ESD SEARS REPORT

Wentworthville Public School

ESD SERVICES

JHA

CONSULTING ENGINEERS

DOCUMENT CONTROL SHEET

Project Number	170412
Project Name	Wentworthville Public School | 70-100 Fullagar Road, Wentworthville NSW
Description	Ecologically Sustainable Design for SEARS
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Revision History

Issued To	Revision and Date								
	REV	P1							
	DATE	09.10.18							
	REV	A							
	DATE	12.11.18							
	REV								
	DATE								

CONTENTS

1 EXECUTIVE SUMMARY

This report has been prepared by JHA to identify and summarise the Ecologically Sustainable Design (ESD) initiatives which have been considered in the design of the proposed new facilities for Wentworthville Public School located at 70-100 Fullagar Road, Wentworthville NSW 2145.

The report demonstrates compliance with the Secretary's Environmental Assessment Requirements (SEARs) which apply to the project and has been prepared to accompany a State Significant Development (SSD) application to the NSW Department of Planning and Environment. This report should be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The aim of the ESD objectives is to encourage a balanced approach to designing new facilities for the public school project; to be resource efficient, cost-effective in construction and operation; and to deliver enhanced sustainability benefits with respect to impacts on the environment and on the health and well-being of students, staff and visitors whilst providing the best possible facilities for a constructive student learning experience.

Some of the proposed ESD key initiatives to be committed for the proposed development are listed below:

- Sufficient exposure to daylight
- Well-designed openings to promote natural ventilation
- Appropriate construction and glazing selection
- Energy efficient air-conditioning systems
- LED luminaires
- Rainwater recycle tank
- Efficient water fixtures
- Waste management plan
- Landscaping

The report also identifies how the principles of Ecologically Sustainable Design (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design and on-going operation phases of the development.

2 INTRODUCTION

2.1 PROJECT DESCRIPTION

The project is planned to address the New South Wales Department of Education's (DoE) need to provide suitable teaching spaces that meet increased demand in the area. The Department proposes to increase the capacity of Wentworthville Public School and cater for the future demand in the Parramatta area.

The proposed upgrade of Wentworthville Public School will result in 31 new permanent teaching spaces, new hall and administrative areas to accommodate 396 additional students, bringing the total student number to 1,000. The project will also provide upgrade of core facilities and removal of demountable teaching spaces in line with the Department's Education Facilities Standards and Guidelines (EFSG) and to facilitate future focused learning objectives.

2.2 SITE LOCATION

The subject site is located at 70-100 Fullagar Rd, Wentworthville within the suburbs of Cumberland and surrounded by residential developments.

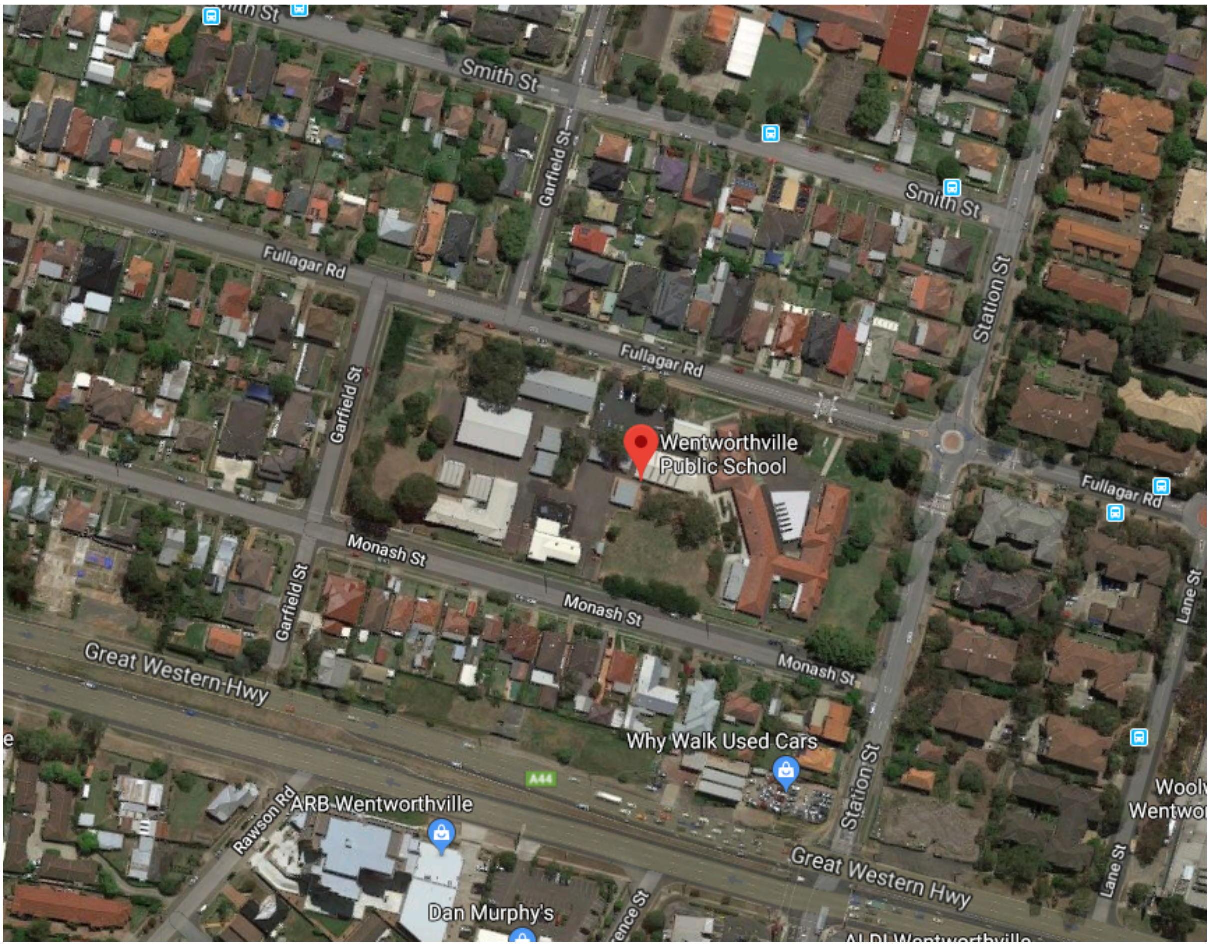


Figure 1 – Aerial photo of site

2.3 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (SEARS)

This report acknowledges the SEARs prepared by the Secretary which notes the following in Section 8 of the document:

"8. Ecologically Sustainable Development (ESD)

- Detail how the 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.
- Include a framework for how the 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.
- Include preliminary consideration of building performance and mitigation of climate change, including consideration of Green Star Performance.
- Provide a statement regarding how the works are 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)."

The items listed above of the SEARS requirements are addressed in sections 3, 4, 5 & 6 of this report respectively.

3 GENERAL

In accordance with the above variety of categories, the development will implement a holistic and integrated approach to Ecologically Sustainable Design (ESD), maximising passive opportunities with the selective application of modern technology where appropriate. Initiatives will be chosen with due regard to whole of lifecycle cost benefits to the school.

The ESD initiatives and targets outlined within this document have been compiled based on the following:

- Best practice design principles
- National Construction Code (NCC) Section J – Energy Efficiency Targets (i.e.: exceeding targets)
- NSW Department of Education's Educational Facilities Standards & Guidelines (EFSG)

4 PRINCIPLES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The principles of Ecologically Sustainable Development as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 have been incorporated into the design and on-going operation phases of the development as follows:

4.1 THE PRECAUTIONARY PRINCIPLE

Namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and;
(ii) An assessment of the risk-weighted consequences of various options.

PROJECT RESPONSE:

This development is being designed in accordance with a wide range of ESD goals that pertain to the design, construction and operational stages. The development team will ensure that the building minimises the impact on the environment in the areas of energy, water and materials. A strong focus on electrical and mechanical strategies, including the use of renewable energy contributes to significant strides toward minimising climate change impacts.

4.2 INTER-GENERATIONAL EQUITY

Namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

PROJECT RESPONSE:

This development will not cause any significant impact on the health, diversity and productivity of the environment and will provide a community benefit in the form of increased student capacity, upgraded teaching and learning facilities. The project will contribute to a lively community environment and add architectural interest to the surrounding area.

4.3 CONSERVATION OF BIOLOGICAL DIVERSITY AND ECOLOGICAL INTEGRITY

Namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration

PROJECT RESPONSE:

This development is proposed on a previously developed area of land adjacent to a main road, in an urban environment in a western suburb of Sydney.

The project will be following a detailed Biodiversity Constraints Assessment Report prepared in accordance with relevant legislations to ensure that any future development will not have a significant effect on any threatened species, endangered communities, or their habitant.

4.4 IMPROVED VALUATION, PRICING AND INCENTIVE MECHANISMS

Namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

PROJECT RESPONSE:

The design of this development has employed lifecycle costing to determine the optimum strategy with regards to major items of plant, with decisions being made based on whole of life costs rather than capital expenditure only.

5 SUSTAINABLE DESIGN INITIATIVES

5.1 SUSTAINABILITY BENCHMARKING

In accordance with the NSW Resource Efficiency Policy all new facilities must be designed and built to exceed by 10% the reference building energy consumption as specified in National Construction Code (NCC) Section J deemed-to-satisfy provision.

The design team must include Ecologically Sustainable Development principles in new school buildings to a level that could achieve an equivalent of 4 Star Green Star rating.

5.2 ENVELOPE

Intelligent design and material selection ensure that thermal comfort is not entirely achieved by a mechanical means. Passive design initiatives such as performance glazing, shading and use of insulation will reduce demand on the mechanical air conditioning systems resulting in a reduction of energy consumption and greenhouse gas emissions.

5.2.1 Building Envelope Performance

The building fabric will be designed to meet or exceed the NCC 2016 requirements for building envelope. Thermal breaks will be incorporated into walls and roofs where appropriate.

5.2.1.1 Building Fabric

The minimum performance requirements for the building form and construction at the proposed development location as per the NCC 2016 Section J- Energy Efficiency are:

- Roof and Ceiling R3.2
- External Walls R2.8
- Internal Walls R1.8
- Suspended Floor R2.0

This will necessitate the use of insulation in the walls, floor and roof. Insulation reduces heat flow and consequent heat loss in winter and heat gain in summer. This minimises the heating and cooling load demand on the air conditioning systems.

Light coloured roof material is recommended to be used to reflect more sunlight and reduce summer heat gain.

5.2.1.2 Glazing

It is recommended that windows will be high performance glazing systems. Performance glazing substantially reduces heat transmission. This particularly reduces heat loss in winter; therefore, internal heat gain from equipment, lighting and people are better contained. Also, performance glazing absorbs the infrared portion of sunlight and reduces the amount of heat transferred into the conditioned space. This will correspond in a reduction of both heating and cooling loads.

The building will comply with NCC Section J Energy Efficiency by means of Deemed-To-Satisfy Solution or Performance Solution as appropriate. The assessment to show compliance will be carried out during the detailed design stage of the project.

5.3 SHADING AND DAYLIGHTING

The proposed buildings have been design to have a large portion of the façade facing North and South. This will avoid the unwanted heat gains from the Eastern and Western sun.

The provision of South facing glazing allows for increased natural daylight whilst minimising unwanted passive solar heat gain. The large portion of windows are shaded by roof eaves and vertical battens that will reduce the amount of summer solar radiation through windows.

These passive design features allow for enriched daylighting and greater access to external views for occupants. Additional daylighting reduces the reliance on artificial light and benefits alertness, mood and productivity. External views provide a connection to nature and the school setting and also help to create an environment encouraging constructive learning.

5.4 NATURAL VENTILATION

Adequate natural air movement makes an important contribution in creating a comfortable indoor environment and reducing the need for mechanical ventilation by carrying accumulated heat out and replacing it with cooler external air. This is important during the summer months where heat build-up within spaces can be quickly removed with the availability of suitable breeze at the site.

The design team proposed to utilise natural ventilation and air circulation trough ceiling fans and openable windows.

5.5 ENERGY EFFICIENCY

Each climate zone under the Building Code has different design and conditioning requirements to minimise energy use for heating and cooling. Good balance of heating and cooling reduction techniques are required to create an energy efficient development.

5.5.1 HEATING, COOLING AND VENTILATION SYSTEMS

Teaching spaces, Libraries and Office Building E to be air conditioned via VRF concealed ducted systems. All rooms to be naturally ventilated. Mechanically assisted natural ventilation required to areas which do not comply with bets design practices for natural ventilation.

All areas which are air conditioned will be heated via reverse cycle. For office spaces which are not air conditioned, flued gas heaters shall be installed for heating.

All bathroom, storage, and general exhaust to be naturally ventilated where possible, with mechanical ventilation required where necessary. Cleaners, printing, comms, switchrooms and pump rooms to be mechanically ventilated via in-line or roof mounted fans.

The air-conditioning and ventilation systems shall be designed to comply or exceed the minimum requirements of NCC 2016 Section J5.

Ductwork and pipework systems will be designed to reduce system pressure losses to reduce fan and pump motor power. This includes the selection of equipment for reduced coil and vessel pressure drops and being generous with ductwork and pipework sizes to reduce friction losses.

These initiatives will provide significant savings in energy use.

5.5.2 LIGHTING

Lighting will be designed to comply or exceed the minimum requirements of NCC 2016 Section J6.

Fittings incorporating the latest lamp technologies will be installed to minimise energy use and provide efficient artificial lighting systems.

The proposed development shall be illuminated using LED fittings and be controlled via automatic control system.

Lighting in each learning area shall be provided with a daylight sensor to reduce light output or turn off lights when sufficient daylight is provided within the space. For large spaces the perimeter lighting shall be on a separate zone to make maximum use of daylight.

5.5.3 CONTROLS

All new lighting and HVAC installed must be controlled by time switch or motion sensor for energy conservation for:

- Home bases
- Practical activities areas
- Library main reading areas

A period bell alarm timer system shall be installed to control luminaires in appropriate rooms.

The automatic switching shall operate as per the EFSG requirements.

5.5.4 ELECTRICITY METERING

Electricity metering and sub-metering shall be specified in accordance with the EFSG to monitor and manage electricity consumption in the building.

5.5.5 PHOTOVOLTAICS

Collecting solar energy has been chosen as a key ESD strategy for the project, with an aspirational goal of reducing the building's energy consumption and greenhouse gas emissions from a renewable source via the provision of a roof-mounted photovoltaic system.

5.5.6 VERTICAL TRANSPORT

The use of lifts within the development will be discouraged by providing visually prominent staircases for all floors.

5.6 INDOOR AIR QUALITY (IAQ)

The quality of indoor air has a significant impact on our health and environment. Poor indoor air quality resulting in adverse health effect such as allergy, asthma, etc.

The outdoor air ventilation rates shall be in accordance with AS 1668.2 for mechanically ventilated spaces. Mechanical ventilation systems shall be linked to CO_2 sensors and designed to not exceed 1,500ppm for more than 20 consecutive minutes in each day.

Ventilation system shall be designed to minimise the entry of outdoor pollutants.

5.7 WATER CONSERVATION

The following initiatives are proposed to ensure that significant water saving be achieved.

5.7.1 Fittings and Fixtures

It is the EFSG requirement that all water fittings and fixtures such as showerheads, water tap outlets and toilet cisterns must have or exceed the following Australian Government's Water Efficiency Labelling Scheme (WELS) star ratings.

Water Fittings / fixtures	Minimum WELS Rating	Highest Available Rating (AS/NZS 6400-2016)
Shower head rating	3	4
Sink tap rating	5	6
Toilet cistern rating	4	6
Urinals rating	4	6

5.7.2 On-Site Alternative Water Supply

It is DoE policy to include roof water harvesting and tank storage in new schools to reduce the demand on drinking water supply. The exact tank size has not yet been established.

5.7.3 METERING

Sub-metering shall be specified in accordance with the EFSG to mixed irrigation systems, laboratory buildings, amenities blocks, canteens and any other major water use on the site.

5.8 MATERIALS

5.8.1 LOW VOC / LOW FORMALDEHYDE MATERIALS

Adhesives, sealants, flooring and paint products will be selected to contain low or no Volatile Organic Compounds (VOCs) and all engineered wood products used in exposed or concealed applications are specified to contain low or no formaldehyde to avoid harmful emissions that can cause illness and discomfort for occupants.

5.8.2 RECYCLED CONTENT

Loose furnishings within the building shall be selected based on their recycled content, end-of-life recyclability and product stewardship agreements. By selecting loose furnishings which comply with independent environmental certification, for example Ecospecifier or Good Environmental Choice Australia, the project will confidently reduce environmental impacts and waste from furnishings over the life of the building.

Steel and concrete to comply with Green Star requirements, pending feasibility.

- For steel frame buildings at least 60% of the fabricated structural steelwork shall be supplied by a steel fabricator/ contractor accredited to the Environmental Sustainability Charter of the Australian Steel institute (ASI).
- For concrete framed buildings at least 60% (by mass) of all reinforcing bar and mesh is produced using energy-reducing processed in its manufacture.

No Rainforest timbers, or timbers from high conservation forests, are to be used unless plantation grown. Sustainable timber shall be specified for at least 95% (by cost) of all timber products used on the project. This can be achieved by using products certified by a forest certification scheme and from a reused source.

5.9 WASTE

Waste collection and disposal plays an important role in the protection of the environment and the health of the population in the modern world.

A waste management plan will be prepared in accordance with the EFSG requirements to assess and monitor the waste management process during construction and demolition, as well as waste produced during occupation within the development.

The waste management plan shall incorporate how to minimise the amount of waste generated, maximise the reuse, recycling and reprocessing construction waste materials and minimise the volume to materials disposed to landfill.

5.10 WATER SENSITIVE URBAN DESIGN

External area design will implement best practices of water sensitive urban design, including permeable paving and indigenous low water usage plants to increase stormwater retention, decrease total suspended solids and mitigate the urban heat island effect. The carbon sequestration of the plants will also combat climate change contributions.

6 IMPACTS OF CLIMATE CHANGE

6.1 NEEDS ANALYSIS

Considering climate risk during the needs analysis stage of the project can help with the early identification of the challenges and opportunities that are likely to have an impact on the project across the lifecycle of the asset.

The first step is to consider whether any of the extreme events are likely to have an impact on the project by considering the project's exposure to climate impacts. Past climatic events that have impacted and potential hazards that may affect the site are summarised below:

- Heat waves – Over the period 1911–2013, heatwaves in parts of NSW have become longer, hotter and occur more often. Infants and young children are considered one of the groups most at risks to impact of heat related illness. [Source: AdaptNSW Heatwaves Climate Change Impact Snapshot]
- Storm – Low rainfall intensity for 60minute 1:100yr Storm. Predicted to receive 60.00mm, or up to 445.00mm over 3 days. This location experiences an average of 19 days per year where severe thunderstorms occur.
- Flood – No known exposure to riverine flood events. [Source: Flood Exclusion Zone (FEZ) dataset 2018]. See also Appendix A: Inundation Map.
- Bushfire – The parcel of land selected is not identified as bush fire prone however it could still be affected by a bush fire. [Source: NSW RFS Bushfire Prone Land 2017].

Studies have shown that learning performance can be impacted by higher temperatures. Warm classrooms may decrease interest and alertness, distracting students. In hotter classrooms, headaches and heat exhaustion symptoms may develop that can hinder academic performance. High temperatures may be accompanied by higher levels of humidity. Increased humidity can cause drowsiness in students. Studies have shown concentration tests scores are lower in humid, hot environments.

6.2 CLIMATE VARIABLES OF INTEREST

Based on the above, the climate variables of interest for this site are maximum daily temperature and rainfall (rainfall correlates to humidity), particularly for the summer months of December to February.

6.3 IDENTIFIED TIME SERIES

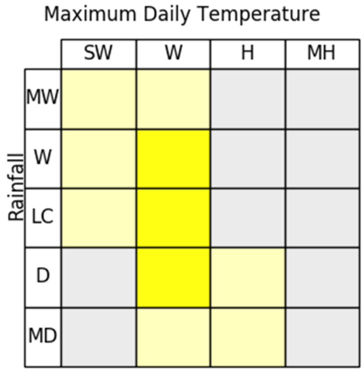
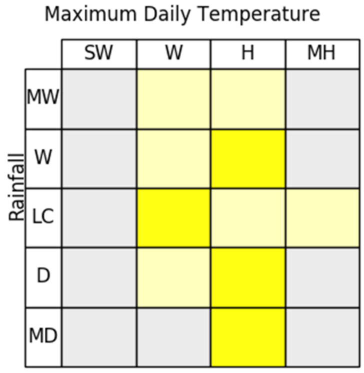
The lifespan of the project components were considered to determine time series. Based on components design life, the time series that is selected to understand the future climate impacts across the project's life are 2030 and 2070.

6.4 IDENTIFIED GREENHOUSE GAS SCENARIOS

In order to source relevant climate projection, a representative concentration pathway (RCPs) based on the latest IPCC report (AR5) is chosen. The RCPs provide plausible climate futures that may eventuate over the coming years. RCP 8.5 scenario has been selected as one future climate projection for this assessment as it's the most conservative pathway and because current emissions are tracking close to RCP 8.5. RCP 8.5 reflects a future with less curbing of emissions, coal fired power generation, increased carbon dioxide concentration reaching 940 ppm by 2100. The RCP 4.5 is chosen to represent a stabilisation pathway in which lower emissions is achieved by application of some mitigation strategies and technologies. RCP 4.5 reflects a future where emissions peak around 2040, and the CO2 concentration reaches 540 ppm by 2100.

6.5 CLIMATE FUTURE PROJECTIONS

The series of climate futures matrices representing the combination of time periods and greenhouse gas scenarios and classified by the combined changes of the climate variables identified above are provided in table below:

<table>
<tr><td colspan="2" rowspan="2">East Coast (South) Climate Futures</td><td colspan="2">Year</td></tr>
<tr><td>Summer 2030</td><td>Summer 2070</td></tr>
<tr><td rowspan="2">Emissions Scenarios</td><td>RCP 4.5</td><td>
</td><td>
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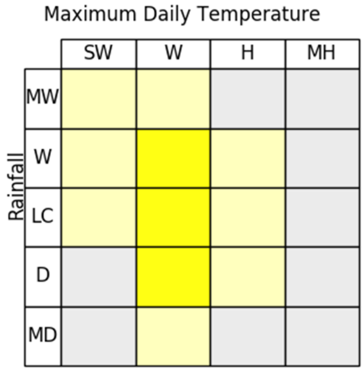
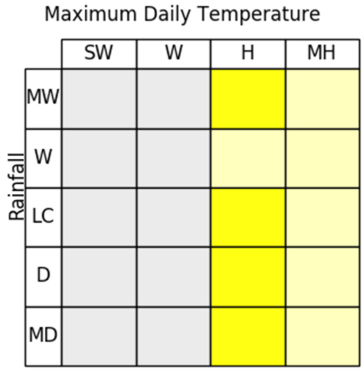
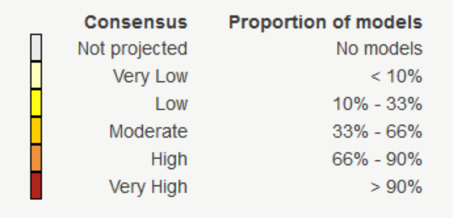
<tr><td>RCP 8.5</td><td>
</td><td>
</td></tr>
<tr><td colspan="2">Keys</td><td>Maximum Daily Temperature
SW Slightly Warmer < 0.50
W Warmer 0.50 to 1.50
H Hotter 1.50 to 3.00
MH Much Hotter > 3.00

Rainfall
MW Much Wetter > 15.00
W Wetter 5.00 to 15.00
LC Little Change -5.00 to 5.00
D Drier -15.00 to -5.00
MD Much Drier < -15.00</td><td>
</td></tr>
</table>

Source: CSIRO and Bureau of Meteorology, Climate Change in Australia website (http://www.climatechangeinaustralia.gov.au/), cited 07/09/2018.

6.6 KEY CASES

For thermal comfort:

"Best Case": Climate Future with the least increase in maximum daily temperature and the largest decrease (or least increase) in rainfall (shorthand: "coolest and driest")

"Worst Case": Climate Future with the greatest increase in maximum daily temperature and the greatest increase (or least decrease) in rainfall (shorthand: "hottest and wettest")

6.7 RESULTS

For thermal comfort:

Case	2030 Climate Future		2070 Climate Future	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
"Best"	Slightly warmer and no change (Consensus: Very low)	Slightly warmer and little change (Consensus: Very low)	Warmer and drier (Consensus: Very low)	Hotter and much drier (Consensus: Low)
"Worst"	Warmer and much wetter or Hotter and drier (Consensus: Very low)	Hotter and wetter (Consensus: Very low)	Much hotter and little change (Consensus: Very low)	Much hotter and much wetter (Consensus: Very low)
"Maximum consensus"	Warmer and little change to drier (Consensus: Moderate)	Warmer and little change to wetter (Consensus: Moderate)	Warmer to hotter and little change to drier (Consensus: Moderate)	Hotter and little change to drier (Consensus: Moderate)

6.8 DISCUSSIONS

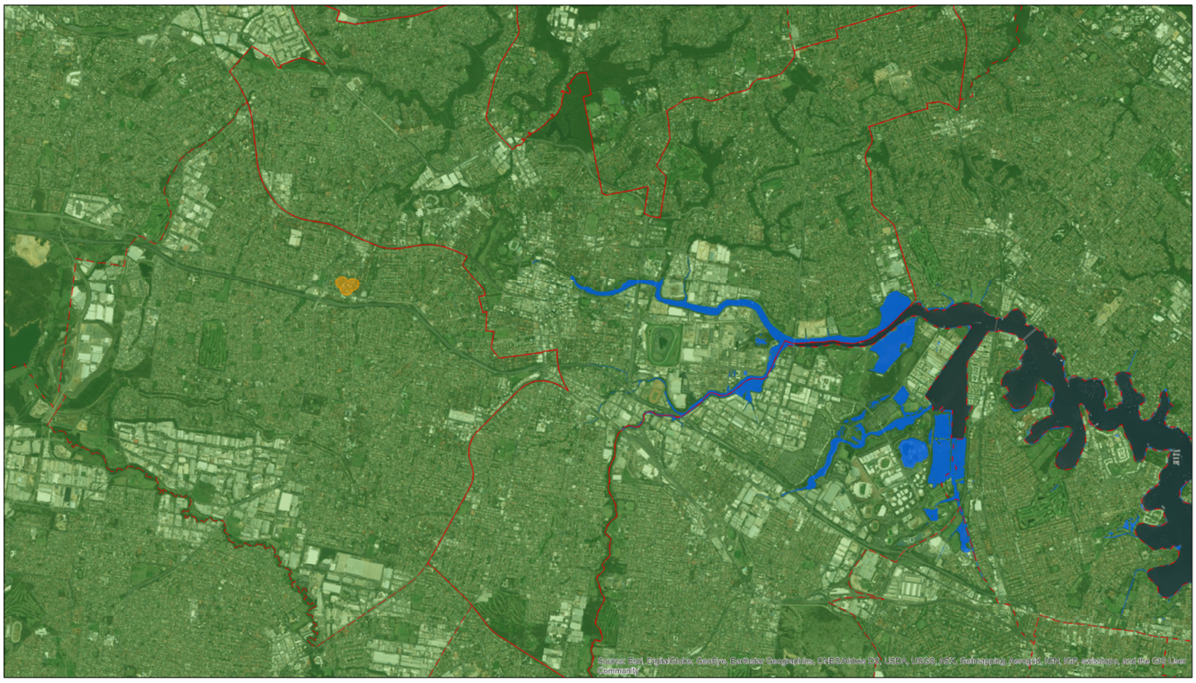
In the "best case" scenarios, the summer maximum daily temperature is projected to be slightly warmer by 2030 and warmer to hotter by 2070. Therefore, this project should be designed with warmer temperature being taken into considerations. The direction of rainfall change (increasing or decreasing) is highly uncertain at this stage; as such, this project may consider a wait and see approach until a clearer pattern emerges to avoid potential maladaptations.

High level of passive thermal features should be considered, especially features that will assist in reducing solar heat gains in summer. Air-conditioning should be considered throughout, budget permitting. However, overreliance on air-conditioning should be avoided, especially during extreme temperature and heatwave events; air-conditioning should be accompanied by appropriate occupant behaviours and responses to ensure fitting and efficient use of the system. As the climate becomes warmer, energy consumption associated with cooling will increase. This additional electricity demand and associated greenhouse gas emission could be offset with additional photovoltaics panels to provide renewable electricity.

Dedicated "Cool outdoor areas" where students and teachers can take shelter during extreme hot days when the power fails and there is no air conditioning should be explored by the design team. This cool area should utilise passive design principals to moderate temperature during extreme days. Secondly, this cool area should consider ways to harness the cooling power of water to provide additional cooling.

APPENDIX A: INUNDATION MAP

Maps shows site is not subjected to risk of inundation. Site clouded in orange.



PARRAMATTA

0 0.5 1 1.5 2
Kilometres

Scenario

Inundation for a **high (RCP8.5) sea-level rise scenario** of **0.27m** relevant to **2050**, derived from CoastAdapt sea-level rise charts (red line). Sea-level rise (SLR) is combined with the nominal Highest Astronomical Tide (HAT) for the region to give an inundation level of **1.43m** above mean sea level. Inundation is modelled using high-resolution digital elevation data and a simple 'bucket fill' approach. The result is approximate only; actual inundation may vary as the model does not take account of existing sea walls, storm surge, erosion etc. Find further information on map development at http://coastadapt.com.au/slr

Local government boundaries shown in red

Blue shading: Flooded for this scenario
SLR + HAT = 1.43m

Green shading: LiDAR available, not flooded for this scenario

No shading: no LiDAR data

Disclaimer

This map has been developed to communicate the risk of sea-level rise. The information included is not provided as professional advice, and should not be relied upon for site-specific decision-making or for making financial or other commitments. For decision-making purposes, appropriate independent professional advice should be obtained. The maps have been prepared for NCCARF by the Cooperative Research Centre for Spatial Information (CRCSI). NCCARF and the CRCSI expressly disclaim liability for loss, however caused and whether due to negligence or otherwise, arising directly or indirectly from the use of or reliance on this map or the information contained in it, by any person.

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Australian Government Department of the Environment

Date created: 31/05/2016