Department of Education

Redevelopment of Arthur Phillip High School & Parramatta Public School

Development Application ESD Report

REP/DA/ESD001

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1 Introduction

Arup has been engaged by Grimshaw Architects on behalf of the Department of Education to prepare a report outlining the ESD concept design strategy for the proposed redevelopment of the existing Arthur Phillip High School (APHS) & Parramatta Public School (PPS) located along Macquarie Street between Smith and Charles Street.

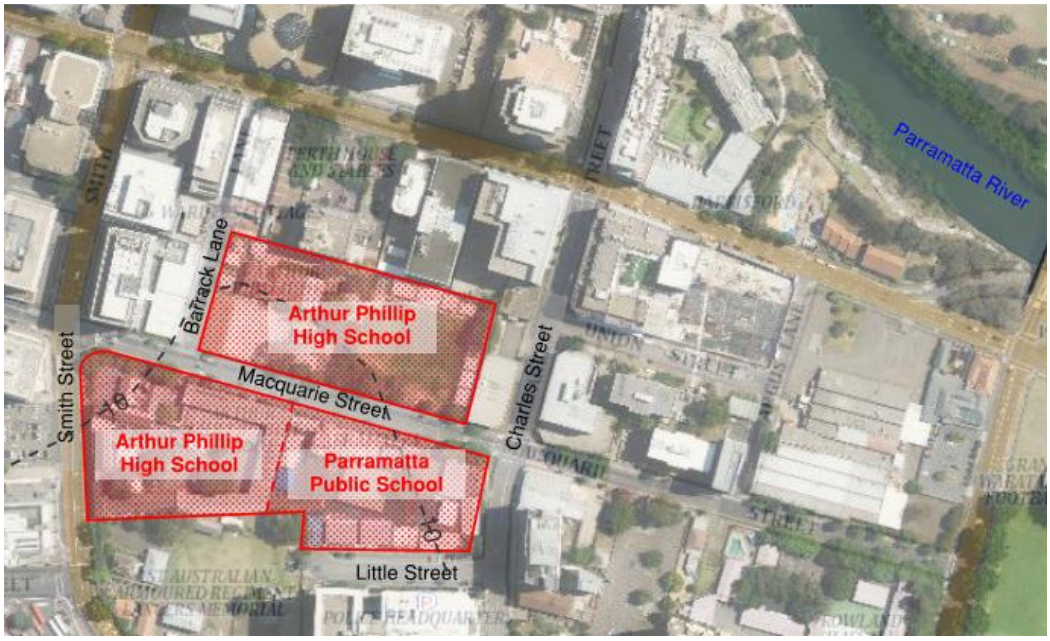
This report has been prepared as supporting documentation to accompany a development application for the site with regards to the State Significant Development (SSD) assessment criteria (Application Number - SSD 7237).

1.1 Site Description

The project site is located within Parramatta City central business district approximately 300m from Parramatta River. The site is currently occupied by the existing Parramatta Public School and Arthur Phillip High School. The Site is split into two parcels by Macquarie Street. The High School occupies the entire northern parcel and shares the southern parcel with the Public School located to the east.

The northern parcel shares a common boundary with commercial developments to the north and east, Macquarie Street to the south and Barker Lane to the west.

The southern parcel is bound by Macquarie Street to the north, Charles Street to the east, Little Street and 1st Australian Armoured regiment lancers memorial to the south and Smith Street to the west. Refer figure below.



Existing Site location (Source: SIX maps, Land and Property Information)

The entire site is made up of fifteen lots identified as Lots 65, 64, 63A, 63 and 62 Section 17, DP758829, Lots 1, 2 and 3 DP115296, Lots 23, 24, 25 and 26

DP7809, Lot 413 DP820541, Lot 414 DP820542 and Lot 27A DP449406, with easments for substation (AF945909) and restricted use AF945910 in the eastern corner of the site.

1.2 Overview of Proposed Development

It is proposed that the existing primary and high school be substantially demolished and replaced with two multi-story buildings, with smaller existing historic buildings retained for supporting functions. The northern site parcel would be developed for the high school and the southern parcel for the primary school, refer below.

The high school comprises a tower building of 17 storey equivalent height (11 primary levels plus mezzanines) towards the north east corner plus a sports hall on the western site with a total floor area of approximately 26,000m².

The primary school building is a 4-storey "U-shaped" building opening onto the school coutryardwith a floor area of approximately 6,500m².

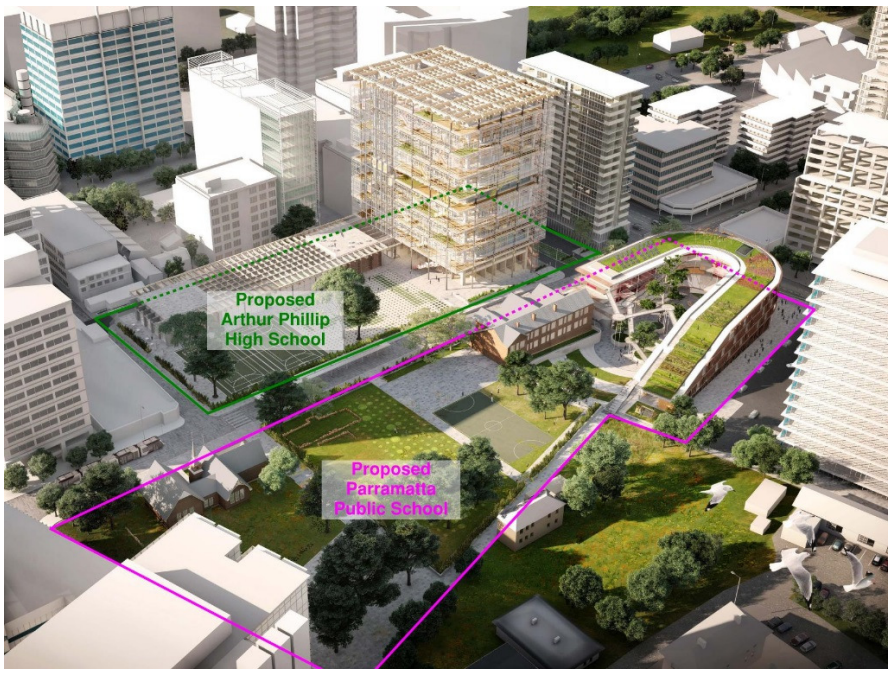


Figure 1 Proposed Development (source: Grimshaw)

1.3 Secretary's Environmental Assessment Requirements

The overall ESD design strategy for the site and its buildings has been developed to respond to Section 6 of the Secretary's Environmental Assessment Requirements (SEARs) named "Ecologically Sustainable Development (ESD)".

The design ESD strategy responds to the following elements within the SEARs:

- ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) have been and will be

incorporated in the design, construction and ongoing operation phases of the development

- Sustainable strategies and technologies are being considered in order to achieve best practice sustainability initiatives, and are assessed against the requirement intent of a suitably accredited rating scheme (Green Star Education v1); and
- Measures (including water sensitive urban design) to minimise consumption of resources, water and energy will be implemented in the design.

2 Overall ESD Strategy

The buildings' design will integrate sustainable initiatives to ensure superior environmental performance of the buildings.

The main premise of the environmental strategy for the project has been to incorporate robust principles of passive design such as daylight, natural ventilation and a high performing façade in order to create a learning environment where staff and students can experience high levels of comfort and at the same experience a high performing building in terms of its carbon emissions, energy, water and resource consumption, with this visually expressed to students.

The purpose of this document is to discuss the services strategies and ESD opportunities that will be incorporated within the buildings' design.

The following areas will be the main focus of the design team:

- Energy – reduce energy use and greenhouse gas emissions. The buildings' envelope and services have been designed in integration to ensure comfortable conditions are provided whilst optimising energy efficiency.
- Indoor Environmental Quality – design the buildings to provide occupant comfort and control addressing issues of thermal and visual comfort and indoor air quality.
- Water – minimise potable water consumption and optimise the water efficiency of the development.
- Materials – minimise waste, encourage reuse and recycling of materials and use low environmental impact materials.
- Transport – encourage more energy efficient and less polluting forms of transport to and from the site.

Benchmarking the buildings against Australian best practice has been carried out from the beginning of the design process. The ESD strategy has been developed to address the brief requirement of achieving a Green Star Education V1 Design & As Built rating equivalent of a minimum of 4 Stars for both school buildings, and initiatives have been assessed against the intent of the Green Star tool credits.

The buildings are models for typologies reflecting new flexible learning models. The ESD strategy seeks to support flexible and evolving patterns of use by adopting a layered approach to zones of environmental control, providing a suitable level of occupants' control over their environmental conditions, and

relying on systems with quick response times and simplicity of retrofit if required in the future.

3 ESD initiatives

Aiming at best practice in environmental targets, the design team focused on the following strategies for the proposed buildings:

- Energy efficiency through passive design
- Improved Indoor Environmental Quality for building occupants
- Water strategies to minimise potable water consumption and address stormwater management
- Use of reused or recycled materials to reduce embodied energy
- Effective transport strategies to reduce vehicular emissions
- Environmental benchmarking – aiming at Green Star targets as described below.

The ESD strategy has been developed to address the brief requirement of achieving a minimum of 4-Star Green Star Education V1 Design & As Built equivalence. The strategy addresses the comfort and efficiency considerations noted above through the following main design elements:

Design aspect	APHS	PPS
Building envelope	High performance façade with external circulation doubling as deep shading overhangs, separate outer screen creating a sheltered outdoor zone, performance inner façade with selective glazing	High performance façade concentrating window area at sheltered building side with outdoor and circulation space doubling as shading, smaller extent of high performance double glazed view windows at outer facade
Mixed mode ventilation	Operable façade area designed in conjunction with exposed thermal mass to provide adaptive comfort conditions for a large percentage of the year	Operable façade area designed in conjunction with exposed thermal mass to provide adaptive comfort conditions for a large percentage of the year
HVAC systems	Efficient mechanical system delivering highly efficient operation through mixed mode and natural ventilation, and through control strategy based on adaptive comfort conditions. System to provide flexible operation with quick response times, simplicity of retrofits, etc to support the flexible learning space use strategy	Efficient mechanical system delivering highly efficient operation through mixed mode and natural ventilation, and through control strategy based on adaptive comfort conditions. System to provide flexible operation with quick response times, simplicity of retrofits, etc to support the flexible learning space use strategy
Energy efficient lighting	High efficiency LED or fluorescent lighting	High efficiency LED or fluorescent lighting

Water efficiency	High efficiency water fixtures	High efficiency water fixtures
Metering	Energy and water sub-metering	Energy and water sub-metering
Transport and circulation	Stairs located in prominent locations as primary circulation elements	Stairs located in prominent locations as primary circulation elements
	Cyclist facilities for staff	Cyclist facilities for staff & students
Low embodied carbon materials	Recycled concrete and steel	Recycled concrete and steel
Renewable energy	Exploration of added rooftop renewables subject to cost feasibility analysis	Reuse of existing PPS photovoltaic roof plant

The environmental concepts incorporated in the design are discussed in detail in the following sections.

They have been assessed against the intent of the Green Star Education v1 tool credits to confirm that the design could obtain sufficient points under the scheme to obtain a 4-Star rating.

3.1 Building Envelope

The building envelope is essential in the design to guarantee the delivery of an appropriate environment. The role of the envelope is to block solar gains from penetrating the building fabric in summer while optimising daylight, minimizing glare and providing visual connection to the exterior. The glazing performance and shading configuration for each orientation has been optimised to ensure that thermal comfort is achieved and solar gains are adequate for effectiveness of the mixed mode ventilation strategy and the efficient operation of the mechanical system.

3.1.1 APHS

The design proposal for the tower comprises a layered façade arrangement. An external, highly perforated screen shelters the outside/inside spaces from wind whilst letting moderated daylight through. This also allows outside spaces within the tower footprint to give students access to external environment without having to leave the tower. The external circulation walkways and stairs in this interstitial zone double as deep shading overhangs and shading elements.

The internal skin provides the thermal barrier with limited high level automated openings for background natural ventilation, and low level larger openings for higher ventilation rates during summer. Vision and daylight windows will be high light transmittance performance low emissivity coated glazing, and opaque areas will consist of insulated structural members and added spandrel area with insulated back pans inside an air cavity.

Sports hall facades will be protected from summer solar gains with wide roof overhangs. Daylighting will be predominantly through high facades to reduce thermal loads through skylights.

3.1.2 PPS

The primary school building's high performance façade concentrates window area at the sheltered building side towards the courtyard, with outdoor and circulation space doubling as deep shading elements to performance low emissivity windows.

The outer façade will have a smaller extent of high performance glazed view windows.

Opaque areas consisting of spandrel with insulated back pans inside an air cavity will be integrated in façades on either side of the building to reduce solar loads and thermal conduction.

3.2 Mechanical System

The overall servicing strategy is based on the principle of prioritizing the reduction in energy demand by efficient passive design of the building envelope and switching systems off when not in use.

Both high school and primary school are provided with heating and cooling systems. Minimising the energy demand of systems is supported by the adoption of adaptive comfort criteria, which activate air conditioning under extreme conditions to provide a comfortable environment, but recognise human adaptation to the mid-term external climate to avoid over-conditioning. These will mean that e.g. in summer, air conditioning will only be operated when operative temperatures exceed comfort levels, allowing more use of natural ventilation and greatly reducing system operation hours.

The school buildings employ a hierarchy of spaces with more or less stringent environmental control to maximise opportunity to take advantage of adaptive comfort.

The adaptive comfort conditions will be achieved through a layered strategy combining the elements of:

- Natural ventilation, viable for a large part of the year
- Supporting low energy mechanically assisted ventilation through the central smoke extraction duct (APHS only)
- Ceiling fans, providing an energy efficient way of lowering operative temperatures slightly above limits through air movement
- An efficient and flexibly operable VRV HVAC system, controlled to the extended adaptive comfort band to balance comfort and energy use
- Concrete soffits to teaching spaces exposed as much as possible to allow the structures thermal mass to reduce diurnal temperature extremes.

HVAC system controls will assist users in operating natural ventilation openings appropriately when conditions are favourable.

3.3 Water

Water recycling is a key component of the total water cycle management and integrated water resource management. Water recycling is fundamental to manage and balance all of the components of hydrological cycle (rainwater, stormwater, wastewater, groundwater, surface water and recycled water) to secure a range of social, economic and environmental benefits. The effective and safe implementation of water recycling strategies can help to reduce inputs of nutrients and other contaminants to surface water, conserve potable water and provide economic and social benefits to local communities.

3.3.1 Building Water Strategy

The following initiatives will be incorporated into both buildings:

- Water efficient fixtures – 5 Star rated taps based on WELS rating scheme, Shower heads rated at 7.5 l/min max.
- Waterless or Low flow urinals with a minimum 6 star WELS rating
- 3 / 4.5 Litre dual flush toilets with a minimum 4 star WELS rating.

To maximise water resources within the APHS and PPS buildings, rainwater will be harvested through the roofs with tanks sized to supplement water for non-potable uses such as irrigation.

3.3.2 Stormwater and Water Sensitive Urban Design (WSUD)

Water Sensitive Urban Design encompasses all aspects of urban water cycle management, including water supply, wastewater and stormwater management. WSUD is intended to minimise the impacts of development upon the water cycle and achieve more sustainable forms of urban development.

For details about stormwater detention, pollution reduction, harvesting and re-use please refer to the Stormwater Management Plan enclosed with the submission.

3.4 Energy

It is essential to ensure the buildings are designed and built to minimize energy consumption and reduce greenhouse gas emission to the atmosphere. Energy performance is considered by the design team as a crucial issue. Reduction of greenhouse gas emissions through energy efficiency is expected to contribute centrally to achievement of the Green Star 4-Star rating equivalent performance, with a reduction of 30-40% against the Green Star standard practice benchmark targeted.

This level of performance is attributed mainly to:

- A high performance facade designed to reduce solar gain into perimeter areas for all buildings
- The use of an efficient mechanical system to provide heating and cooling effectively

- The use of natural ventilation to minimise HVAC energy use
- The adoption of adaptive comfort criteria for operation of the HVAC system, reducing running times
- Use of high efficiency lighting
- Use of renewable energy to offset greenhouse gas emissions. Extension of the existing photovoltaic system will be considered

3.5 Daylight

The design proposal for the APHS tower comprises a layered façade arrangement. Outside spaces within the tower footprint have daylight levels moderated by the external shading screen, providing a level of glare reduction and creating a transitional zone to the interior spaces. Daylight levels inside the internal skin will be higher with views at the perimeter and lower in the deeper plan spaces, with deeper plan spaces being better suited to intense computer based teaching. Vertical format windows are provided up to underside of the concrete structure to maximise use of the large façade height to help offset the depth of floorplates.

Even daylighting is provisioned to the sports hall building via the tall facades supported by the presence of rooflights, with the intention that artificial lighting is not needed for the majority of the year.

The shallow plan nature of the PPS building allows good daylight penetration into the teaching areas. The circulation and outdoor areas on the courtyard side function as shading overhangs allowing maximisation of the transparent area on the courtyard facing elevations. The intent is for predominantly vertical format glazing, allowing deep penetration of daylight.

While internal blinds or mobile shading elements are provided to give occupants the opportunity to control against potential glare, the slab overhangs forming external spaces and walkways and the external screen on the high school building limit the amount of direct sunlight potentially causing glare conditions and thus contribute to reduce blind operation, which would limit daylight availability deeper within the space.

3.6 Transport

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

The development creates an environment where pedestrian and cycling access is stimulated by:

- Selection of a site within close proximity to public transport networks including trains, buses and major transport focal points
- Encouraging walking and cycling by ensuring provision of bicycle facilities for staff

- Provision of limited parking spaces on site encouraging the use of alternative modes of transport such as public transport, cycling and walking, with parking provided at a number lower than allowed under the SEPP
- Walking access to buildings promoted by stairs located in prominent locations as primary circulation elements.