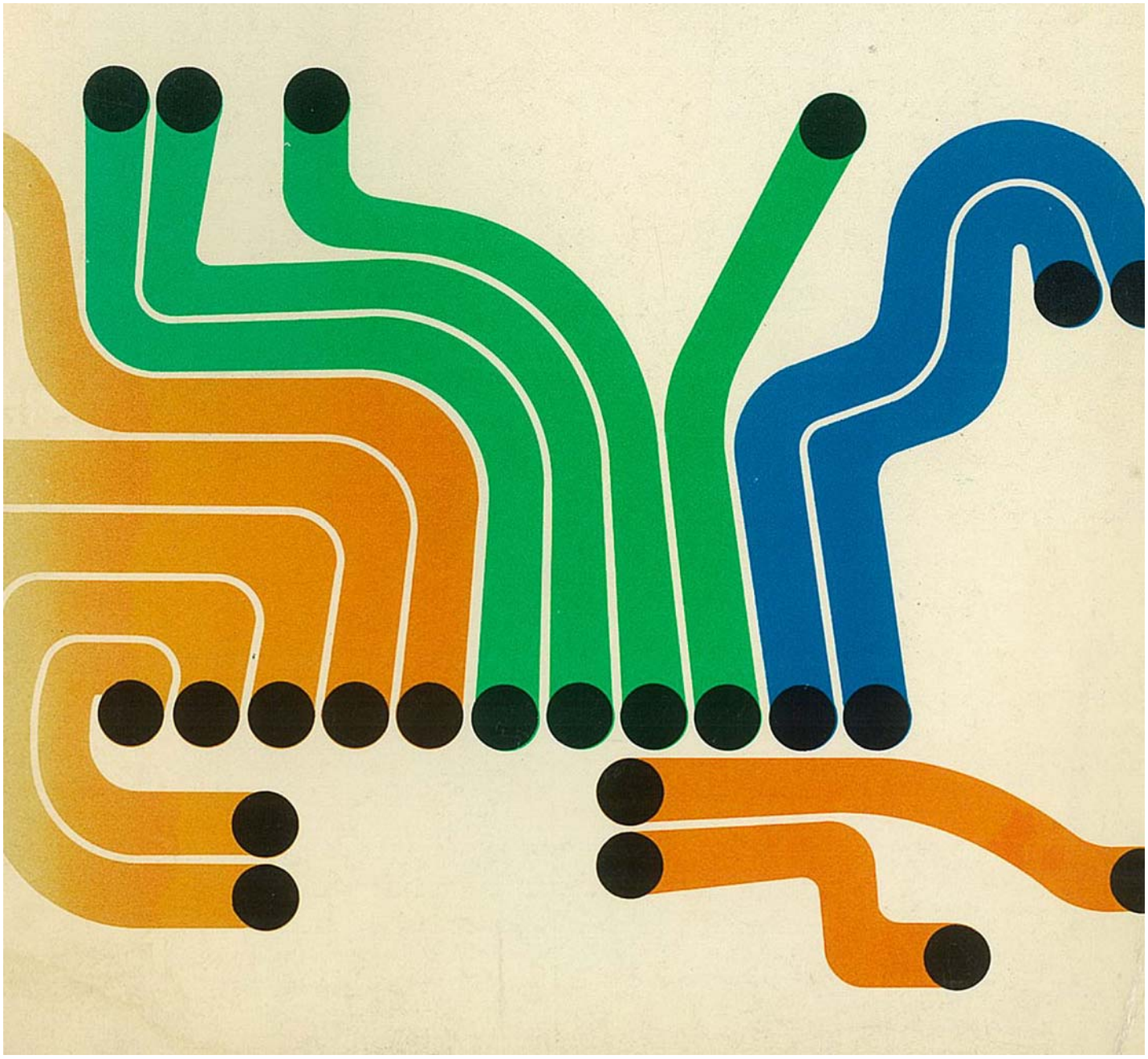
SUSTAINABLE DESIGN

STEENSEN VARMING

University of Sydney F23 Building
DA - ESD Report



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1.0 Executive Summary

This report has been prepared by Steensen Varming for inclusion in the Development Application submission for the University of Sydney (UoS) F23 project to be located at the UoS Campus.

The key intent of this report is to provide a response to the Environmentally Sustainable Design (ESD) criteria stated in the project Secretary's Environmental Assessment Requirements (SEARs) for State Significant Development (SSD) 7055.

The SEARs were issued by the Department of Planning and Environment on 28.05.2015, and include of the following requirements for energy efficiency and ESD:

6. Ecologically Sustainable Development (ESD)

Item	Secretary's Environmental Assessment Requirements	Project Response to DGR
1	Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and ongoing operation phases of the development.	The ESD initiatives proposed for the F23 project aim to reduce the environmental impacts typically associated with buildings during the construction and ongoing operation of the building. The F23 project utilises a resource hierarchy approach, with emphasis on avoiding then reduction of energy, water, materials etc. The outcome of the resource hierarchy approach is to ensure the F23 building aligns with the ecological sustainable development principles of Clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. Refer to section 3.0 for the proposed ESD initiatives.
2	Demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.	The F23 project is not targeting a formal certification against an accredited rating scheme. The project will target a 'Gold Ambition Level' under the UoS Sustainability Framework. Refer to section 2.0 for the F23 sustainability goals.
3	Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy.	Refer to sections 3.1 – 3.6 for Sustainable Design Initiatives. Refer to 3.5 for water sensitive urban design strategies.

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The University is committed to deliver functional, flexible, resource efficient and sustainable buildings. A Sustainability Framework developed by the University of Sydney has been utilised on the F23 project to ensure integration of efficient and sustainable development measures.

This report presents a concise summary of the design decisions made during the Schematic design stage, and outlines the key ESD opportunities and initiatives that are likely to be implemented into the F23 project. The strategies presented in this report are based on the current architectural design developed by Grimshaw Architects.

To ensure a sustainable outcome, the following are key strategies being addressed within the proposed design:

- Incorporate a high-performance building envelope, to ensure energy efficiency as well as occupant comfort (including thermal, visual and acoustic comfort);
- Incorporate appropriate passive and active design strategies to ensure a low-energy as well as low-maintenance design outcome;
- Adopt water sensitive urban design principles through the incorporation of rainwater harvesting and integration with the University of Sydney campus wide storm water strategy; and
- Adopt practices to minimise demolition, construction and operational waste including recycling of demolition and construction waste.

To benchmark the environmental performance of the building, the project will achieve a Gold sustainability ambition level using the UoS Sustainability Framework. For more information regarding the UoS Sustainability Framework, refer to section 2.2.

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2.0 Targets / Benchmarks

In addition to the Secretary's Environmental Assessment Requirements (SEARs), the following environmental targets are aspired by the University:

- Exceed the requirements of Section-J of the National Construction Code (NCC) for energy-efficiency in building fabric and building services / systems
- Achieve a 'Gold Level' ambition level against the University of Sydney's Sustainability Framework v2. Refer to Section 2.2 for further details.

2.1 NCC Section-J

Section-J of the National Construction Code (Previously known as the Building Code of Australia) 2015 relates to "energy efficiency" of buildings". Section J is a minimum performance target for standard buildings, and specifies minimum performance targets known as deemed-to-satisfy (DTS) requirements, for building fabric and services.

The proposed UoS F23 project aims to exceed the DTS requirements of Section-J. A JV3 methodology is being applied for the project to demonstrate the improvement beyond DTS.

Any improvement in energy-efficiency beyond the minimum requirements of Section-J, will also contribute towards the project's Gold Level sustainability ambition level under the UoS Sustainability Framework.

2.2 UoS Sustainability Framework

The UoS Sustainability framework draws from the best national and international environmental building rating systems and best design practices. The Sustainability Framework provides the University with an equivalent rating system to demonstrate industry best practice for sustainable design. Key to this approach is a 'from first principles design' in the minimisation / reduction of energy use, water consumption materials, waste, etc. The UoS framework will also address other key sustainability criteria such as occupant comfort, amenity, transport, ecology, user awareness and education.

Similar to other accredited rating systems, the UoS framework requires a formal submission of design and as-built documentation to the University for review and validation, to demonstrate the requirements of the Framework have been achieved.

The University has stated that the approach to sustainable design for the F23 building is through the incorporation of the 'University of Sydney Sustainability Framework'. This is to ensure that the proposed F23 building aligns with the core sustainability aspirations of the University.

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The Sustainability Framework benchmarks sustainability across different building types by using common sustainability ambition levels. There are four ambition levels available:

a. Bronze – corresponds to 65-69% of the total points available
b. Silver – corresponds to 70-74% of the total points available
c. Gold – corresponds to 75-79% of the total points available
d. Platinum – corresponds to greater than 80% of the total points available

The sustainability ambition level is determined by the UoS Campus Infrastructure & Services Planning Team. For the F23 building, it has been determined that the project must achieve a 'Gold' sustainability ambition level.

This framework is intended for use by the members of design teams (planners, architects, urban designers, engineers and construction professionals) who are involved in the projects commissioned by the University.

The UoS Sustainability Framework consists of the following themes:

1. Leadership and Communication
2. Resource Efficiency
3. Healthy environment
4. Materials
5. Climate Change, Landscape & Infrastructure
6. Sustainable Transport

Each sustainability measure is awarded a number of points, proportional to the sustainability benefit delivered by it. Most initiatives are awarded one, two or three points, but specific measures that provide a high level of operational savings and broader sustainability benefits are awarded higher points.

The following table identifies the 'industry best practice ESD goals' of typical accredited rating schemes, and the measures and targets that have been proposed for the F23 project to meet these goals. The 'F23 Mandatory Measures' are a brief requirement from the UoS. The F23 project is working to the mandatory requirements in achieving the goals and targets of the UoS Sustainability Framework.

Refer to Section 3.0 for further details in relation to the sustainability measures incorporated in the project.

Sustainability Issue	**Industry Best Practice Goals**	**F23 Mandatory Measures to achieve a Gold Ambition Level** (Implemented using the UoS Sustainability Framework)
Indoor Environment Quality (IEQ) / Occupant Comfort	Improve occupant comfort and indoor environments	The F23 project incorporates building strategies to improve: • Daylighting, Glare and views; • Indoor Air Quality; • Acoustics; and • Toxicity

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Sustainability Issue	**Industry Best Practice Goals**	**F23 Mandatory Measures to achieve a Gold Ambition Level** (Implemented using the UoS Sustainability Framework)
Energy	10% improvement over the benchmark requirement.	The F23 project will achieve a minimum 20% energy improvement over the benchmark requirement. This will be achieved through the building envelope design, efficient building services systems, controls and renewable energy.
Water	Reduce potable water consumption	The F23 project will reduce potable water consumption through: • Water efficient fixtures and fittings; • Rainwater Harvesting and reuse; and • Capture of fire system test water
Materials	Minimise Material consumption or utilise best environmentally preferable materials and products	The F23 project will target the following measures to reduce environmental impact of materials: • 50% of all furniture items to be of environmentally preferable products with certification. • 50% of all timber products used in construction and internal linings to be of sustainably sourced. • 60% of all steel has a post-consumer recycled content greater than 50% or is reused.
Waste	Minimise waste generation during demolition, construction and operation	Recycle at least 85% of building demolition and construction waste by weight. Internal and external centralised waste and recycling bin systems will be incorporated in the design.
Emissions	Minimise best emission impacts from the ongoing operation	The F23 project has been designed to reduce the following building emissions: • Integration with the University of Sydney campus wide storm water strategy • Surface heat reduction
Transport	Promote use of alternative modes of transport and to encourage a healthy life style	The F23 project will include cyclist parking and end of trip facilities to encourage and support the use of bicycles.

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3.0 Sustainability Approach

Sustainable building design involves a holistic and integrated design approach, which builds on an increased awareness of site opportunities, form and function, to encompass and target a broad range of sustainable design initiatives:

- Occupant Comfort
- Energy and water conservation;
- Material selection;
- Emissions reduction; and
- Waste reduction.

The above approach has been taken to ensure the ESD strategies proposed meet the SEARs and targets/benchmarks discussed in the previous section (section 2.0).

3.1 Occupant Comfort

The following occupant comfort strategies have been proposed design for the F23 project.

- **Indoor Air Quality Management Plan** –An IAQ management plan will be developed and implemented for construction and pre-occupancy building phases. The purpose of the IAQ management plan is to ensure the protection and contamination of HVAC during the construction stage and pre-occupancy phases is minimised.

- **Daylighting** – Good daylighting will be designed for at desk- height level, minimising the need for artificial lighting.

- **External views** – will be provided to give views of nature, which help to improve attention span and wellbeing of occupants.

- **Glare** - will be reduced through a combination of fixed shading devices, window tinting or operable devices such as shades or blinds to all external or perimeter windows and glazing.

- **Thermal comfort** – will be a key focus of the mechanically ventilated spaces.

- **Materials with low VOC content –** will be specified, to reduce the effects of VOC off-gassing from internal materials and finishes which are harmful to occupant

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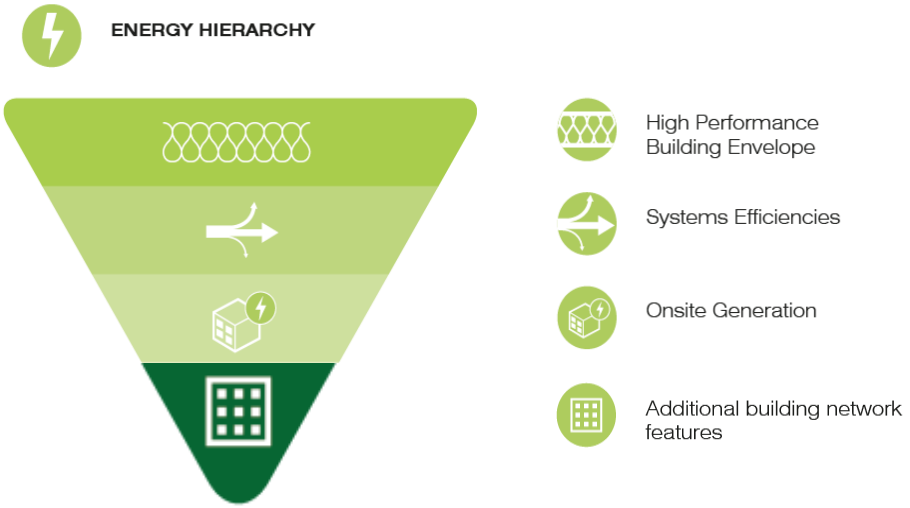
health and productivity. The design team will ensure that flooring, paints, adhesives and sealants are specified to meet low VOC requirements.

- **Formaldehyde minimisation** - all engineered wood products will be specified to either have low formaldehyde emissions or contain no formaldehyde.`
- **Building noise** – Both internal and external noise sources and levels will be controlled in accordance with AS/NZS 2107.
- **Over lighting of spaces** will be avoided to ensure uniformity in light levels and to reduce waste energy consumption.

3.2 Energy

The proposed approach to sustainability and energy related systems is based on applying an "energy hierarchy" methodology.

This methodology has the reduction of energy use as its first priority, and then seeks to meet the remaining energy demand by the most efficient means available, before the inclusion of on-site generation and importation of green power.



The following energy initiatives have been proposed for the F23 project:

- **Passive design principles** will be employed to respond to environmental conditions of the building including orientation, solar access, prevailing winds, seasonal and diurnal temperatures changes.
- **Building energy performance improvement -** Energy modelling will be undertaken using the BCA Section J, JV3 energy modelling guidelines and the UoS small plug loads template. The energy modelling will demonstrate the project achieves a minimum 20% energy reduction against the benchmark standard.

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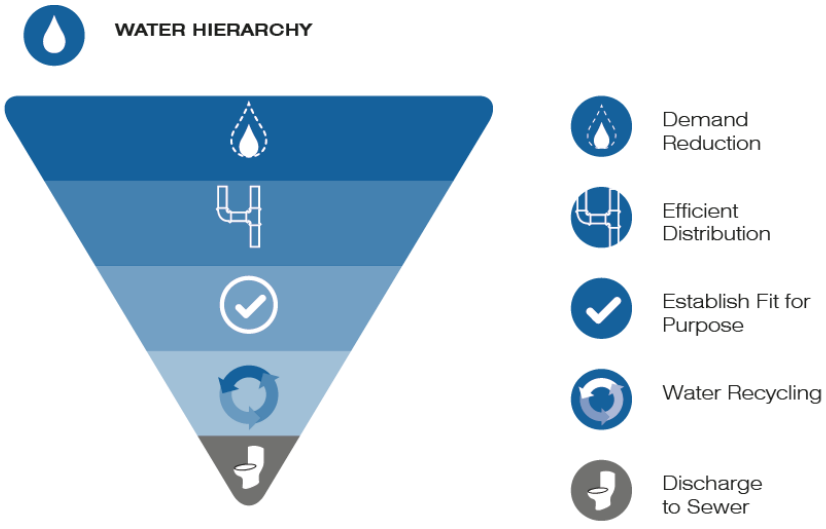
- **Highest efficiency energy consuming equipment** will be selected according to the Australian Government's Energy Rating scheme. Preference is to be given to locally manufactured equipment, where multiple options are available.
- **Efficient lighting fittings, zoning, controls and site co-ordination** for both internal and external lighting systems are to be designed.
- **Occupancy controls** will be provided to UFA spaces so that AV, lighting and mechanical systems can be shut down both manually and automatically when unoccupied.
- **A Solar photovoltaic (PV) system** has been proposed and will be located on the roof.
- **Efficient solar hot water systems** will be selected based on analysis of the building hot water demand.

3.3 Water

Water efficiency is another key aspect of sustainable design. For the proposed UoS F23 building, major uses of water would include:

- HVAC systems;
- General water demand (domestic hot and cold water, toilet flushing and cleaning/maintenance)

The following hierarchy will be applied, along with the following proposed strategies:



- **Efficient fixtures / fittings** will be specified.

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- **Rainwater Reuse** - Rainwater collection and reuse systems will be incorporated. Reuse options include landscape irrigation, toilet flushing, and cooling tower makeup.

- **Fir Systems test water** will be captured and stored for re-use.

3.4 Materials

Selection of environmentally preferable materials is a key priority for the project, because building materials consume energy and natural resources during its manufacture and for their transportation to the construction site.

Preference will be given to materials that contain high-recycled content and/or are highly recyclable. The following strategies have been proposed:

- **Use sustainable timber-** timber products used for concrete formwork, structure, wall linings, flooring and joinery will be sourced where possible from reused, post-consumer recycled or FSC-certified, or PEFC certified timber.

- **Steel** – will be specified to meet specific strength grades, energy-reducing manufacturing technologies, and off-site fabrication. Steel will also be sourced with a proportion of the fabricated structural steelwork via a steel contractor accredited by the Environmental Sustainability Charter of the Australian Steel Institute.

- **Recycled concrete** – The project is targeting a 30% reduction of Portland cement through substitutions. Fine and coarse aggregate inputs are to be sourced from manufactured sand or other alternative materials, and the amount of Portland cement will be reduced within the concrete mix.

- **Joinery** – to be either modular, reusable, eco-preferred, or environmentally innovative.

- **PVC minimisation** – 30% of common PVC uses will consist of environmentally preferable alternatives.

- **High recycled content or recyclability** – 50% of all furniture items with high recycled or recyclability content have been proposed.

3.5 Emissions

Proposed design aims to ensure reduction of all forms of emissions, including watercourse pollution, light pollution and ozone depletion.

The following initiatives have been proposed:

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- **Water Sensitive Urban Design (WSUD)** integrates water cycle management with urban planning and design. The aim of WSUD is to manage the impacts of storm water run-off from the development to protect and improve waterway health by replicating the natural water cycle.

  As part of the WSUD, the development will incorporate rainwater reuse (refer to section 3.3) and storm water management.

  The storm water drainage system will prevent storm water contamination, control sedimentation and erosion during construction and operation of the building. The storm water drainage system will be integrated with the University of Sydney campus wide storm water strategy/system.

- **Surface heat reduction** – will be pursued where possible to improve thermal comfort, by providing natural shade to ground materials, specifying paving materials and shading elements which reflect some of the incident solar gain, and specifying open-grid pavement systems with vegetation.

3.6 Additional Sustainability Initiatives

- **ESD Professional** – will be appointed as a principal participant of the design team, suitably trained to provide sustainability advice from the schematic phase through to project implementation (i.e. Green Star Accredited Professional or similar).

- **Accessible, visible stair locations** – will be provided as an alternative to vertical transportation, along with visible signage.

- **CO_2 monitoring and control** – will be provided.

- **Landscape** – The design will consider planting of native flora, while recognising the cultural value of the campus landscape. Vegetation can provide shade, visual interest, and reduction of heat island effects.

3.7 Construction

The following measures have been proposed and will be incorporated in the construction phase of the F23 Building, These measures are intended to reduce the environmental impacts associated with the construction of new buildings.

- **Environmental Management Plan (EMP)** – The EMP will be developed and implemented for the construction stage, including demolition and excavation, to address environmental, worker health and safety and community risks. The EMP is a project specific plan and developed using State and Federal Guidelines and standards. The main contractor will implement an Environmental Management System certified to the ISO 14001 standard to ensure the objectives of the EMP are met.

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- **Site waste management plan**. During the demolition and construction phase, a project-specific site waste management plan (WMP) will be developed and implemented, and targeting an 85% recycling of demolition and construction waste.

3.8 Operation

The following sustainable design measures have been incorporated in the F23 building to reduce waste energy and water consumption, waste generation and greenhouse gas emissions associated with transportation.

- **Comprehensive commissioning** – pre-commissioning, commissioning, and quality monitoring for all building services will be carried out.
- **Metering and sub-metering** will be provided to track and monitor energy and water consumption.
- **Waste storage** will be provided dedicated to the separation and collection of recyclable waste.
- **Building Users Guide** - relevant information will be provided about the building's use, functional and environmental aspects, and special features according to the Building Users' Guide template.
- **Public information display** - an energy efficient display will be provided in the foyer and similar prominent public area(s) to educate building occupants and communicate building information such as real-time utility (energy, water, gas) consumption, waste management, transport options etc.
- **Cycle parking and end of trip facilities** – bicycle parking racks, changing and shower facilities and lockers will be provided for staff.
    - End of Trip Facilities
    - Motor Cycle and Small Car parking