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

Copenhagen
London
Sydney
Canberra
Hong Kong
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SUSTAINABLE DESIGN

STEENSEN VARMING

SGS Weigall Sport Complex - Ecologically Sustainable Development (ESD) SSDA 10421

Document Revision and Status

Date	Rev	Issue	Notes	Checked	Approved
22-05-2020	00	Draft	For comment	BJ / CL	BJ
3-07-2020	01	95%	For comment	BJ / CL	BJ
7-09-2020	02	Final		BJ / CL	BJ

Sydney May 22, 2020
Ref. No. 207016

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1.0 Executive Summary

This report has been prepared for the Sydney grammar School – Weigall Sports Complex, in response to the SSDA General Requirement 8.0 – Ecologically Sustainable Development (ESD).

The report provides an overview of how the proposed design is responding to sustainable planning, through all stages of design, construction, and operation of the facility.

As outlined in our response to Item 6B, we are proposing to develop a Project-specific "Environmental Framework". At its core, it will be based on Green Star Design & As-Built version 1.3 and seek to achieve 4 Star Green Star Equivalency as a minimum. The Project-specific "Environmental Framework" will then propose a broad range on enhancements, that specifically align with the requirements of this particular building, in being a Personal Development, health and Physical Education (PDHPE) centre, and the projects sustainability brief.

The main philosophy of this approach is to provide appropriate and sensible sustainable design initiatives that align with the building's functional and operational requirements, for a high-quality learning and sporting facility.

The tool once developed will guide the design process and help achieve a low energy and sustainable building that draws on the expertise of the design team, the schools facility management team, and of local and international best practice standards, such as:

- Green Star (AUS); LEED (US); BREEAM (UK); WELL (US);
- Government Architects NSW Environmental Design in Schools Manual;
- Industry Standards such as: ASHRAE (The American Society of Heating, Refrigerating and Air-Conditioning Engineers), CIBSE (Chartered Institution of Building Services Engineers), EA (Engineers Australia);
- City of Sydney: Sustainable design technical guidance;
- Sydney Water: Best practice design guidelines;
- Sporting institutions such as Sport England, and FIBA (International Basketball Federation).

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2.0 Project Background

2.1 Scope of Project

The scope of the project is as follows:

1. **Demolition** of the following existing structures and buildings (which are not heritage significant) at the southern edge of the SQS Weigall Sports Ground:
    a. Multipurpose/tennis courts and associated fencing;
    b. Barry Pavilion;
    c. The existing cricket nets off Alma Street; and
    d. Paved car park near Neild Avenue.
2. **Construction** of the SQS Weigall Sports Complex comprising the following:
    a. Building 1 - Sports facilities building accommodating the following facilities:
        i. Ground floor: Main pool, programme pool, terrace/assembly facing Weigall, entry foyer, offices, change rooms, back of house, services and external car parking (5 spaces) and loading;
        ii. Mezzanine floor: spectator terrace and services;
        iii. First floor: Multipurpose sports hall 01 – basketball and volleyball, Multipurpose sports hall 02 –cardio, weights, taekwondo, fencing, PDHPE, change rooms, storage and services;
        iv. Level 2: Multipurpose room 04; Multipurpose sports hall 03 – cardio, weights, taekwondo, fencing, PDHPE, storage and services;
        v. Driveway entry from Neild Avenue (comprising relocation of the existing driveway southwards with existing driveway potential retained for maintenance access).
    b. Building 2 – Car park comprising an ancillary car park of one/two split levels accommodating 93 spaces with an additional 4 spaces on grade, accessed from an existing entry from Alma Street (located on the existing cricket nets site). The lower ground level includes the flexibility to be used as an extension of the existing playing fields.
    c. Parking for a total of 102 cars comprising:
        i. Building 1: 5 spaces;
        ii. Building 2: 97 car spaces (93 within the building and four at grade).
    d. Landscaping of the site including tree removal/retention/replacement, paths, fencing and lighting.
    e. Building identification signage.
    f. New kiosk substation.
3. **Use** of the completed building as an educational establishment with external/community use of the proposed facilities that coordinates with the programming of the SQS.

The proposal does not include any of the following:

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- General learning areas (**GLA**);
- An increase in the existing student or staff population.

2.2 Site description

The State Significant Development Application (SSDA) site is part of the Weigall Playing Fields located on Neild Avenue at Rushcutters Bay.

Weigall is bordered by:

- Neild Avenue to the west (Neild Avenue is classified as a collector road and also forms part of the State Road MR625 managed by Roads and Maritime Services)
- State Rail land and the Eastern Suburbs Railway viaduct to the north
- White City (Hakoah Club and Maccabi Tennis Club), SGS Edgecliff Preparatory School, Vialoux Avenue, Alma Street and residential development to the south
- Residential development to the south and north-east
- A Sydney Water stormwater channel which traverses the site
- A right of way from Alma Street, benefiting the site, which crosses the site formerly known as White City.

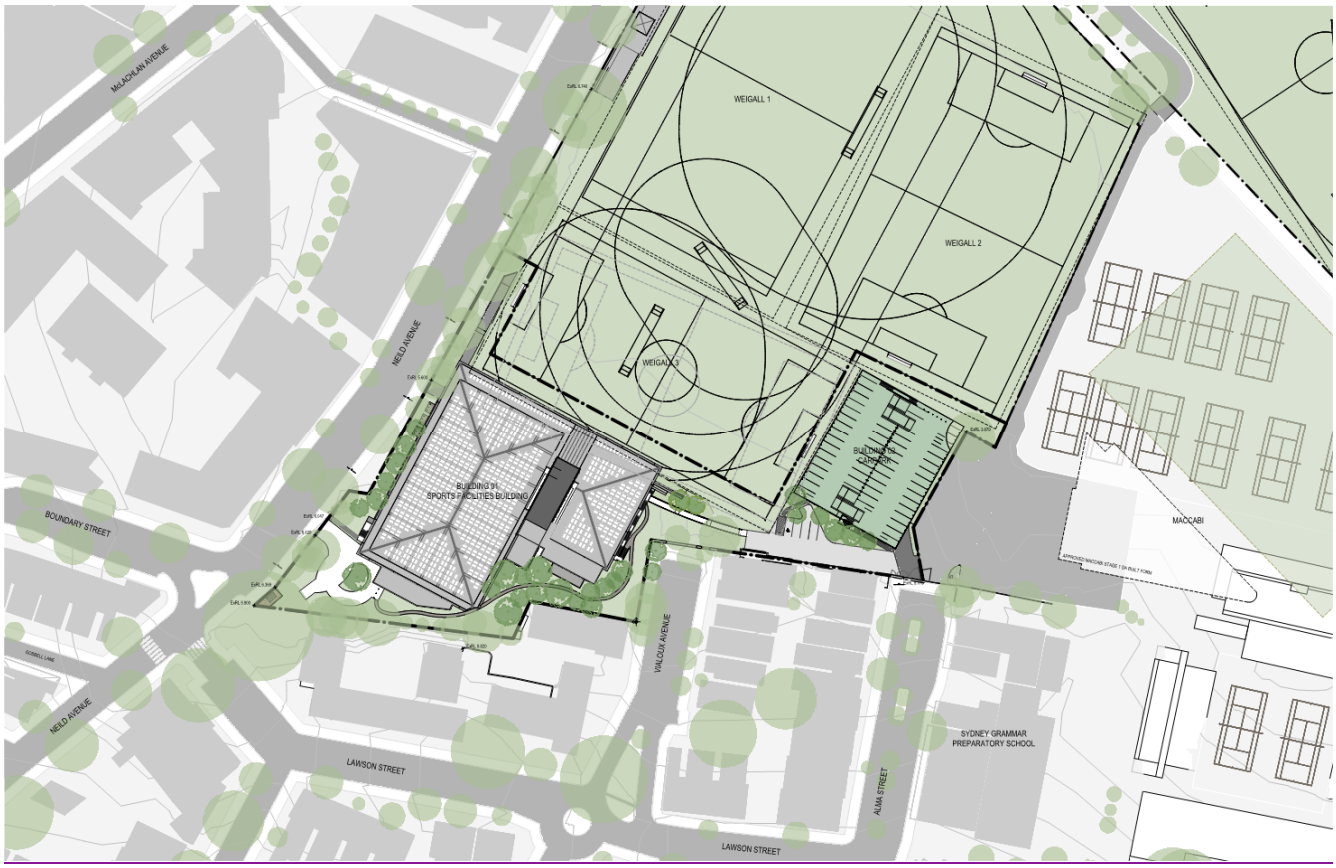

Image: Weigall Sports Complex Site Plan

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3.0 Introduction

3.1 Response to SEARs

The Sydney Grammar Sport Complex SEARs Report is required by the Secretary's Environmental Assessment Requirements (SEARs). This table identifies the relevant SEARs requirement/s and corresponding reference/s within this report.

Table 1 – SEARs Requirement 8.0 and Relevant Reference

SEARs Items	**Project Response to DGR**
A) Detail how ESD principles (as defined in clause 7(4) of Schedule 2 of the Regulation) will be incorporated in the design and ongoing operation phases of the development.	The ESD initiatives proposed for the project aims to reduce the environmental impacts typically associated with buildings during the construction and ongoing operation of the building. The project utilises a resource hierarchy approach, with emphasis on avoiding then reduction of energy, water, waste, materials etc. The outcome of the resource hierarchy approach is to ensure the school 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 6.0 Resource Conservation for the proposed ESD initiatives.*
B) Include a framework for how the future development will be designed to consider and reflect national best practice sustainable building principles to improve environmental performance and reduce ecological impact. This should be based on a materiality assessment and include waste reduction design measures, future proofing, use of sustainable and low-carbon materials, energy and water efficient design (including water sensitive urban design) and technology and use of renewable energy.	Steensen Varming have proposed the development of a Project-specific "Environmental Framework" to guide and inform the design of this building. This Framework provides detailed sustainable guidance to the design team, contractor and client from concept through to construction and operational phases of the project. The main philosophy of this approach is to provide appropriate and sensible sustainable design initiatives that would align with the building's functional and operational requirements, for a high-quality learning environment & physical education centre. The tool once developed will guide the design process and help achieve a low energy and sustainable building that draws on the expertise of the design team and of local and international best practice, such as: ■ Green Star (AUS); ■ LEED (US); ■ BREEAM (UK); ■ WELL (US); ■ Industry Standards such as: ASHRAE (The American Society of Heating, Refrigerating and Air-

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SEARs Items	Project Response to DGR
	Conditioning Engineers), CIBSE (Chartered Institution of Building Services Engineers); ■ City of Sydney: Sustainable design technical guidance Section 3.2.17-20 (Swimming pools); ■ NSW Energy efficient water heating technology guide for aquatic centres; ■ Sydney Water: Best practice guidelines for water management in aquatic leisure centres; ■ Sport England: Swimming pool design guide; ■ Good practice design guide 219: Energy efficiency in swimming pools; ■ FIBA (International Basketball Federation). The 'Environmental Framework' will provide a means to prioritise, monitor, record and ultimately achieve compliance with the project's environmental briefing requirements. Quantifiable benchmarks will be included where applicable, such as in the modelling of daylight, occupant comfort and main plant emissions during the early stages of the project to inform design progression. All of which will be in general accordance with the best practice calculation methodologies.
C) Demonstrate how environmental design will be achieved in accordance with the GA NSW Environmental Design in Schools Manual.	Although the Weigall Sports Complex is not directly comparable to a traditional school, the general approach to sustainable design still aligns with ours (see Section 5.0) and that of environmental rating systems such as Green Star (see Item E below). Generally, this is in seeking a predominantly passive design response where possible, a strong focus on the Indoor Environmental Quality (IEQ), incorporating flexibility and adaptability from the onset, and in showcasing good environmental design.

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SEARs Items	**Project Response to DGR**
D) Include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance.	Operational building performance will be considered in the design of the Weigall Sports Complex. Refer to section 5.0 and 6.0 for the building performance measures considered to reduce resource consumption and carbon emissions and impacts on climate change. The principles of Green Star Performance will be considered and incorporated into the Project-specific "Environmental Framework" where applicable, to ensure continued optimal operational performance through the fine tuning of the systems and operational standards. The aim of Green Star Performance focuses on the building operation and maintaining a valid certification against the Australian Government's National Carbon Offset Standard for buildings. This requires ongoing measuring, reduction, offsetting and reporting of emissions. The project will consider strategies and building systems that facilitates measuring, reduction and reporting if desirable at a later stage.
E) Include an assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.	As outlined in our response to Item B, we are proposing to develop a Project-specific "Environmental Framework". At its core, it will be based on Green Star Design & As-Built version 1.3 and seek to achieve 4 Star Green Star Equivalency as a minimum. The Project-specific "Environmental Framework" will then propose a broad range on enhancements, that specifically align with the functional requirements of this particular building.

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SEARs Items	Project Response to DGR
F) Provide a statement regarding how the design of the future development is responsive to the CSIRO projected impacts of climate change. Specifically: ■ Hotter days and more frequent heatwave events; ■ Extended drought periods; ■ More extreme rainfall events; ■ Gustier wind conditions; and ■ How these will inform material selection and social equity aspects (respite/shelter areas).	At the current stage, the Weigall Sports Complex proposes the following strategies in response to the CSIRO projected impacts of climate change. **Hotter days and more frequent heatwave events:** ■ Passive building design features to reduce/dampen the effects of increasing temperature, such as solar shading and solar control glazing. ■ The project proposes the use of mixed mode ventilation, however, acknowledges the impacts of climate change and has proposed the use of air conditioning during peak conditions. This is to ensure that appropriate internal conditions can be achieved and maintained as temperatures increase. ■ To ensure the proposed systems have spare capacity to meet increased demand and in the avoidance of major system upgrades / refurbishments. ■ Consideration of alternative heat rejection systems that are less affected by changes in external temperatures. **Extended drought periods:** ■ Consideration of native low water landscaping to reduce potable water consumption; and ■ Rainwater harvesting and low flow fixtures and fittings. **More extreme rainfall events:** ■ Consideration of increased drainage capacities to reduce flooding of roofs and hard surfaces; and ■ Assessment of design of the building to address post development probable maximum flood (PMF) level. **Gustier wind conditions:** ■ Design of windows and openings with controls to limit the impact of gustier wind conditions for internal spaces; ■ Landscaping to buffer strong winds to outdoor areas. **Material selection:** ■ Use of durable façade materials and materials to improve building thermal performance such as insulation and thermal mass; and ■ Covered/shaded outdoor respite areas.

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This report presents a concise summary of the design decisions made during early design stages and outlines the key ESD opportunities and initiatives under consideration for the project.

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);
- In acknowledging the high energy and water consumption of swimming pools and sporting facilities, we will seek to incorporate appropriate passive and active design strategies to ensure a low-energy, water as well as low-maintenance design outcome;
- Adopt water sensitive urban design principles;
- Adopt practices to minimise demolition, construction, and operational waste;
- Utilise environmentally preferable materials.

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4.0 Targets / Benchmarks

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

- Exceed the requirements of Section-J of the National Construction Code (NCC) for energy-efficiency in building fabric and building services / systems.
- Incorporate appropriate and sensible sustainable design initiatives that would align with the building's functional and operational requirements, for a high-quality / physical education environment. Seek guidance from the experience within the design team, and of local and international Environmental Rating Standards / Best Practice such as Green Star, LEED (US), BREEAM (UK), High Performance Collaborative Schools (US), WELL, CIBSE, ASHRAE etc.
- Demonstrate good design through early stage modelling and guidance, in general accordance with the best practice standards such as Green Star;
- Pool specific design requirements and recommendations from standards:
    - CIBSE GPG 219 Energy efficiency in swimming pools;
    - Sport England swimming pool;
- Align with new Government Architects NSW school standards such as:
    - Environmental Design in Schools (2018);
    - Better Placed Design Guide (2018).

4.1 NCC Section-J

Section-J of the National Construction Code (Previously known as the Building Code of Australia) 2019 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 Sport Complex project aims to exceed the DTS requirements of Section-J where practical. A JV3 methodology is being applied for the project to demonstrate the improvement beyond DTS.

4.2 Project Specific Environmental Framework

In the creation of a Project Specific "Environmental Framework", guidance is to be taken from national and international environmental rating standards. These include Greenstar, BREEAM, CHPS, WELL Building Standard and LEED. Greenstar is an Australian voluntary Environmental Assessment system. BREEAM is the UK equivalent, and CHPS (Collaborative for High Performance Schools) & LEED are American Environmental Standards. The WELL Building Standard is an American Standard specifically focused on occupant health & wellbeing and is currently gaining recognition & traction across the major markets. This guidance will be viewed in combination with the design teams past project experience and lessons learnt, in particular those from the SGSs FM (Facilities Management) team on current building operation, maintenance, supplier and control requirements.

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5.0 Sustainability Approach

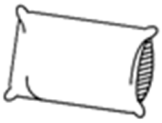
Sustainable building design involves a holistic and integrated design approach, which builds on an increased awareness of site opportunities, form and function, to encompass and target a broad range of sustainable design initiatives.

The Weigall Sports Complex will endeavour to demonstrate through all aspects of design a strong commitment to sustainability, through adhering to the following key sustainable design initiatives:

- **Healthy** (Indoor air quality & access to natural daylight)

- **Correctly commissioned** (System optimisation / Ensure building performance)

- **Comfortable** (Thermal Visual and Acoustic Comfort)



- **Be a teaching tool** (Showcase the buildings sustainable attributes)

- **Efficient** (Energy, Material & Water)

- **Safe and secure:** for staff, students and visitors

- **Easy to maintain and operate**

- **A community resource**

- **Environmentally responsive** (To changing climatic conditions)

- **Be of stimulating architecture** (Invoke a sense of pride)

In expanding on some of those initiatives outlined previously:

The promotion of quality natural daylight – There is a direct correlation between access to daylight and student performance, attention, productivity, and general wellbeing. Glare potential is a significant issue for safety in pools, players' performance during a game, and spectators' visual comfort to provide a positive experience;

Excellent Indoor Air Quality (IAQ) – In a similar manner to daylight, there is proven correlation between user's performance, occupant wellbeing, student attendance and staff retention. Principle strategies include:

- Increased levels of outside air through the promotion of mixed mode or natural ventilation strategies, and increased outdoor air allowances;

- Mould prevention through the avoidance of thermal bridges, condensation and effective strategies in ventilation, odour and pollution control;
- Low pollutant emitting materials selections such as low VOC paints, adhesives, sealants, composite woods etc.

Excellent Thermal, Visual and Acoustic comfort – To address:

- Thermal comfort: To ensure coaches, students, administrators and casual users of the complex are not subject to unacceptable extremes in temperature as they train, teach, learn and work;
- Visual comfort: To ensure the quality of light is supportive of specific tasks. In design for natural daylight, consideration must be given to daylight uniformity, penetration depth, solar heat ingress and glare control;
- Acoustic comfort: To ensure effective communication can always be achieved, noise from ventilation systems, external and internal disruptive noise affecting classrooms is minimised.

Resource conservation (energy, water and waste) – In delivering on the functional demands of a training facility (high levels of daylight, thermal comfort, visual comfort, and IAQ), incurs resource use through the optimisation of these attributes. These are to be supported with minimal consumption of energy and water resources, or the generation of waste and pollution in demolition, construction and operation of the building. Our approach to resource conservation is based on applying a "hierarchy" methodology as outlined in the following sections (See section 6.0).

The creation of an integrated community resource – The sport complex can play a role within the local community through the use of shared facilities (pools, play courts and car parking outside of school hours).

The development of the building and surrounds as a teaching tool – Students develop greater knowledge retention, understanding and awareness, when they have the opportunity to interact directly with their environment through the mediums of touch, sight and feel, compared to the traditional textbook learning.

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

The following sections provide a high-level overview of some of the strategies being considered.

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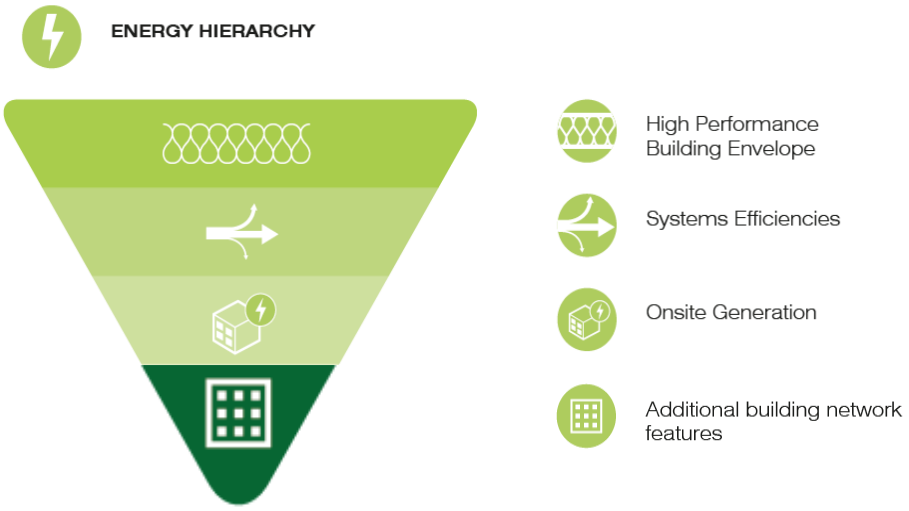
6.0 Resource Conservation

This section provides a further breakdown for resource conservation.

6.1 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 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 and their individual merits will be assessed further during future design stages:

- **Building Form** has been designed with consideration of façade access for greater access to natural daylight and opportunity for natural ventilation, within the constraints of the site.
- **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 envelope performance** (airtightness and thermal) will be enhanced by prefabrication.
- **A Mixed Mode Ventilation strategy** will be accessed for improved indoor air quality, whilst also reducing energy consumption associated with air-conditioning. When external and internal conditions are favourable, external windows to each cluster can open to facilitate natural ventilation.
- **Building energy performance improvement -** Energy modelling will be performed in development of a design that betters current minimum standards.

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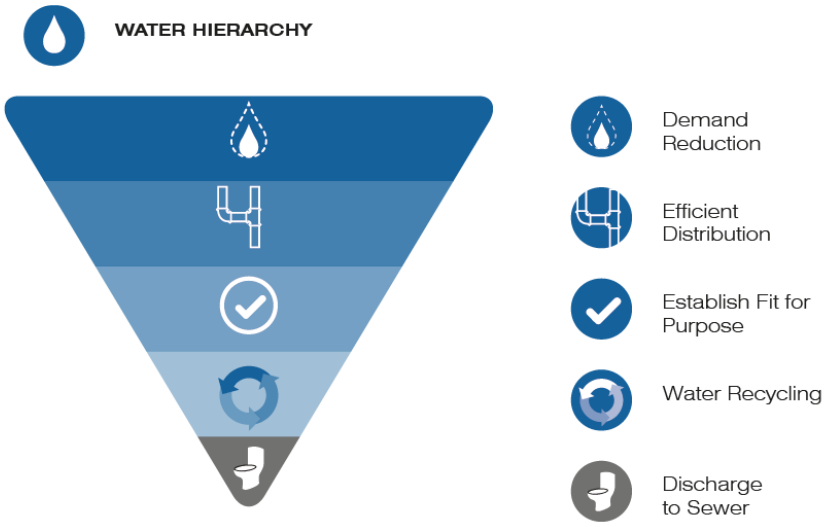
- **Energy efficient LED lighting, zoning, controls and site co-ordination** for both internal and external lighting systems are to be designed.
- **Occupancy controls** will be provided to spaces so that AV, lighting and mechanical systems can be shut down both manually and automatically when unoccupied where appropriate.
- **A Solar photovoltaic (PV) array** has been proposed and will be located on the roof. Energy generated onsite can be reused onsite.
- **High efficiency HVAC (Heating, Ventilation & Air-conditioning)** systems to be incorporated;
- **CO_2 monitoring** in the appropriate control of outdoor air provisions.

6.2 Water

The following hierarchy and strategies will be applied:



The following water initiatives have been proposed and their individual merits will be assessed further during future design stages:

- **Water efficient fixtures / fittings** will be specified. These include fittings such as taps, showerheads, toilets, zip taps, dishwashers etc certified under the WELL rating scheme;
- **Rainwater Reuse** - Rainwater collection and reuse systems will be accessed. Reuse options include landscape irrigation and toilet flushing;
- **Fire Systems test water** capture and storage for re-use using the rainwater tank will be accessed;
- **Efficient water management in aquatic area** including water reuse, wastewater management, leaks detection, water monitoring and managing;
- **Safe water treatment in the aquatic area.**

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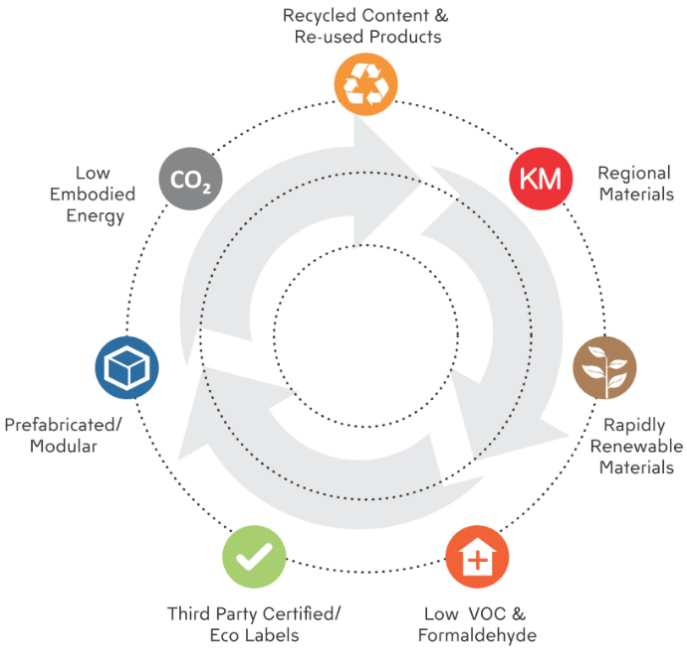
6.3 Materials and Construction Waste

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. Choices of materials and construction methods can significantly change the amount of energy embodied in the structure of a building.



Low-impact construction methods such as offsite prefabrication/preassembly shall be applied for the Sporting Complex where applicable. Prefabricated structures built in purpose-built factories are less labour intensive, more time efficient, and produce less waste compared to traditional onsite construction methods. Raw materials and construction elements are not exposed to the elements, which ensures high quality in the final building, and the construction process is less weather dependant.

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 aims to reduce the use of Portland cement through substitutions. Fine and coarse aggregate inputs are to be sourced from

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manufactured sand or other alternative materials, and the amount of Portland cement will be reduced within the concrete mix.

- **High recycled content or recyclability** – Furniture items with high recycled or recyclability content to be considered.
- **Site waste management plan**. During the demolition and construction phase, a project-specific site waste management plan (WMP) will be developed and implemented, for recycling of demolition and construction waste.

6.4 Additional Key Measures

- **Environmental Management Plan (EMP)** – An EMP has been considered for the school. This measure is intended to reduce the environmental impacts associated with the construction of new buildings. 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.