Darlington Road Terraces Mixed Use Building Additions and Alterations to the Darlington Road Terraces and Public Domain Improvements

The University of Sydney

Ecologically Sustainable Development (ESD) Report

003 | Final

November 2016

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Project No:	IA115900
Document Title:	Ecologically Sustainable Development (ESD) Report
Document No.:	003
Revision:	3
Date:	21 November 2016
Client Name:	The University of Sydney
Client No:	
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Author:	Philippa Owen, Samantha Craig
File Name:	J:\IE\Projects\04_Eastern\IA115900\21 Deliverables\UoSyd Comments November\Jacobs ESD Report Draft v3.0 21.11.2016.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
1	20.06.16	Draft	Philippa Owen Samantha Craig	Craig Niles	
2	21.10.2016	Revision Draft for issue	Samantha Craig	Philippa Owen	Philippa Owen
3	21.11.2016	Final	Samantha Craig	Philippa Owen	Craig Niles

Contents

1. Introduction

Jacobs Group (Australia) Pty Ltd (Jacobs) has been appointed by The University of Sydney (Campus Infrastructure and Services (CIS)) to prepare an Ecologically Sustainable Design (ESD) report for the Darlington Terraces Redevelopment project (the Proposal). The report is based on inputs from the project design team during schematic design as described in Section 4. In order to address the Secretary's Environmental Assessment Requirements for ESD, this report:

- summarises the ESD initiatives that have been incorporated into the Proposal; and
- provides a preliminary assessment of the Proposal against The University of Sydney's Sustainability Framework.

1.1 Site description

The development site is located along Darlington Road, Darlington NSW 2008. The site is bounded by Darlington Road to the north, Golden Grove Street to the west, Darlington Lane to the south (the lane is also included in the project works), and Codrington Street to the east. The site currently consists of a row of thirty-eight (38) late Victorian Terraces with rear gardens backing onto Darlington Lane.

The terraces that are privately owned include 88-93, 97 &120 Darlington Road which are not included in the proposed development.

1.2 Proposal description

The University of Sydney is proposing building additions and alterations to the existing Darlington Road Terraces and H66 Darlington House for mixed uses integrating affordable student accommodation and other educational establishments.

The development will include adaptive reuse of the existing Terraces and construction of four (4) separate mixed use buildings within the rear yards for use by residents and the wider University community.

Once completed the mixed use development will provide:

- 337 beds in mixed single, twin, double and loft dormitory style bedrooms;
- Other educational establishment facilities including:
    - Bookable meeting and tutorial rooms;
    - Computer labs. e-learning;
    - Lecture theatre;
    - Multi-function learning spaces;
    - Study areas;
    - Maker spaces; and
    - Meeting rooms and informal spaces.
- Communal areas including:
    - Self-catered kitchens;

  - Main dining hall;
  - Lounge;
  - Breakout spaces;
  - Laundry facilities; and
  - Music Rooms.
- Central courtyards;
- Roof top terraces with courtyard views;
- Ground level waste and bike storage;
- Basement level with plant room;
- External areas – soft and hard landscaping, and
- Operator administration office.

The project contributes to the University's Campus Improvement Program (CIP), which identifies the need to develop over 4,500 student beds within close proximity to its main campuses at Darlington and Camperdown.

1.3 Secretary's Environmental Assessment Requirements

The proposal is to be submitted to the NSW Department of Planning and Environment as a State Significant Development Application (SSDA). The Secretary's Environmental Assessment Requirements (SEARs) were provided on 21 March 2016 which provides key issues to be addressed in the Environmental Impact Statement (EIS). Specifically, item 6 of the SEARs requires:

Ecologically Sustainable Development (ESD)

- *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.*
- *Demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.*
- *Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy.*

The SEARs are addressed in this ESD report as per Table 1-1 below.

Table 1-1 ESD SEARs requirements for the Proposal

SEARs requirement: ESD	Responses in this report
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.	Section 2 of this report summarises how the following ESD principles have been integrated into the Proposal: (a) the "precautionary principle" (b) "inter-generational equity" (c) "conservation of biological diversity and ecological integrity" , (d) "improved valuation, pricing and incentive mechanisms"
Demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.	The Proposal has been assessed against The University of Sydney's Sustainability Framework based on inputs from the design team. Refer to Section 3 of this report for a description of the rating scheme and assessment findings.
Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy.	A description of initiatives included or recommended for the scheme, based on inputs from the design team, is provided in Section 4.

2. ESD Principles

2.1 ESD Principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000)

Principles of ecologically sustainable development	Response
(a) 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 (ii) an assessment of the risk-weighted consequences of various options	The potential environmental impacts on the environment have been identified and assessed through the preparation of an Environmental Impact Statement (EIS). The EIS documents the evaluation of environmental impacts associated with the project and has been carried out using available technical information and adoption of environmental standards, goals and measures to minimise environmental risks. The impact assessments have been carried out in consultation with key stakeholders and relevant statutory and agency requirements.
(b) ***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	The project aims to provide educational establishment facilities and affordable student accommodation on campus, thereby improving access to education, and providing teaching and learning spaces that support education and collaboration. ESD design principles will be adopted to: • provide healthy indoor environments through adequate ventilation, daylight and low toxicity materials; • conserve resources including energy and water; and • preserve the heritage values of the site for future generations.
(c) ***conservation of biological diversity and ecological integrity***, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration	The landscape design of the project aims to: • Retain all significant trees. • Retain existing planting where plants are in good condition. • Provide native trees and new planting in garden beds.

Principles of ecologically sustainable development	Response
(d) ***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.	The University's Sustainability Framework has been applied to the project. The framework defines relevant sustainability performance criteria to be achieved by buildings and considers a range of environmental aspects related to building design, procurement, construction and commissioning. Real time monitoring of energy and water use and costs will be displayed in common areas to encourage building users to change behaviour, conserve resources and reduce operational costs.

3. Sustainability Framework

3.1 The University of Sydney Sustainability Policy

The University of Sydney Sustainability Policy (2015):

- establishes principles for a University-wide approach to achieving environmental sustainability
- specifies the environmental sustainability principles to be applied throughout the University
- provides for continual improvement in environmental sustainability, and avoidance and minimisation of environmental risks
- provides for the management of compliance with applicable legislation
- establishes a framework for setting environmental sustainability objectives
- promotes environmentally sustainable investment practices

The University of Sydney's Sustainability Policy is implemented through the incorporation of the University of Sydney's Sustainability Framework, described below.

3.2 The University of Sydney Sustainability Standard and Sustainability Framework

The CIS Sustainability Standard sets out the minimum requirements for achieving sustainable design of major building projects at the University of Sydney. Requirements of this Standard are met by completing the University's Sustainability Framework which is a dynamic Microsoft Excel based tool used by project teams to benchmark sustainability performance for a particular project.

The Sustainability Framework endeavours to ensure the University's built environment is resource efficient, operationally cost-effective and provides improved environmental health and wellbeing benefits to student, staff and visitors. The framework is not an accredited rating scheme such as Green Star but is a holistic assessment that draws from national (Green Star) and international building (BREEAM & LEED) accredited rating systems and best design practice. The Proposal has therefore been assessed against this Framework as an 'equivalent' rating scheme to demonstrate industry best practice for sustainable design.

The Sustainability Framework considers the following themes:

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

The Sustainability Framework comprises mandatory and optional individual measures which detail specific design and infrastructure requirements to enhance sustainability of the project. The Framework is supported by a range of guidelines, standards and templates to assist in advising and demonstrating the achievement of measures as appropriate.

The applicable measures are tailored according to the project type:

- Student accommodation;
- General university buildings; and
- Laboratory buildings.

Points are awarded where the measures are achieved. The Proposal has been assessed under the 'Student accommodation' type, for which a total of 140 points are available. The overall percentage score is translated into a sustainability level as shown in **Table 3-1**.

Table 3-1 Sustainability Framework - scoring levels

Sustainability level	Score
Bronze	65%
Silver	70%
Gold	75%
Platinum	80%

Similar to other rating systems, the University of Sydney's Sustainability Framework requires a formal submission of design and as-built documentation to the CIS Engineering and Sustainability Team for review and to demonstrate the project has achieved the requirements of the framework.

Table 3-2 Integration of the Sustainability Standard into the CIS gateway process sustainability requirements

CIS Gate	Stage	ESD activity
Gates 1 & 2	**Initial Project viability Assessment** **Project Brief Preparation and Assessment**	CIS ESD consultant is appointed (note that ESD was appointed at Gate 3 for the Proposal)
Gate 3	**Project Endorsement** Final Project Brief(PDP/PPR) & Schematic Design & necessary documentation required for Authority approvals	CIS Planning Team to endorse the minimum sustainability ambition level required for the project. CIS Project ESD consultant to submit the Gateways 1-3 Preliminary Sustainability Framework with the "Preliminary design response" completed and accompanied by all documents identified in the Framework as "Preliminary Submission Requirements". This must be approved by the CIS Engineering and Sustainability Team representative prior to inclusion in Tender documentation
Gate 4	**Project Procurement** Including Design Development, Tender Document Preparation, tender award Project delivery /relocation contractors /Consultants	The minimum ambition level and Preliminary Sustainability Framework must be included in Request for Tender documentation. Complying tenders must submit a completed Sustainability Framework demonstrating how the minimum sustainability ambition level will be met. Tender assessment criteria will include a value-added weighting for exceeding the minimum Sustainability Framework ambition level. The contractor must conduct an ESD workshop, nominally at 80% construction documentation for the CIS Project ESD Consultant to

CIS Gate	Stage	ESD activity
		review and endorse the proposed method of compliance. The contractor must submit the completed Gateway 4 Sustainability Framework with the "Contractor Design Response" accompanied by all documents identified in the Framework as "As Built Submission Requirements". CIS Project ESD consultant must peer review the As Built Submission Requirements and sign-off that the project would meet the requirements of the Sustainability Framework.
Gate 5	**Project Delivery** Including Relocations Commissioning, Operational Readiness and Handover	CIS Project ESD consultant verifies completion of Sustainability Framework commissioning initiatives.
Gate 6	**Occupation Management** Up to 1 year after occupation	CIS Project ESD consultant must verify completion of Sustainability Framework tuning and monitoring initiatives.

3.3 The University of Sydney Sustainability Framework Assessment

The Darlington Terraces Redevelopment is targeting a 'Silver' level which equates to a score of at least 70%. A preliminary assessment has been undertaken with inputs from the project team to identify the targeted points. The summary is provided below and the framework is attached in full in Appendix A. Further assessment and evidence will be required at the D&C stage to confirm the rating.

JACOBS

THE UNIVERSITY OF SYDNEY

Project name:	Darlington Road Terraces
What type of building is your project?	Student Accommodation
What is the ambition level for your project?	Silver - 70%

	Preliminary Design	D & C Stage
Total Points Available	140	140
Current total points targeted	107	TBC
Remaining points required to achieve ambition level	-9	98

		Points Available	Mandatory Points*	Preliminary Design Points Targeted
1. Leadership and Communication				
1.1	ESD Professional	2	2	2
1.2	Life Cycle cost evaluation	3	3	0
1.3	Commissioning and Building Tuning	3	3	2
1.4	Environmental Management Plan	1	1	1
1.5	Site Waste Management Plan	1	1	1
1.6	Indoor Air Quality Management Plan	3	3	3
1.7	Building Users' Guide	1	1	1
1.8	Sheet Metal and Air Conditioning National Contractors Association	2	0	2
		16	**14**	**12**
2. Resource Efficiency				
Passive Design and Energy Efficiency				
2.1	Passive Design Principles	1	1	1
2.2	Improve Building Energy Performance by 20%	3	3	2
2.3	Solar PV Systems	3	3	3
2.4	Hot Water Systems	3	3	3
2.5	Energy Consuming Equipment	2	2	2
2.6	Metering Utility Use	3	3	3
2.7	Lighting Systems	2	2	2
2.8	Unoccupied Spaces	2	2	2
2.9	No Hot Water in Public Restrooms	1	1	0
2.10	Improve Building Energy Performance by 30%	3	0	3
2.11	Natural Ventilation	3	0	3
2.12	Mixed Mode Ventilation	10	0	0
2.13	Peak Power (1)	3	3	1
2.14	Peak Power (2)	3	0	1
Water Efficiency				
2.15	Water Use	1	1	1

		Points Available	Mandatory Points*	Preliminary Design Points Targeted
2.16	Laboratory equipment water use	0	0	0
2.17	Process water efficiency	0	0	0
2.18	Water Harvesting	3	3	3
2.19	Fire Systems	1	1	0
Waste Management & Resource Recovery				
2.20	Centralised Building Waste Management System	1	1	1
2.21	Waste Storage	1	1	1
		49	**30**	**32**
3. Healthy Environment				
3.1	Access to water stations	1	1	1
3.2	Avoid Over lighting Spaces	3	3	3
3.3	Daylighting	2	2	2
3.4	External Views	2	2	2
3.5	Avoid Glare	2	2	2
3.6	Thermal Comfort	2	2	1
3.7	Location of Stairs	1	1	1
3.8	Building Noise	1	1	1
3.9	CO2 Monitoring	3	3	0
3.10	Volatile Organic Compounds - Adhesives & Sealants	2	2	2
3.11	Volatile Organic Compounds - Paints & Carpets	2	2	2
3.12	Formaldehyde Minimisation	2	2	2
3.13	Ceiling Fans	2	0	1
3.14	Planting selection	1	0	0
		26	**23**	**20**
4. Materials				
4.1	Loose Furnishings	2	2	2
4.2	Sustainable Timber (1)	2	2	2
4.3	Recycled Steel (1)	3	3	3
4.4	Façade Reuse	2	0	2
4.5	Structure Reuse	3	0	3
4.6	Sustainable Timber (2)	2	0	2
4.7	Steel (2)	3	0	3
4.8	Recycled Concrete	3	0	3
4.9	Regional materials	3	0	3
4.10	Joinery	3	0	3
4.11	PVC Minimisation	3	0	3
4.12	Design for Disassembly	3	0	3
		32	**7**	**32**
5. Climate Change, Landscape & Infrastructure				
5.1	Infrastructure Future proofing	3	3	3
5.2	High Albedo Roof Materials	1	1	1
5.3	Surface Heat Reduction	1	1	1

		Points Available	Mandatory Points*	Preliminary Design Points Targeted
5.4	Landscape	1	0	1
5.5	Flood Risk Management	2	2	2
5.6	Stormwater Management	2	0	0
5.7	Green Roof / Wall	2	0	1
		12	**7**	**9**
6. Sustainable Transport				
6.1	Cycle Parking	2	2	2
6.2	End of Trip Facilities	0	0	0
6.3	Car parking	2	0	0
6.4	Motor cycle and small car parking	1	0	0
		5	**2**	**2**

* Where not appropriate / practical to achieve ‘mandatory’ points due to project scale / details – these can be discounted subject to CIS Request Dispensation form (CIS-ENG-F001) and agreement by CIS Sustainability Officer.

4. ESD Initiatives

This section describes the ESD initiatives that have been incorporated into the design and the ESD commitments to be included in the detailed design, procurement and / or construction phases. The descriptions are based on design reports and communications with the project team.

4.1 Energy efficiency

4.1.1 Passive Design

Passive design elements aim to improve indoor environmental quality, thermal comfort and energy efficiency, and to minimise reliance on mechanical cooling and heating whilst preventing noise and pollution sources. Passive design strategies have been incorporated into the architectural design where possible in order to utilise certain environmental conditions as opportunities for energy reduction and energy efficiency. These strategies include building orientation, solar access, prevailing winds, and seasonal and diurnal temperature changes.

The building orientation is influenced by the existing building layouts and available development area which are on a southwest to northeast axis (Figure 4-1).

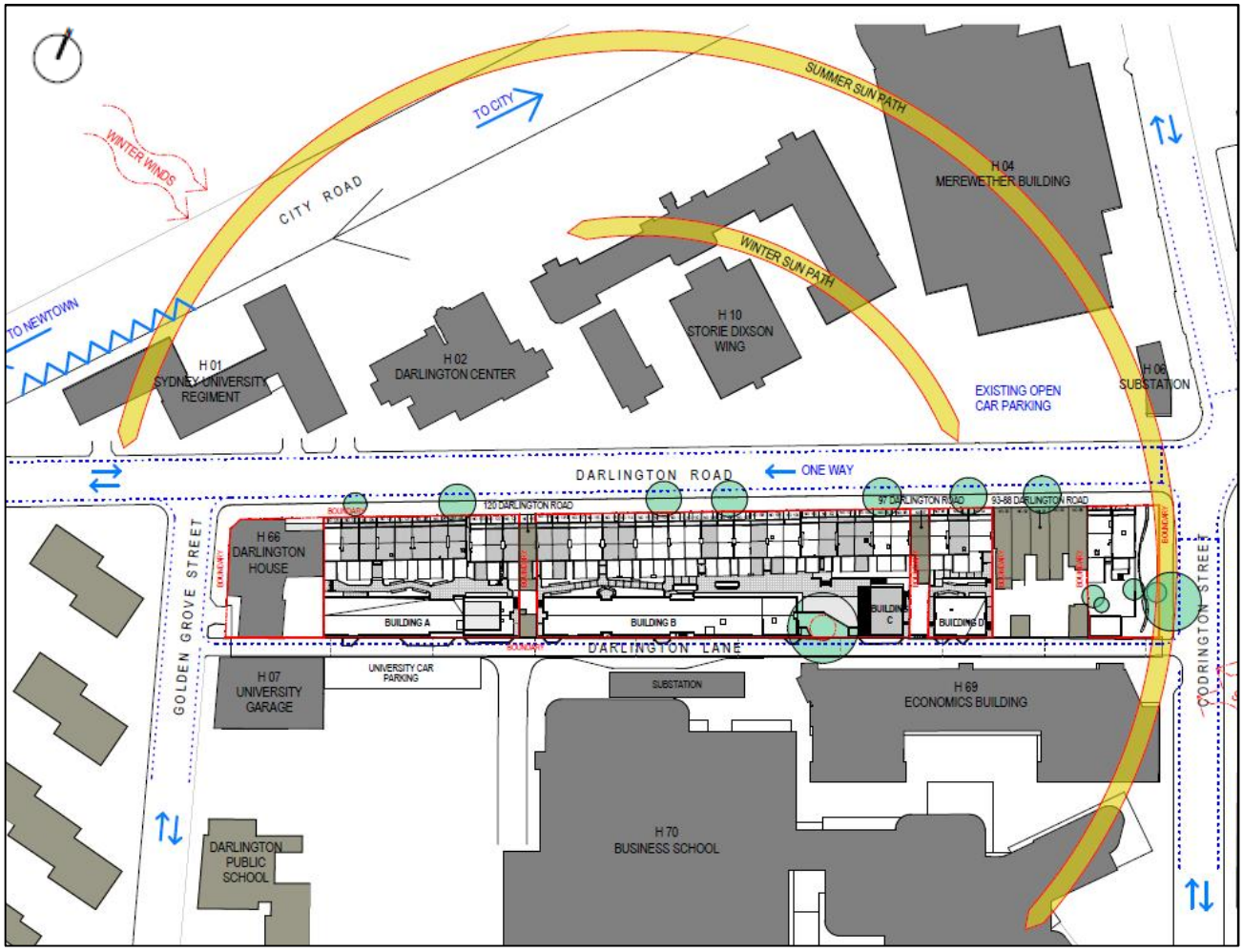

Figure 4-1 Building orientation and solar path (AJ&C Development Application Drawings 2016)

During summer, solar gains would mostly affect the north facing facades of the existing buildings and of the new blocks, which predominantly serve bedrooms. Solar gains and glare of the existing terraces would be controlled by self-shading such as balconies and roof overhangs as well as existing trees (Figure 4-2). Windows would also be fitted with manually controlled blinds (refer to Section 4.4). During winter low angle sun would provide solar gain into the internal spaces; which could provide useful solar heat gain and can be controlled via blinds.

Figure 4-2 Examples of north facing facades of existing terraces along Darlington Road (Oculus 2016) and new Block B (AJ&C 2016)

The new buildings A, B, C and D incorporate building fabric to comply with BCA requirements. Insulation would be added to the existing buildings (in the roof spaces) to improve thermal comfort and energy efficiency. All bedrooms (new and existing) would have openable windows to allow for natural ventilation and cooling as required to promote energy efficiency and indoor air quality. Daylight would be used where possible to promote energy efficiency (by reducing reliance on electric lighting) and to promote user amenity and productivity. Daylighting methods such as courtyards, stick glazing systems and internal voids have been incorporated into the building to allow daylight to penetrate the internal building spaces.

Natural shade would be provided by landscaping and building elements. Roof and paving materials with a high solar reflectance index (SRI) would be selected.

4.1.2 Energy efficient systems

The University of Sydney aims to improve building energy performance by 20% by focusing on energy efficient systems. These include:

- Provision of solar hot water panels and preheat storage system to Buildings A and B (Figure 4-3). The Building A's solar system supplies 50% of its hot water requirements. The Building B solar system supplies 42.5% of its hot water contribution, and also supplies hot water to the existing terraces. The remaining hot water would be provided via instantaneous gas hot water booster (84% efficiency);
- Providing mechanical cooling to common areas only. All bedrooms would be unconditioned (but would have provision for a ceiling fan, wall mounted heater and internal blinds);
- Electrical equipment and appliances including clothes dryers, dishwashers, refrigerators, freezers, washing machines and decentralised air conditioning units, are to have the highest energy rating available under the Australian Government's Energy Rating Scheme;
- Installation of metering and sub-metering to hot water services, gas services and electrical supply, to monitor and improve the buildings energy management performance;

- Designing internal and external lighting systems to include energy efficient fittings, zonings, controls and site coordination;
- Providing a control system so that lighting and mechanical systems can be shut down both manually and automatically in unoccupied spaces. This includes air conditioning and fan systems that run on timers and PIR and motion detectors used in areas which may be unoccupied spaces for automatic control of lighting (manual override also provided); and
- Provision of a consolidated (both wireless and hard-wired) key card security access system for bedrooms so that systems are shut off when unoccupied.

4.1.3 Renewable energy

Renewable energy is incorporated into the building design to reduce reliance on carbon intensive grid electricity. An 11.95kW solar photovoltaic (PV) system is proposed on the roof of Building A and a 9.9kW solar PV system on the roof of Building B (Figure 4-3). The installation will consider the available roof space for a PV system to be installed, as well as the new building's orientation, shadowing from the existing terraces (to avoid shading between the hours of 10am – 3pm throughout the year), and other services (including solar hot water) located on the rooftop.

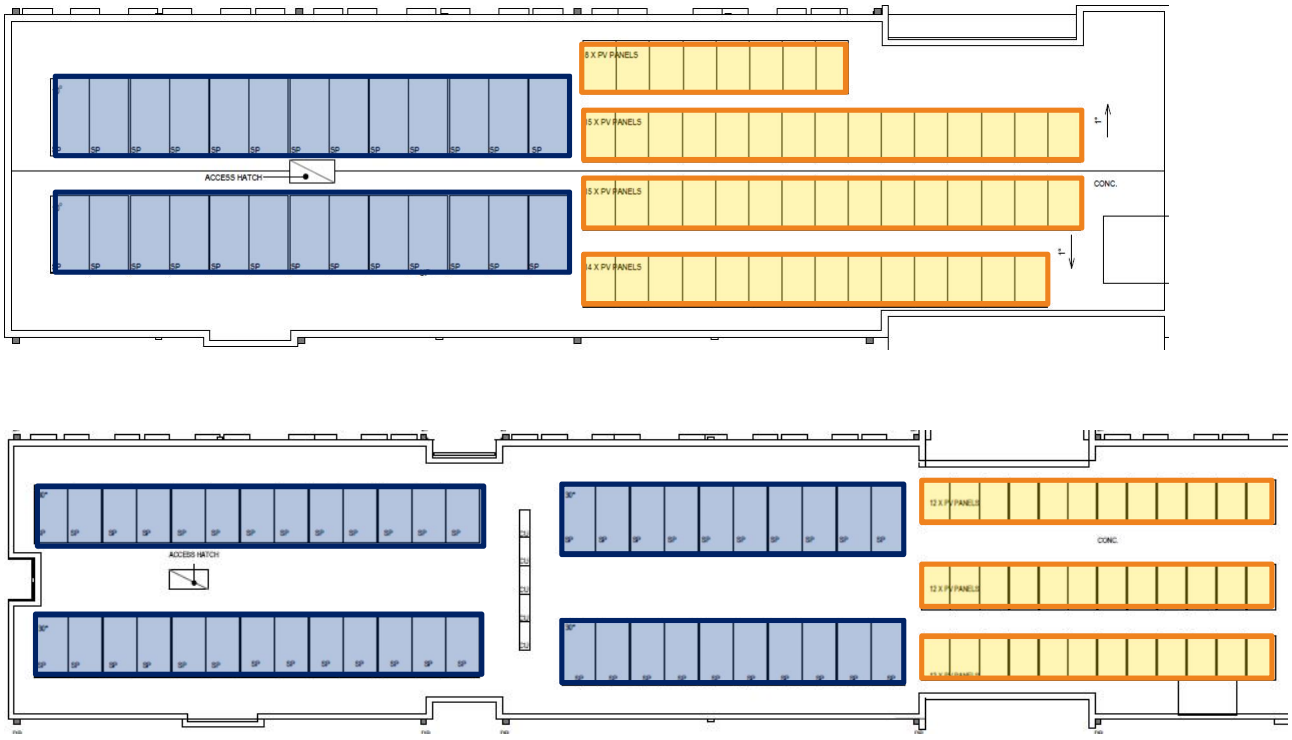

Figure 4-3 Roof plans of Buildings A & B (not to scale). Solar hot water panels are shaded blue, solar photovoltaic panels are shaded yellow.

4.1.4 Commissioning and user information

Key systems including hot water (solar and gas), air conditioning and ventilation services will be commissioned to confirm that they are operating as designed.

A building user guide will be provided which will deliver relevant information about the building's use, functional and environmental aspects, and special features according to the University of Sydney's Building Users' Guide.

An energy efficient display will be provided in the foyer to educate building occupants and communicate building information such as real-time utility (energy, water, gas) consumption, waste management and transport options. Displays will be suitably sized and be connected to data ports and necessary communications equipment to connect to the IT network.

4.2 Water efficiency

The University of Sydney will provide water efficient sanitary fixtures, tap ware and associated equipment in accordance to the University Hydraulic Design Standard. The standard requires:

- Sanitary fixtures and tapware installed must incorporate a high level of water efficiency. Water saving devices include aerated tap fittings, water flow restriction devices, dual flush toilets, low flush urinals and high efficiency showerheads;
- Fixtures and tapware installed must be low maintenance with a design life expectancy of 15 years; and
- Fixtures, tapware and appliances are to have the Watermark approved certification and be provided with full product support, including spare parts and technical assistance, within the Sydney area.

The roof water for the new development will be collected into rainwater harvesting tanks (preliminary design is based on 50 litres storage per square metres of roof area). Collected roof water will be treated and reticulated for sanitary flushing and landscape irrigation. The existing terrace roofs facing Darlington Road will discharge to the kerb at Darlington Road as per the current arrangement.

Sub-meters would monitor water supplies to hot water services, rainwater re-use and major water consuming equipment.

4.3 Waste management

Avoiding and reducing the generation of waste is the highest priority of waste management. By implementing the ‘waste hierarchy’ principles of reduce, reuse and recycles, there is a more sustainable use of the waste that is produced as opposed to disposal to landfill.

4.3.1 Construction waste

A Demolition and Construction Waste Management Plan will be developed to manage the different waste types generated during demolition and construction. This plan will incorporate the requirements of the University’s Waste Management Standard and aim to recycle at least 85% of the building demolition and construction waste by weight, provide instruction on maintaining easily accessible and well-organised records of waste dockets and auditable chain-of-custody documentation and provide the University quarterly waste disposal and recycling reports.

4.3.2 Operational waste

An operational Waste Management Plan (WMP) has been prepared (Waste Audit & Consultancy Services 2016) which provides calculations of projected operational general waste and recycling, recommendations for suitable equipment and storage and handling practices, and a description of expected collection procedures, based on expected future occupancy of the Proposed Development. Storage areas would be provided for:

- Paper / cardboard recycling;
- Comingled recycling; and
- General waste.

General and mixed recycling bins will be provided in all bedrooms, common areas and offices.

It is a University of Sydney requirement for new residential buildings of more than three stories in height to incorporate waste chutes (CIS Resource Recovery & Waste Management Standard March 2016, Section 5.4.1). For Buildings A and B, residents will deposit general waste and recyclables into a diverter type chute emptying into separate bins in each storage room. Building maintenance/cleaning staff will take the bins to the collection point setback off Darlington Lane on designated collection days.

4.4 Healthy Environment

The University of Sydney would employ the following proposal specifications to ensure a healthy environment:

- Avoid over lighting spaces: the building lighting design for Fully Enclosed Covered Areas (FECA) provides illuminance of no more than 25% above the minimum maintained illuminance levels in accordance to the Lighting Design Standard;
- Daylighting: a Daylight Factor (DF) of 2% is to be achieved where practicable;
- External views: all bedrooms have a direct line of sight to the outdoors, including the internal courtyard, Darlington Road and Darlington Lane. External views help improve the attention span and wellbeing of occupants by providing daylight, sense of time, weather and distant focal points / connections to the campus environment. Some views would be constrained by the high density nature of the development;
- Avoid glare: the architectural design includes internal glare control blinds (internal blackout blinds) in the bedrooms, study areas, lecture theatre, break-out rooms, music rooms, learning hubs and games rooms; external fixed shading devices (aluminium louvres) in the stairwells facing north; external awnings over entries and kitchen / dining areas; foyers and central common spaces to have low-e glass and frosted glazing design. External walls are to be coloured brickwork in lieu of cladding; and
- Location of stairs: accessible and highly visible stairs as an alternative to vertical transportation by lift, with emergency and exit lighting provided.

4.5 Material selection

4.5.1 Reuse of materials

The existing terraces will be reused and refurbished to provide quality student accommodation which respects the heritage value of existing fabric and avoids resource use that is typically associated with extraction, transport and processing of new materials. The existing structures would be reused, with the exception of demolition of lean-to structures to the rear of the terraces and removing internal walls to join twin terraces. The existing facades would also be reused with minor upgrades such as painting. Selection of new materials

When selecting materials, the University of Sydney design focuses on:

- Locally sourced materials;
- Materials with a high recycled content;
- Materials manufactured using renewable energy sources; and
- Using non-toxic materials.

The University of Sydney would ensure the use of furnishings with high recycled content, end-of-life local recyclability, product stewardship agreements, and warranties greater than, or equal to, ten years.

Certain elements have been integrated into University of Sydney's design to reduce the project's demand for new materials. These include:

- Paint finish in lieu of direct stick plasterboard to concrete exposed walls;
- Sealer to treads and risers on concrete stairs in lieu of vinyl coverings;
- Concrete finish to bedroom ceilings instead of a paint finish; and
- The use of integrated lights / fans in bedrooms in lieu of separate LED lighting and ceiling fans.

The procurement strategy would include the following targets:

- At least 80% (by cost) of all formwork timber and timber joists products selected and used in the building and construction works would be certified by a forest certification scheme that meets the Green Building Council of Australia's 'Essential' criteria for forest certification (either Forest Stewardship Council (FSC) International or Programme for the Endorsement of Forest Certification (PEFC)), or is from a fully compliant reused source, or is sourced from a combination of both. All certified formwork timber and timber joist products selected and used in the entire Project must be supplied in accordance with the Chain of Custody (CoC) rules of the respective forest certification scheme. The Contractor and all sub-contractors must provide the relevant CoC certificates or invoices including a current CoC code or serial number;
- At least 60% of steel by mass is to have a post-consumer recycled content of greater than 50% or is reused. The unstressed reinforcement will typically have a large recycled steel content (around 95%); and
- At least 50% of construction and fit-out materials, including face brickwork, plasterboard, concrete, and Aluminium windows and doors are to be manufactured in and using raw materials from Australia.

The building design would ensure the brickwork infills to concrete structural frame can be disassembled and easily removed after the life of building. Internal wall partitions mean that building will be adaptable for future change of use.

Joinery would be standardised and reusable in different areas and be made from Low-VOC materials and paint. All fixed and loose joinery items will use Low VOC materials and can be disassembled to be re-used or recyclable.

PVC pipe is to be used for sanitary plumbing, drainage and stormwater drainage. Options to replace PVC products with alternative environmentally preferable alternatives would be investigated at detailed design.

Adhesives and sealant products, used in the interior of the buildings and applied on site, including both exposed and concealed applications, would have low Total Volatile Organic Compound Levels (TVOCs). Low volatile organic compound products are to be used for paint and carpets that are internal to the buildings. This would be achieved by installing products that are certified to either Ecospecifier's GreenTag GreenRate – GGTv3.2 – Paint Supplementary Product standards at Level A or Level B, or Good Environmental Choice Australia GECA PCv2.2i-2012 – 'Paints and Coatings' standard. All engineered wood products used in exposed or concealed applications are to have either have low formaldehyde emissions or contain no formaldehyde.

4.6 Climate change

4.6.1 Flood risk

The Darlington Terrace Development is located within the Blackwattle Creek catchment. The Darlington Terrace development is located outside the flood hazard area but is affected by overland flow path (WMA 2013). The existing site condition is predominantly impervious in nature. It consists of roadways, terrace roof rainwater down pipes and other paved areas. The design proposal for Darlington Terrace development is to capture the

stormwater (78% of the development) with water re-use tanks and onsite detention tanks for each block to mitigate the flooding effect downstream of the catchment and then connect to a new public pit and pipe drainage line along Darlington Lane. An erosion and sediment control plan has been provided to control the area of disturbance via a sediment fence, stabilised site access, earth banks, geotextile inlet filter and mesh and gravel inlet filter.

4.6.2 Temperature increase

As discussed previously, natural shade would be provided by building elements (overhangs) and landscaping and selection of roofs and paving materials high SRI will be utilised for surface heat reduction.

4.7 Landscaping and ecology

University of Sydney aims to develop landscape elements and fixtures that are both functional and aesthetic, and provide improved amenity. It ensures that landscaping elements are of high quality, durable, integrated with existing landscapes, cost effective to operate and maintain, and are derived from a limited palette of materials, finishes and colours currently found on campus.

A Landscape Design Report has been prepared for the Proposal. The landscape design aims to create a verdant, attractive and high quality landscape for the amenity of residents, users of the adjacent street and adjoining neighbours. Sustainable landscaping initiatives include:

- Retention of existing trees, planting and pavers where possible;
- Provision of a green roof and a green wall;
- Use of trees as natural shading to buildings and communal areas;
- Incorporation of a mixture of small and large communal external seating areas;
- Provision of rooftop deck / study area and BBQ area for student use;
- Provision of a park area at the eastern end of the development which includes an open turf area and seated area on paved plaza; and
- External areas identified for drying of laundry.

The landscaped areas aim to tell a story about the past, present and future. It will aid the principles of the 'Wingara Mura Strategy' which aims to integrate the inclusion of Aboriginal values, art and culture in all developments. All artwork, text, stories, previous land uses etc. would be workshopped with the local indigenous community and university stakeholders.

The planting palette will incorporate shade tolerant species especially in the courtyard spaces. As the area used to be Turpentine Iron Bark Forest, species have been selected to reference this. Herbs such as oregano, rosemary, sage and thyme will be planted in pots for use by the students near the BBQ area. The park will use species from both sun and shade loving plants and introduce some larger trees. Larger shrubs will be used as a buffer to the private residences and to screen the services.

Natural and integral materials such as stone, concrete, timber and steel that do not require unnecessary amounts of repainting and upkeep have been selected for the hard landscape elements. Materials and treatments have been chosen to allow for some interpretation to take place to reference the Wingara Mura Strategy.

4.8 Active transport

The University of Sydney will incorporate design solutions to provide 90 bicycle parking racks for staff and students to encourage alternatives to commuting.

Building Occupants	Population Figures	Cyclist Parking Spaces Provided	% provision	Space type
Staff	5	2	40%	Undercover
Student	350	88	25%	Undercover

End of trip facilities (changing / showering facilities and storage) would be provided as part of the residential accommodation facilities and shared bathrooms.

Appendix A. University of Sydney Sustainability Framework

THE UNIVERSITY OF SYDNEY

The University of Sydney - Sustainability Framework

Project Name: Darlington Road Terraces
Building Type: Student Accommodation
Date : 21/11/2016

		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
				Project Team Input Points Targeted	Preliminary Design Response Specify how the design intent will achieve the targeted measure	Preliminary submission requirements
1. Leadership and Communication						
1.1	**ESD Professional** Ensure that a principal participant in the design team is suitably trained to provide sustainability advice from the schematic phase through to project implementation (i.e. Green Star Accredited Professional or similar).	2	Yes	2	Jacobs has been appointed as the ESD consultant to prepare Sustainability Framework and ESD Report.	Jacobs has been appointed as the ESD consultant to prepare Sustainability Framework and ESD Report.
1.2	**Life Cycle cost evaluation** Ensure a Whole of Life/Life Cycle Cost (LCC) analysis is used to select between HVAC options and determine the true cost implications of different facade designs. Mechanical plant analysis should be conducted on a 25 year time-frame, and facade designs should be analysed on a 50 year time-frame. This analysis should take into account plant/materials choice, construction costs, ongoing operations and maintenance costs. Financial input data used for analysis, e.g. electricity, gas, inflation and discount rates must be obtained from the CIS Engineering & Sustainability Team. If changes in system design are proposed in the D&C design, the contractor must demonstrate that any substituted system provides better value for money on a life-cycle cost basis.	3	Yes	0	HVAC limited to air conditioning to common areas, generally via split units. Façade is to comply with BCA DTS requirements. No WOL costing completed due to project scale.	CIS Request Dispensation form (CIS-ENG-F001)
1.3	**Commissioning** Incorporate requirements for comprehensive pre-commissioning, commissioning, and quality monitoring for all building services into contracts. All commissioning and building tuning requirements must be is carried out in accordance to the Electrical, Lighting, Hydraulic, Mechanical, AUMS, BMCS Design Standards. Note that there will be an independent commissioning agent, appointed by The University reviewing commissioning practices.	3	Yes	3	Commisioning will be specified as part of the Mechanical and Electrical works, however an ICA may be of little benefit due to the simple systems involved.	No evidence provided at this stage.
1.4	**Environmental Management Plan** Develop and implement a project-specific Environmental Management Plan for the construction in accordance with State/Federal government guidelines and standards to address environmental, worker health and safety, and community risks. The main contractor must implement an Environmental Management System certified to the ISO 14001 standard. The above requirements are applicable, as a minimum to all of the below works: * Demolition * Excavation and * Main construction.	1	Yes	1	The potential environmental impacts on the environment have been identified and assessed through the preparation of an Environmental Impact Statement (EIS). The mitigation measures identified in the EIS will be applied to the Proposal via the EMP.	Refer EIS
1.5	**Site Waste Management Plan** Develop a Site Waste Management Plan (SWMP) in accordance to the Waste Management Standard. Recycle at least 85% of building demolition and construction waste by weight. The contractor must maintain easily accessible and well-organised records of waste dockets and auditable chain-of-custody documentation and provide the University quarterly waste disposal and recycling reports.	1	Yes	1	Construction waste management plan to be provided before construction begins. This is a condition of the Head Contractors engagement prior to commencing on site.	Completed UoS Waste Tracking Template to be provided. Construction Waste Management Plan to be provided.
1.6	**Indoor Air Quality Management Plan** During construction, the Contractor must meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) Indoor Air Quality (IAQ) For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3). The Head Contractor must develop and implement an IAQ management plan for the construction and pre-occupancy phases of the building, in accordance with the UoS Mechanical Standard and the SMACNA Guidelines. The IAQ management plan must address the air quality during construction and include: • HVAC Protection from both dust and odours • Source Control of any materials that contain Volatile Organic Compounds - Construction team must recover, isolate and ventilate containers housing toxic materials • Pathway interruption - clean or occupied areas are to be isolated from areas of work • Housekeeping - cleaning activities must be regularly undertaken to control contaminants, maintenance teams should protect all porous materials from exposure to moisture, vacuum cleaners with high efficiency particulate filters should be used • Scheduling of cleaning prior to occupancy including flush-out activities The IAQ management plan must be submitted to CIS (or the appointed representative) for review and approval, prior to implementation on the project.	3	Yes	3	IAQ Management Plan is to be prepared prior to construction.	IAQ Management Plan to be required as part of tender documentation and provided prior to construction.
1.7	**Building Users' Guide** Provide relevant information about the building's use, functional and environmental aspects, and special features according to the Building Users' Guide template.	1	Yes	1	A Building User's Guide is to be provided upon completion and occupancy.	Completed UoS Building Users' Guide Template to be provided.
1.8	**Public information display** Provide an energy efficient display 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. Displays must be suitably sized for the audience in the space and be connected to data ports and necessary communications equipment to connect to the IT network. The Display and associated IT equipment must at least be on a programmable time clock or be linked to an occupancy control system so it switched off when the building is not in use.	2	No	2	Energy metering equipment to be as per University's specifications and interface with meters to allow consumption to be displayed (real time system, display via TV sreen). Public information display equipment to be as per University's IT and AV guidelines.	Design specification for PID.
		16		13		

The University of Sydney - Sustainability Framework

Project Name: Darlington Road Terraces
Building Type: Student Accommodation
Date : 21/11/2016

		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
				Project Team Input Points Targeted	Preliminary Design Response Specify how the design intent will achieve the targeted measure	Preliminary submission requirements
2. Resource Efficiency						
Passive Design and Energy Efficiency						
2.1	**Passive Design Principles** Building designs must employ passive design strategies to respond to environmental conditions of the building including orientation, solar access, prevailing winds, seasonal and diurnal temperatures changes. Provide a passive design report demonstrating how passive design elements are maximised by the design to improve indoor environmental quality, thermal comfort and energy efficiency, and to minimise reliance on mechanical cooling and heating whilst preventing noise and pollution sources.	**1**	**Yes**	**1**	Passive design report not provided however the principles include natural ventilation (openable windows) to bedrooms, additional insulation provided to existing terrace roof spaces and blinds to be provided to control heat gain / loss through windows. Openable windows to be provided for cross flow ventilation to common areas.	Passive design report - to be provided (AJC to provide)
2.2	**Improve Building Energy Performance by 20%** Complete an energy model using BCA Section J energy modelling Guidelines and the small plug loads template. The report must reasonably estimate predicted energy consumption for each space type within the building and a predicted total annual energy use. Demonstrate that the proposed building will perform: a) at least 20% better than the reference building when the proposed building is modeled with the proposed services; and b) at least 10% better the reference building when the proposed building is modeled with the same services as the reference building. SOFTWARE: Energy simulation software packages such as IES-VE, TAS, Energy Plus must be utilised for creating a representative dynamic Energy Model. The energy simulation software must comply with one of the following Standards: * BESTEST (US NREL, 2005); or * The European Union draft standard EN13791 July 2000; or * Be certified in accordance with ANSI/ASHRAE Standard 140-2001. METHODOLOGY: Energy modelling must be conducted using the JV3 methodology prescribed in the National Construction code 2015. Part load efficiency curves must be applied for modelling mechanical plant operation. The energy report must also address the following: * Thermal bridging - The architectural building design must demonstrate that there are no potential thermal bridging issues. * R values (Building fabric and glazing). R values for building fabric and glazing must be for the full facade or glazing panel and take into account thermal bridging. Centre panel / pane values are not acceptable. U-value and Solar heat gain coefficients must be for the full glazing panel. Centre pane values are not acceptable.	**3**	**Yes**	**3**	Energy model not provided due to scale of project (as agreed by UoS Sustainability Officer). Energy performance has been improved via: - provision of solar hot water for approximately 50% hot water needs - provision of solar PV cells - no mechanical cooling of bedrooms (common areas only). Bedrooms will be fitted with ceiling fans and wall mounted heaters for cooling and heating purposes. Bedrooms will also be fitted with a key card switch which will turn off any power when no one is in the room.) Further studies recommended to ensure performance of building fabric and systems.	Preliminary energy model report Completed UoS Energy Modeling and Passive Design Template Completed UoS Plug-in loads Template. Templates not ye provided - to be completed and provided at detailed desig stage.
2.3	**Solar PV Systems** Maximise roof design with northeast-northwest orientation to maximise the integration of solar PV technology. The PV system is to be designed so that shading is avoided between the hours of 10am to 3pm throughout the year. The rooftop is to incorporate a PV system of capacity equivalent to 75 Watts per m² of available roof area, or maximised so that the building will not export power. e.g. if there is 1000m² of usable rooftop area 75kW of photovoltaics is to be installed. This capacity must ensure safe access and maintenance of the solar PV system. Roof-top structures and plant must not be located in areas where that may shade solar PV.	**3**	**Yes**	**3**	A 11.95kW system proposed for the roof of Building A and a 9.9kW system is proposed for the roof of Building B. Generally the avaliable area for a PV system to be installed has been limited by the following: - the new building's orientation - shadowing from the existing terraces - other services located on the rooftop - height restrictions	Concept design architectural roof plans, marked up. (Updated PV panel no's: Building A: 52, Building B: 36) To confirm total capacity of system to determine that system meets 75W per m^2 of roof area. Currently, Building A and meet the requirement, but not A-D inclusive.
2.4	**Hot Water Systems** During Schematic Design, analysis of building hot water demand must be undertaken to determine the most efficient type of solar hot water(SHW) system for the building. It is envisaged that all student accommodation and laboratory buildings would be served by a centralised SHW system with gas/electric boost. Life cycle costing analysis must be conducted using the University's prevailing contracted energy rates. Where the schematic design indicates a SHW hot water is viable, the contractor must develop the design and provide detailed life cycle cost analysis for review by the University's independent project sustainability consultant.	**3**	**Yes**	**3**	Solar panels and preheat storage system being provided to contribute 50% of hot water heating energy. LHO confirm 50% contribution for building A and 42.5% for building B. Instantaneous gas hot water booster proposed (84% efficiency).	Life cycle costing report (not provided). Concept design architectural roof plans, marked up. (Updated SP panel no's: Building A: 26, Building B: 40)
2.5	**Energy Consuming Equipment** Appliances (clothes dryers, dishwashers. refrigerators, freezers, washing machines, decentralised air conditioning units) are to have the highest energy rating available under the Australian Government's Energy Rating scheme for each standard capacity range of the appliance. Where multiple products are available in the market with the highest energy rating, preference is to be given to locally manufactured products. See compliance template for more detail on appliance capacity ranges. Laboratory equipment: Energy efficiency must a selection criterion for procurement of all laboratory equipment. Guidance can be obtained from the Labs 21 Energy-Efficient Laboratory Equipment guidelines. http://labs21.lbl.gov/wiki/equipment/index.php/Energy_Efficient_Laboratory_Equipment_Wiki	**2**	**Yes**	**2**	All electrical equipment to be energy efficient and have the highest energy raing avaliable. Generally, the university's design guidelines indicate equipment selections.	Energy consuming equipment to be specified in tender / procurement documentation.
2.6	**Metering Utility Use** Provide metering and sub-metering in accordance with the University's Electrical, Hydraulic, Mechanical and AUMS Standards.	**3**	**Yes**	**3**	Metering to be provided as outlined in the CIS Electrical Services Standard. Hydraulic - sub meters to hot water service, gas services and rainwater re-use back-up water supply. All water systems and supplies to major equipment to be metered to monitor water consumption.	Completed UoS Metering and Monitoring Template (not provided) . Schematic drawings. (Lena to ensure included in D&C specifications)
2.7	**Lighting Systems** Design internal and external lighting systems in accordance to the Lighting Design Standard including energy efficient fittings, zoning, controls and site coordination.	**2**	**Yes**	**2**	Lighting design and strategyto be provided as outlined in the CIS Lighting Standard. All light fittings selections to be referenced from Deemed-to-Comply Luminaire Schedule Form (CIS-ENG-F006). LED lights will be provided throughout. Sensor lighting to be provided through out all common areas.	Completed UoS Lighting Systems Template Document (from DSC) and / or DSC to provide commentary on changes to lighting design.

The University of Sydney - Sustainability Framework

Project Name: Darlington Road Terraces
Building Type: Student Accommodation
Date : 21/11/2016

		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
				Project Team Input Points Targeted	Preliminary Design Response Specify how the design intent will achieve the targeted measure	Preliminary submission requirements
2.8	**Unoccupied Spaces** Provide a control system to UFA spaces in accordance to the AV, Electrical and Mechanical Design Standards so that AV, lighting and mechanical systems can be shut down both manually and automatically in unoccupied spaces. Note: this excludes labs.	2	Yes	2	AC systems to incorporate run on timers. All Common areas lighting will be on sensors (PIR sensors and motion detectors), to be used in areas (common rooms) which may be unoccupied spaces for automatic control of lighting. Manual override control to also be provided when occupied. All bedrooms to be fitted with key card switch to switch off all power to the room (excluding the fridge GPO outlet).	Written provision/target
2.9	**No Hot Water in Public Restrooms** Eliminate the provision of hot water to wash basins in public restrooms and other facilities as deemed appropriate. Note that the CIS Hydraulic Standard does not permit hot water in certain spaces.	1	Yes	1	Common toilets must be provided as per BCA code requirements. Hydraulic design to ensure that there is no hot water in wash basins in public restrooms.	Written provision/target. BCA Compliance Statement
2.10	**Improve Building Energy Performance by 30%** Further to item 2.2, demonstrate that the building will perform an additional 10% better, e.g. a) at least 30% better than the reference building when the proposed building is modeled with the proposed services; and b) at least 20% better the reference building when the proposed building is modeled with the same services as the reference building.	3	No	0	Mech services are proposed to be standard efficiency. Power and Lighting equipment is to be energy efficifent complying with NCC Section J6 energy consumption minimisation. Building energy modelling and reporting does not form part of the electrical scope of works.	Preliminary energy model report Completed UoS Energy Modeling and Passive Design Template Completed UoS Plug-in loads Template. DSC to provide statement along the lines of how the development will improve building energy and general design principals i.e. combination of natural ventilation and energy saving items etc.
2.11	**Natural Ventilation** Naturally ventilate at least 15% of the GFA of the building, excluding car parking spaces.	3	No	3	All bedrooms will be naturally ventilated, along with corridors (fans and openable windows). Range hoods for each stove in lieu of ventilated ceilings.	Concept design architectural plans, marked up
2.12	**Mixed Mode Ventilation** Provide BMS controlled mixed mode ventilation to the building, including installing reed switches to operable windows.	10	No	0	No BMS Proposed.	
2.13	**Peak Power (1)** Incorporate infrastructure, e.g. thermal storage / pre cooling technologies and load shedding controls to the BMS to reduce peak HVAC energy demand by 5%. PV systems are excluded from this measure. Peak energy demand must be calculated as follows: • Assuming the Building Code of Australia 'Deemed-to-Satisfy' approach for building fabric • In accordance with AS3000 • As the absolute design capacity of the system, after the application of diversity factors • Peak load for mixed-mode ventilated buildings must be calculated assuming mechanically air-conditioned mode is in operation	3	Yes	0	No BMS propoosed, no load shedding proposed for the mechanical systems. Electrical maximum demand for each of the blocks has been calculated based on the AS300 Maximum Demand calculation based on the C2 Table.	CIS Request Dispensation form (CIS-ENG-F001) (To be provided by DSC)
2.14	**Peak Power (2)** Further to 2.13 above, reduce peak HVAC energy demand by a further 5%, e.g. total reduction peak HVAC energy by 10%.	3	No	0	No Mechanical Input. Investigate proposal to provide Power Factor Correction	
Water Efficiency						
2.15	**Water Use** Provide water efficient sanitary fixtures, tap ware and associated equipment in accordance to the University Hydraulic Design Standard.	1	Yes	1	As per Integrated Water Management Report and University Standards, Sanitary fixtures and taps will be low flow/water usage such as low water usage 3/4.5 litre flush WCs and low flow shower outlets.	Completed UoS Water Use Template Integrated Water management report.
2.16	**Laboratory equipment water use** Minimise laboratory water usage, and maximise opportunities for non-potable water use. **Flow control** All laboratory equipment must incorporate control valves or solenoid valves to allow water to flow only when the unit is being used (unless there is a special requirement for continuous flow of water). **Disinfection and sterilization** Ensure laboratory equipment, e.g. Autoclaves and sterilizers are designed to recirculate water or allow the flow to be turned off when the unit is not in use, or both. • Adjust flow rates to the minimum recommended by the manufacturer, and review and readjust periodically. • Install a small expansion tank instead of using water to cool steam for discharge to the sewer if it does not interfere with the unit's normal operation. • Shut off units that are not in use, or install an automatic shut-off feature if it does not interfere with the unit's normal operation.	0	No	0	Not applicable to the building type.	Not applicable to the building type.
2.17	**Process water efficiency** Provide process water via a closed-loop system designed to provide water at a pre-set temperature to cool the laboratory equipment. Always avoid the use of once-through cooling water for lab equipment.	0	No	0	Not applicable to the building type.	Not applicable to the building type.

The University of Sydney - Sustainability Framework

Project Name: Darlington Road Terraces
Building Type: Student Accommodation
Date : 21/11/2016

		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
				Project Team Input Points Targeted	Preliminary Design Response Specify how the design intent will achieve the targeted measure	Preliminary submission requirements
2.18	**Water harvesting** Prepare a monthly water balance report to assess options for rainwater reuse for building. The water balance report must assess the roof collection area, amount of median monthly rain water available, monthly building and garden water demands, life cycle cost savings in avoided water consumption, and the operation and maintenance costs of the water treatment system. Water tanks must be sized appropriately to maximise water collection potential of the building for irrigation, cooling tower use and WCs and urinals. Nominally allow the lesser of either 0.05 cubic meters or 50L storage per 1 m2 of roof area, or 75% of the maximum monthly peak water demand for the building. The water balance report must identify the portion of annual building water consumption that will be met by rainwater reuse. The appropriate system must be installed in accordance with the CIS Hydraulic Standard.	3	Yes	3	Preliminary design based on 50 litre/sqm of roof area (for buildings A and B). Rainwater reuse to be used for toilet flushing and irrigation (buildings A and B only). No non-potable water service provided from the terraces (new buildings (A/B) only).	Completed UoS Water Harvesting Template. Water balance report, identify space allowance for tank ar size of tank - to be provided.
2.19	**Fire Systems** Provide a system to capture, store and reuse fire system test water or use a fire protection system that does not expel water for testing.	1	Yes	0	No re-use of fire test water; too little and too dirty for re-use.	Completed UoS Fire Systems Template Design to be developed to achieve criteria.
Waste Management & Resource Recovery						
2.20	**Centralised Building Waste Management System** Design internal and external centralised waste and recycling bin systems in accordance with the Waste Management Design Standard.	1	Yes	1	Garbage / Waste rooms are provided in each building as per Waste Management Plan. General and mixed recycling bins will be provided in all bedrooms, common areas and offices	Completed UoS Waste Storage Template Waste Management Plan (WasteAudit 2016)
2.21	**Waste Storage** Provide a dedicated storage area for the separation and collection of recyclable waste in accordance to the Waste Management Design Standard. Laboratory hazardous waste: Storage and handling of hazardous waste from laboratories must be in accordance with the Design Standard http://sydney.edu.au/whs/guidelines/hazardouswaste/	1	Yes	1	Garbage / Waste rooms are provided in each new building - meets separation/collection requirements.	Completed UoS Waste Storage Template Waste Management Plan (WasteAudit 2016)
		49		29		
3. Healthy Environment						
3.1	**Access to water stations** Provide outdoor filtered water stations, non chilled (with bottle fill facilities) in all new buildings over 2000m2 unless a University filtered water station is in the local vicinity (50m) precinct. Include internal drinking fountains in large student common/seating spaces and eating/dining spaces.	1	Yes	1	No outdoor water stations currently specified. Potable water provided in kitchens which are accessible to site users (within 50m of courtyard). Achieved in principle.	
3.2	**Avoid Over lighting Spaces** Ensure the building lighting design for Fully Enclosed Covered Areas (FECA) provides illuminance of no more than 25% above the minimum maintained illuminance levels in accordance to the Lighting Design Standard. Working plane shall be taken as 720mm above finished floor level (AFFL) unless agreed otherwise with University of Sydney. Fully Enclosed Covered Areas (FECA) is defined by the Tertiary Education and Facilities Management Association (TEFMA) Guidelines.	3	Yes	3	Lighting design and strategy to be provided as outlined in the CIS Lighting Standard. All light fittings selections to be referenced from Deemed-to-Comply Luminaire Schedule Form (CIS-ENG-F006).	Complete UoS Avoid Over Lighting Spaces Template (not provided) - to be provided by AJC / DSC
3.3	**Daylighting** Demonstrate a Daylight Factor (DF) of 2% is achieved at desk-height level (720mm AFFL) under a uniform design sky for at least 30% of the nominated area. Nominated areas are those occupied continually for a period of 4 hours or greater during daylight hours, including offices, learning spaces such as classrooms, computer rooms, library and workshops. Daylighting is desirable to reduce reliance on artificial lighting. Vision glazing does not include windows below 720mm or above 2400mm AFFL.	2	Yes	2	Targeted for nominated areas but template / calculations still to be provided to confirm that these targets are achieved.	Completed UoS Daylight Template Document (not provided) (AJC to confirm with calcs)
3.4	**External Views** Ensure that 40% of the nominated area has a direct line of sight to the outdoors, or into an adequately sized and day lit internal atrium. Views of nature help improve the attention span and wellbeing of occupants by providing daylight, sense of time, weather and distant focal points / connection to campus environment.	2	Yes	2	Most of the rooms in the proposal have views to the internal courtyard or Darlington Road and Darlington Lane. Calculations to be completed to confirm percentage.	Completed UoS External Views Template Document (not provided). (AJC to confirm with calcs)
3.5	**Avoid Glare** Reduce glare through the use of fixed shading devices, window tinting or operable devices such as shades or blinds to all external or perimeter windows & glazing in accordance with the Architectural Standard. Provide black-out shades as appropriate for spaces with audio-visual requirements. All shading devices must include and incorporate a safe and cost-effective access system for cleaning and maintenance. Where glare reduction is achieved by other than use of operable shading devices, the following assessment is required: • Glare Assessment in accordance with the Daylight Glare Index (DGI) methodology • DGI not exceeding 22 (Acceptable) on the DGI Scale The most cited model for predicting discomfort or reduction in visibility in a day-lit environment is the Daylight Glare Index (DGI). It is calculated from the 'Hopkinson-Cornell large-source glare formula'. It is a function of source size and location, source and background luminance, and direction of view. The probable subjective responses to glare index levels are: * Discomfort Zone Intolerable = DGI 30+ , * Just Intolerable 28, * Uncomfortable 26, * Just Uncomfortable 24 * Comfort Zone Acceptable 22 , * Just Acceptable 20 , * Noticeable 18, * Just Perceptible 16 Modeling of the DGI must be performed in Radiance or equally approved software with high level of detail and accuracy according to relevant guidelines. The calculation basis for estimated DGI values (equation based) given in the below section. The following information and parameters must be utilised for all Glare assessments. * Building Simulation Model - The simulation model must reflect the finalised design and include over-shadowing from adjacent structures (such as adjacent walls, buildings and shading projections) * Geographic Location - • The assessment should be undertaken using Sydney design conditions * Materials Surfaces - The following material reflectance represents typical surface reflectance for materials used in buildings design • Floors: 0.1 , • Internal walls: 0.4 , • Ceilings: 0.7, • Window Framing: 0.7, • Roofs: 0.2 , • Surrounding buildings 0.2-0.3 Where the specified materials used significantly differ from the reflectance values noted above, the actual reflectance properties must be provided (i.e. manufacturer material datasheet). * Glazing Properties - The following Glazing Properties must be used in the glare assessment: • Internal and external reflectance properties (%) and • Visible Light Transmittance (VLT) The glazing used must be consistent with the performance values used in the thermal calculation. * Artificial Lighting - The artificial lighting must be included in the glare assessment. * Design Sky Conditions - The glare study must be assessed for the 21st of June, September and December, with the following sky conditions: * Clear with Sun & * Overcast (The above assessment must be on an hourly basis, for every hour of direct solar penetration).	2	Yes	2	Lighting design and strategy to be provided as outlined in the CIS Lighting Standard. All light fittings selections to be referenced from Deemed-to-Comply Luminaire Schedule Form (CIS-ENG-F006). Glare Control design includes internal glare control blinds (internal blackout blinds) in the bedrooms, study areas, lecture theatre, break-out rooms, music rooms, learning hubs and games rooms; external fixed shading devices (aluminium louvres) in the stairwells facing north; external awnings over entries and kitchen / dining areas; foyers and central common spaces to have low-e glass and frosted glazing design. External walls are to be coloured brickwork in lieu of cladding.	Completed UoS Avoid Glare Template (AJC to update template)

The University of Sydney - Sustainability Framework

Project Name: Darlington Road Terraces
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		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
				Project Team Input Points Targeted	Preliminary Design Response Specify how the design intent will achieve the targeted measure	Preliminary submission requirements
3.6	**Thermal Comfort** For Naturally Ventilated and Mechanically Assisted Naturally Ventilated Spaces the Usable Floor Area falls within the Acceptability Limits of ASHRAE Standard 55-2004 are achieved during Standard Operating Hours of Occupancy for 98% of the year for internal temperatures within 80% of Acceptability Limit 1. For Mechanically Air-Conditioned Spaces the Useable Floor Area falls within the Predicted Mean Vote (PMV) levels, calculated in accordance with ISO7730, for Standard Operating Hours of Occupancy for 98% of the year using standard clothing and metabolic rate values for PMV levels between -0.5 and +0.5, inclusive for 95% of the UFA For mixed mode buildings, the above mechanical and natural ventilation thermal comfort criteria must be met for the relevant Useable Floor Areas where the systems are provided. The thermal comfort indices shown below must be used in the thermal comfort assessment: • Air temperature: Must be calculated and fall within 20°C -25°C. • Mean radiant temperature: Must be calculated and fall within 19°C -26°C. • Air velocity: Must be calculated and fall within 0.1 – 0.3 m/s in occupied zones • Humidity: Must be calculated and fall within 40% – 70% • Metabolic Rate/Activity Level: (1.2 – 1.25) • Clothing (clo): Light Business clothes The PMV value must be calculated in a dynamic building simulation software such as IESVE or equivalent for a whole year. The calculation must be based on local weather data from a reliable source, such as an IWEC (International Weather for Energy Simulation) file. A frequency analysis of the PMV levels must be assessed for a period of 30 days within the peak months of January to February. The building model, ventilation/heating/cooling strategy, input data and results/conclusions must be documented and presented to the University. (Usable floor area for the PMV calculation excludes external covered areas, libraries, cafe / canteens or gymnasiums).	**2**	**Yes**	**2**	Thermal model not provided. Thermal comfort to be achieved via passive and active design measures including - self shading - operable blinds - openable windows - ceiling fans Common areas (theatre/ makerspace/ kitchens/ meeting rooms/ common rooms only) to be mechanically cooled (need to confirm with DSC if AC is provided to common areas under changes from VE excercise)	Mechanical specification. Thermal comfort statelebent to be provided. (AJC to provic to ensure thermal comfort incicies are achieved, to ensure non AC areas do not overheat).
3.7	**Location of Stairs** Provide accessible (available for use by building users and the public) and highly visible stairs in the building as an alternative to vertical transportation by lift. Stairs are to be located within 5m of the primary set of lifts or within 20m of a main entrance. Place highly visible directional signage next to lifts and main entrances to encourage stair use. Signage must be in accordance to the University Signage Standard.	**1**	**Yes**	**1**	Existing terraces: stairs retained and are located near entry. No lifts provided. New buildings: Stairs provided at primary entrances for new blocks and within 20 m of primary lift locations (lifts in new build (buildings A & B) . Stairs are to be the primary access.	DA Architectural plans
3.8	**Building Noise** Design the overall building sound levels in line with the lower values specified in the current version of AS/NZS 2107. The noise-level calculations must account for both internal and external noise sources.	**1**	**Yes**	**1**	Noise assessment by acoustic consultant	Acoustic report to be provided. (Lena to provide)
3.9	**CO_2 Monitoring** Provide a carbon dioxide (CO2) monitoring and control system in accordance with the University Mechanical Design Standard.	**3**	**Yes**	**0**	CO2 monitoring not required as no highly occupied spaces proposed.	CIS Request Dispensation form (CIS-ENG-F001)
3.10	**Volatile Organic Compounds - Adhesives & Sealants** Ensure that adhesives and sealant products (used in the interior of the building, and applied on site, including both exposed and concealed applications) have low Total Volatile Organic Compound levels (TVOCs), maximum limits are defined in the compliance template. Products must be certified to one of the following schemes, as appropriate. Product compliance with the following independent third-party schemes is deemed acceptable: - Ecospecifier - Good Environmental Choice Australia (GECA)	**2**	**Yes**	**2**	AJ+C commit to complying with Sydney University's Sustainability Framework, Clause 3.10 to ensure that adhesives and sealant products (used in the interior of the buildings and applied on site, including both exposed and concealed applications) have low Total Volatile Organic Compound Levels (TVOCs).	Completed UoS VOC Template - to be provided.
3.11	**Volatile Organic Compounds - Paints & Carpets** Ensure that any flooring product have a low Total Volatile Organic Compound levels (TVOCs). Limits are defined in the compliance template. Products must be certified to one of the following schemes, as appropriate. Please see compliance document for more detail on minimum certification levels per scheme. Compliance with the following independent third-party schemes is deemed acceptable: - Ecospecifier - Good Environmental Choice Australia (GECA)	**2**	**Yes**	**2**	AJ+C commit to complying with Sydney University's Sustainability Framework, Clause 3.11 to ensure that low volatile organic compound products must be used for paint and carpets that are internal to the buildings. This can be achieved by installing products that are certified to the following: Ecospecifier's GreenTag GreenRate – GGTv3.2 – Paint Supplementary Product standards at Level A or Level B; or Good Environmental Choice Australia GECA PCv2.2i-2012 – 'Paints and Coatings' standard	Completed UoS VOC Template - to be provided.
3.12	**Formaldehyde Minimisation** Ensure that all engineered wood products used in exposed or concealed applications, must either have low formaldehyde emissions or contain no formaldehyde. Engineered wood products are defined as particleboard, plywood, veneer, Medium Density Fiberboard (IVI DF) and decorative overlaid wood panels. Please see compliance document for more detail on minimum certification levels per scheme. Product compliance with the following independent third-party schemes is deemed acceptable: - Ecospecifier - Good Environmental Choice Australia (GECA) - Institute for Market Transformation to Sustainability (MTS) - Australasian Furnishing Research and Development Institute (AFRDI)	**2**	**Yes**	**2**	To be specified as part of design.	Written specification to be provided.

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Project Name: Darlington Road Terraces
Building Type: Student Accommodation
Date : 21/11/2016

		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
				Project Team Input Points Targeted	Preliminary Design Response Specify how the design intent will achieve the targeted measure	Preliminary submission requirements
3.13	**Ceiling Fans** Provide ceiling fans for all mixed mode and naturally ventilated areas according to the following schedule: 1. Student Accommodation: One ceiling fan per common living room space and one ceiling fan per bedroom where the fan does not exceed i) 15m2 if it has a blade rotation diameter of not less than 900mm; and ii) 25m2 if it has a blade rotation diameter of not less than 1200mm 2. Office: One ceiling fan per individual enclosed office space or meeting room i) 15m2 if it has a blade rotation diameter of not less than 900mm; and ii) 25m2 if it has a blade rotation diameter of not less than 1200mm 3. Education: One ceiling fans per enclosed spaces where the fan does not exceed i) 15m2 if it has a blade rotation diameter of not less than 900mm; and ii) 25m2 if it has a blade rotation diameter of not less than 1200mm Placement of ceiling fans must be designed to avoid light flicker. Note: the following areas are excluded from this measure - communal and open plan office spaces, circulation spaces and plant rooms and special-use spaces such as laboratories.	2	No	2	Ceiling fans will be provided in bedrooms.	Written provision/target. (DSC to confirm size of ceiling fan - min 900mm blade diameter)
3.14	**Planting selection** Incorporate food plants and herbs into the landscape design.	1	No	1	The rooftop will have movable pots with feature plants and herbs. Ground level andscaping includes 98m2 of plants. Existing turf to remain. Planter boxes to be provided on the roof for herbs/plants.	Landscape Design Report
		26		23		
4. Materials						
4.1	**Loose Furnishings** Specify furnishings with high recycled content, end-of-life local recyclability, product stewardship agreements, warranties greater or equal to ten years. Compliance with the following independent third-party schemes is deemed acceptable: - The current version of Ecospecifier's Green Tag Green Rate Level A, B or C; OR - Australasian Furnishing Research and Development Institute (AFRDI) Green Tick Level C/Silver - Level B or Green Tick Level B/Gold - Level or Green Tick Level A/Platinum - Level A - The current version of Good Environmental Choice Australia GECA 28 - 'Furniture Fittings and Foam' - Level or GECA 28 - 'Furniture and Fittings' - Level B; OR - The current versioin of the Institute for Market Transformation to Sustainability (MTS) Institute for Market Transformation to Sustainability (MTS or SMaRT Sustainable Gold - Level A At least 50% of all furniture items are to be certified to one of the above schemes and the remaining 50% of the items must have at least one (1) environmental credential of: A high recycled content OR End-of-life local recyclability OR product stewardship agreements OR product warranty greater or equal to ten years	2	Yes	2	AJ+C will commit to complying with Sydney University's Sustainability Framework, Clause 4.1 to ensure furnishings with high recycled content, end-of-life local recyclability, product stewardship agreements, warranties greater or equal to ten years.	Completed UoS Loose Furnishings Template - to be provided.
4.2	**Sustainable Timber (1)** Use re-used, post-consumer recycled, or FSC-certified and or PEFC certified timber for at least 50% of all timber products used for concrete formwork, structural, wall linings, flooring and joinery on the project. Supplied timber must be accompanied by chain-of- custody certificate.	2	Yes	2	Concrete and timber spec will specify the following: The Contractor and all sub-contractors shall ensure that at least 80% (by cost) of all formwork timber and timber joists products selected and used in the building and construction works for the entire Project are certified by a forest certification scheme that meets the Green Building Council of Australia's 'Essential' criteria for forest certification (either Forest Stewardship Council (FSC) International or Programme for the Endorsement of Forest Certification (PEFC)), or is from a fully compliant reused source, or is sourced from a combination of both. All timber products subject to this environmental requirement includes (but is not limited to) temperate, tropical, hardwood and softwood timbers and engineered wood products. All certified formwork timber and timber joist products selected and used in the entire Project must be supplied in accordance with the Chain of Custody (CoC) rules of the respective forest certification scheme. The Contractor and all sub-contractors must provide the relevant CoC certificates or invoices including a current CoC code or serial number. We think this point should be achievable for the formwork and timber joists. However, the wall lining, flooring and joinery will need to be assessed by the Architect.	Written provision/target.
4.3	**Recycled Steel (1)** Ensure that at least 60% of all steel, by mass, has a post-consumer recycled content greater than 50% or is reused.	3	Yes	3	• The unstressed reinforcement will typically have a large recycled steel content (around 95%) • The PT strand typically does not have a recycled steel content These points looks like they will be achievable but the percentages will need to be confirmed by the QS once we have progressed the design and have reinforcement and PT rates on our drawings. The Architect will need to provide comment on non-structural steel items such as cold-formed stud walls etc.	Written provision/target.
4.4	**Façade Reuse** Where there is an existing building, reuse the existing façade so that it comprises at least 50% of the new development's façade.	2	No	2	Façade of existing buildings will be retained (repaired/repainted)	Completed UoS Façade Reuse Template
4.5	**Structure Reuse** For redevelopment of existing buildings ensure that, by gross building volume, at least 30% of the building structure is reused.	3	No	3	Structure of existing buildings will be retained, some connecting walls to be demolished. Terrace ceilings to be retained. (Note: any elements containing hazardous materials will be removed off site)	Written provision/target. Completed UoS Structure Reuse Template to be provided.

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		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
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4.6	**Sustainable Timber (2)** Use re-used, post-consumer recycled, or FSC-certified and or PEFC certified timber for at least 80% of all timber products used for concrete formwork, structural, wall linings, flooring and joinery on the project. Supplied timber must be accompanied by chain-of- custody certificate.	2	No	2	Concrete and timber spec will specify the following: The Contractor and all sub-contractors shall ensure that at least 80% (by cost) of all formwork timber and timber joists products selected and used in the building and construction works for the entire Project are certified by a forest certification scheme that meets the Green Building Council of Australia's 'Essential' criteria for forest certification (either Forest Stewardship Council (FSC) International or Programme for the Endorsement of Forest Certification (PEFC)), or is from a fully compliant reused source, or is sourced from a combination of both. All timber products subject to this environmental requirement includes (but is not limited to) temperate, tropical, hardwood and softwood timbers and engineered wood products. All certified formwork timber and timber joist products selected and used in the entire Project must be supplied in accordance with the Chain of Custody (CoC) rules of the respective forest certification scheme. The Contractor and all sub-contractors must provide the relevant CoC certificates or invoices including a current CoC code or serial number. Achievable for the formwork and timber joists. Wall lining, flooring and joinery will need to be assessed by the Architect.	Written provision/target.
4.7	**Steel (2)** *When reinforcing steel constitutes more than 50% of the total steel on the project:* - At least 90% of all reinforcing bar and mesh meets or exceeds 500MPa strength grade, and at least 50% of all reinforcing bar and mesh is produced using energy-reducing technologies in its manufacturing (measured by average mass by steel maker annually); AND - At least 90% of all reinforcing steel meets or exceeds 500MPa strength grade, and at least 10% (by mass) of all reinforcing steel is assembled using off site optimal fabrication techniques. *When structural steelwork constitutes more than 50% of the total steel on the project:* - At least 90% of all products must meet or exceed the nominated steel strength grades below: Roof sheeting 550MPa Wall sheeting 550MPa Profiled-steel decking 550MPa Purlins 450MPa Girts 450MPa Light-steel framing systems* 450MPa AND - At least 20% of all products must meet or exceed the nominated steel strength grades below: Hot-rolled structural steels (including plate) (e.g. universal beam and column sections, parallel flange channels, angles) 350MPa Cold-formed sections (including hollow sections) (e.g. square and rectangular hollow sections, circular hollow sections, cold-formed channels and angles) 450MPa Welded sections (e.g. welded beams and columns made from plate) 400MPa AND - At least 50% of the fabricated structural steelwork is supplied by a steel contractor accredited to the Environmental Sustainability Charter of the Australian Steel Institute.	3	No	3	At least 90% of all reinforcing bar and mesh is to be minimum 500MPa strength grade, and at least 50% of all reinforcing bar and mesh is to be produced using energy-reducing processes in its manufacture (measured by average mass by steel maker annually). AND/OR At least 90% of all reinforcing bar and mesh is to be minimum 500MPa strength grade, and at least 10% (by mass) of all reinforcing steel is assembled using off site optimal fabrication techniques. These points should be achievable subject to review of the quantities by the QS once we progress our drawings with reinforcement and PT rates. The 10% off site assembly item will need to be assessed by the Builder. This could include elements such as the reinforcement cages for piles and columns.	Written provision/target.
4.8	**Recycled Concrete** Ensure at least 25% of all fine aggregate (sand) and coarse aggregate inputs in the concrete are manufactured sand or other alternative materials (measured by mass across all concrete mixes in the project) This must be achieved *without increasing the volume of Portland cement used by over 5kg/m3* AND The average content of portland cement used in the concrete mix has been reduced by at least 30% compared to a reference case.	3	No	3	At least 25% of all fine aggregate (sand) and 25% of coarse aggregate or, 25% of total fine aggregate (sand) plus coarse aggregate inputs in the concrete are to be manufactured sand or other alternative materials.	Written provision/target - to be confirmed
4.90	**Regional materials** At least 50% of construction and fit-out materials must be manufactured in Australia, using raw materials from Australia.	3	No	3	Australian sourced face brickwork, plasterboard and concrete. Aluminum windows and doors to be Australian made.	Written provision/target.
4.10	**Joinery** Specify joinery that is either modular and reusable, eco-preferred, or environmentally innovative.	3	No	3	All joinery will be standardised and reusable in different areas and be made from Low-VOC materials and paint. AJ+C will commit to complying with Sydney University's Sustainability Framework to ensure all fixed and loose joinery items use Low VOC materials and can be disassembled to be re-used or recyclable.	Completed UoS Joinery Template - to be completed
4.11	**PVC Minimisation** Replace 30% of PVC products by cost, e.g. pipes, conduits, sheathing and backing of carpet tiles with alternative environmentally preferable alternatives	3	No	0	PVC pipe to be used for sanitary plumbing, drainage and stormwater drainage.	
4.12	**Design for Disassembly** Design the façade such that minimum 95% can be easily removed from the main structure and disassembled at the end of the products life or building life to allow for future reuse of these materials locally.	3	No	3	Brickwork infils to concrete structural frame can be easily removed afetr life of building. Internal wall partitions means that building can be adaptable for future change of use.	Written provision/target.
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Project Name: Darlington Road Terraces
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Date : 21/11/2016

		Points Available	Mandatory Measure	GATEWAY 1 - 3 (Preliminary Design)		
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5. Climate Change, Landscape & Infrastructure						
5.1	**Infrastructure Future proofing** Future proof all infrastructure and plant rooms to allow for readily accessible connection points to future precinct based energy and water distribution systems (e.g.. Hot/chilled water loops, recycled water). This credit is designed to ensure that buildings are able to transition across to centralised utility services.	3	Yes	3	Plant room provided to Building A. Site restrictions limit potential for centralised system to whole site, however provisions for electrical services to be connected to the existing (trenching included).	Written provision/target.
5.2	**High Albedo Roof Materials** Use roofing materials having a Solar Reflectance Index (SRI) equal to or greater than 78 for low-sloped roofs (less than a 2:12 pitch) or 29 for steep-sloped roofs (greater than a 2:12 pitch) for a minimum of 75% of the total roof surface. SRI guide for roofing materials is as follows: Colorbond Wallaby - 38 Colorbond Gully - 39 Colorbond Cove - 51 Colorbond Dune - 61 Colorbond Paperbark - 68 Colorbond Classic Cream - 82 Colorbond Surfmist - 92 White coated grave on built-up roof - 79 White coating on metal roof - 82 White EPDM -84 White cement tile - 90	1	Yes	1	New Build will have concrete roof with insulation and ballast. Light coloured pebbles to be selected to achieve high SRI. Credit targeted - to be confirmed. Credit does not apply to existig roof to due minimal alrerations to building fabric.	Completed UoS High Albedo Materials Template
5.3	**Surface Heat Reduction** Provide a combination of the following for 90% of the ground materials: - Natural shade is provided by building overhangs or landscaping; OR - Paving materials with a Solar Reflectance Index (SRI) of at least 29; OR - Architectural shade features with a Solar Reflectance Index (SRI) of at least 29; OR - Open-grid pavement system for at least 50% of the hardscape surrounding the building. Open-grid paving is 50% impervious and accommodates vegetation in open cells; SRI guide for paving materials is as follows: New grey concrete - 35 Weathered grey concrete - 19 New white concrete - 86 Weathered white concrete - 45 New Asphalt - 0	1	Yes	1	Natural shade provided by landscaping and building elements. Paving material will be chosen with 29 SRI or more.	Completed UoS High Albedo Materials Template
5.4	**Landscape** Increase the number of trees and flora while recognising the cultural value of the campus landscape. Provide tree at natural ground level, for shade and visual interest, to reduce heat-island effects, where they do not obscure views to facades of important buildings nor visual linkages or solar PV systems. Plant native trees and flora in recreational spaces and in accordance to the Landscape Masterplan and Landscape Design Standard.	1	No	1	Landscape Plan will incorporate additional landscaping and native trees.	Landscape Design Report
5.5	**Flood Risk Management** Protect / locate essential building services equipment such as electrical and mechanical infrastructure to avoid inundation and maintain the lesser of either 500mm free board above the modeled 1 in 100 year flood level, or the PMF level.	2	Yes	2	Separate minor (5% AEP) and major (1% AEP) flows with two conduits. The minor flow conduit to be deepened to 600mm deep with 100mm depth of flow to allow 300mm freeboard.	Written provision/target. Stormwater Mgmt Report.
5.6	**Stormwater Management** Ensure the site stormwater management, harvesting system is designed in accordance with the University's Stormwater Masterplan and incorporates water sensitive urban design elements.	2	No	2	WSUD include rain water re-use tanks (buildings A, B & C), onsite detention tanks to mitigate downstream flooding, landscape garden and catch pit. Permissable site discharge is 56L/s).	Stormwater Mgmt Report.
5.7	**Green Roof / Wall** Provide a green roof to at least 50% of the available roof area (excluding areas dedicated to solar PV system) and/or a green wall for at least 20% of the vertical surface area of the building in order to reduce the heat island effect of the project. Use xeriscaping principles to guide the landscape strategy. Where irrigation is required, use non-potable water sources or reduce potable water use by at least 90%.	2	No	2	Green wall installed to the roof terrace (building A) - spaced limited by PV panels and services. Green wall provided in courtyard (to Darlington Lane between buildings B & C). Does not achieve aspecied % areas. (need to confirm % with landscape plan (Oculus). Green wall on the stairs deleted. Green wall between building B/C retained, and green wall in front of the large tree retained.) (AJC/Occulus to confirm % of green roof and % green wall to confirm that these points can be claimed)	Landscape Design Report
		12		12		
6. Sustainable Transport						
6.1	**Cycle Parking** Provide bicycle parking racks for staff and students in accordance to the Architectural Design Standard, CIP Masterplan and Access Strategy.	2	Yes	2	90 Covered student bike spaces provided (1:4 ratio as per University Standard) and 5 covered staff bike spaces provided.	Completed UoS Cycle Parking and End of Trip Facilities Template (to be updated by AJC)
6.2	**End of Trip Facilities** Provide changing / showering facilities and lockers for staff and students in accordance to the Architectural Design Standard, CIP Masterplan and Access Strategy.	0	No	0	Not applicable.	
6.3	**Car parking** Limit car-parking to no more than the minimum local planning allowances requirements. Ensure car parking requirements are in accordance with the Campus Improvement Plan.	2	No	2	No carparking to be provided on the site	
6.4	**Motor cycle and small car parking** Where car parking is to be provided, provide preferential parking to the extent that 20% of non-disabled car spaces are dedicated to motorbikes and 10% to small cars.	1	No	0	No carparking to be provided on the site	
		5		4		

Appendix B. References

Allan Jack and Cottier (AJ&C) (2016) Drawings for Development Application Allan Jack and Cottier (AJ&C) (2016a) Cycle parking submittal form.

Jacobs (2016) Stormwater Management Report

LHO (2016) Integrated Water Management Report

Oculus (2016) Landscape Plan

Waste Audit & Consultancy Services (Aust.) Pty Ltd (2016) Waste Management Plan

University of Sydney (2015) CIS Sustainability Standard