



Illoura Place

28 Elizabeth St, Liverpool, NSW, 2170

PREPARED FOR

Altis Bulky Retail Pty Ltd as trustee for Altis ARET Sub Trust 20 ("Altis") 14/60 Castlereagh St, Sydney NSW 2000 Tel: 0292 339 566

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ESD Report

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Northrop Consulting Engineers Pty Ltd

ACN 064 775 088 | ABN 81 094 433 100

Level 11, 345 George Street, Sydney NSW 2000

02 9241 4188 | sydney@northrop.com.au | www.northrop.com.au

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1. Introduction

We have worked with Altis Property Partners, the development manager on this project, to establish residential sustainability design guidelines for 28 Elizabeth St, Liverpool. The initial concept design has revolved around a 34-storey mixed used development, with 4-storey commercial on the lower floors and 29-storey apartment floors above.

In addition to this work the client has appointed us to provide advice on project specific sustainability initiatives. The objective of this appointment was to guide the client on the delivery of a sustainable project. To realise the objective, initial workshop has been carried out with the broader design team to further explore the key trends and influence within the industry as well as sustainability opportunities within similar building typologies.

Some of the key trends and influences discussed within the workshop includes:

- Global Warming Based on current policies in place, the global mean temperature will experience a 3 deg increase by the end of the century. The development will commit to targets beyond minimum code compliance to reduce greenhouse gas emissions in operations.
- Heightened Responsibility Increasing heightened responsibility and action within the industry via Architects Declare, Engineers Declare or organization climate commitment to set and implement climate commitment within the industry. The client and design team involved has signed up to individual climate commitment and will drive the project to meet its sustainability objective.
- Sustainable Development Goal These are the 17 Sustainable Development Goals that forms an urgent call for action by all countries in a global partnership. There are multiple goals related to climate change which is calling for action. Climate risk will be factored into the design to future proof the building.

Altis Property Partners and the design team fully understand the opportunities available for this development and has committed to conduct further investigation on the initiatives presented during the workshop. The client and the design team then prepared a draft planning design, and the engineers reviewed the options prior to we met again with the client and the design team to confirm the sustainability elements of the brief.

The project will be targeting the following sustainability objectives to enhance the environmental performance of the site:

- BASIX Certification
 - Energy target of 25%
 - Water target of 40%
 - Achieve an average of 7 star NatHERS thermal comfort rating across the development
- Building Code of Australia (BCA) Compliance with Section J Energy Efficiency, J1 (Building Fabric) only;
- Green Star Design & As-Built 5 Star Green Star Design & As-Built rating for the office component

Some of the initiatives the development will adopt to deliver on the frameworks above includes:

- Maximise passive design strategies (ie, daylighting, cross-ventilation, adequate shading).
- Inclusion of efficient equipment and systems.



- 100% electric building eliminating gas as a fuel source for the development in commercial and residential.
- Onsite renewable energy generation 60kW peak solar PV to reduce electricity usage and peak demand.
- Provision of water efficient fixtures and fittings.
- Low water use species are nominated and provision of rainwater tank to collect and re-use rainwater for irrigation to reduce water demand.
- Reduce urban heat island effect through the inclusion of vegetation or use of pale external fabric.
- At source waste separation for the residential component achieved through full size bins in bench, cardboard and glass bins on each residential level to promote recycling.
- Provision of EV charging infrastructure within the development to encourage the use of low emission vehicle.
- Rainwater collected will also be directed for car washing at the car wash bay within the development.

Each of the initiatives are further detailed in Section 5 in this report.

1.1 Site Description

The site is located at Liverpool, approximately 27km from Sydney's CBD, and at the corner of Elizabeth St and George St.

Altis intends to repurpose the land to facilitate a 34-storey building, containing:

- 4-storey commercial space with GFA of 8,284m²
- 312 units residential apartment spread across 29-stories



Figure 1 Site Plan

1.2 General Sustainability Statutory Regulations

The development shall be designed in accordance with Statutory Regulations below:

- BASIX Certification compliance with the requirements of the NSW SEPP BASIX 2004;
- Building Code of Australia (BCA) Compliance with Section J Energy Efficiency
- SEPP 65 Compliance with the requirements of SEPP 65 Design Quality of Residential Apartment Development and the related Apartment Design Guide.
- Liverpool DCP 2008



1.3 Referenced Documentation

The following documentation was referenced in the development of this report:

- Architectural Drawing dated 20.10.2021
- Project Design Brief by Murdoch Projects dated 20.04.2021

1.4 Limitations

Due care and skill have been exercised in the preparation of this report.

No responsibility or liability to any third party is accepted for any loss or damage arising out of the use of this report by any third party. Any third party wishing to act upon any material contained in this report should first contact Northrop for detailed advice, which will take into account that party's particular requirements.



2. Building Sustainability Index (BASIX)

2.1 Overview

BASIX Certification is required for all residential developments as mandated by the NSW Government Department of Planning & Environment. The BASIX assessment considers water, energy and thermal comfort of the development and is assessed on how it is likely to perform against existing dwellings of the same type.

The concept design will achieve the following targets under the BASIX rating tool;

- Energy: 25%
- Water: 41%
- Thermal Comfort: average 7 star NatHERS rating

2.2 Provisions & Design and Compliance Response

Table 1 BASIX Requirements and Project Response

ltem	Design and Compliance Response – Details are provided in Chapter 5 of this report
Energy – achieving 25%	 HVAC system with high efficiency ratios and with day night zoning that allows for control of air delivery to rooms that require air to be installed. Efficient centralised heat pump hot water system to be installed. Joinery around refrigerator compartment will be ventilated to reduce energy use. LED lighting with motion sensors and time switches to be provided for the development. All cooktops to be induction cooktops. 60kW of solar PV system proposed on rooftop and energy generated will be used in common areas.
Water – achieving 41%	 Fire sprinkler test water will be captured and recirculated back into the fire sprinkler tank. Efficient water fixtures specified for the development. Provision of low water use species for the landscape to reduce water demand. Rainwater tank will be provided to collect rainwater for reuse in landscape irrigation and car wash bay.
Thermal Comfort – average 7 star NatHERS rating	 Achieve an average 7 star NatHERS rating via passive design strategies and high-performance external fabric. Windows are designed to maximise operability and take advantage of cross ventilation for passive cooling to improve thermal comfort of the occupants. Balcony as a shading to west-facing apartments to reduce direct solar radiation.

The final BASIX certificate showing compliance with the requirements above will be submitted as part of the DA application.



3. BCA Section J – DTS Compliance Approach

Section J of the National Construction Code (NCC) outlines the energy efficiency provisions for all new building types. Part J1 assesses the requirements for building fabrics and outlines the insulative and glazing performance of different building elements.

Section J requirements are applicable to the commercial floor space of the development and located within Climate Zone 6 as per the below Australian Building Codes Board (ABCB) map in Figure 1.



Figure 2 Sydney Surrounds Climate Zone

3.1 Building Fabric

The proposed building fabric material requirements have been determined in accordance with Part J1 of Section J of the NCC (2019). As the overall design of the commercial areas are yet to be finalised at this stage, the below table lists typical fabric requirements which may be applicable to the final design.

Table 2 Section J, Part J1 DTS Requirements (NCC 2019)

Building Fabric	Required total R-value
Ceiling/Roof	R3.2 and Solar Absorptance of <0.45 (light coloured roof)
External Walls and Glazing	R1.4
Floors	R2.0

A Deemed to Satisfy (DTS) glazing calculator assessment will be undertaken for the commercial areas of the development to assess the glazing performance on each façade orientation once these



have been finalised for construction. This calculation will utilise the NCC Glazing calculator to confirm the required glazing performance requirements applicable for the development.

	NCC 2019 Wall-Glazing Calculator v3.0										
Wall and glazing energy efficiency in Class 2-9 buildings - Method 2 or Building name and description 29 Electrols by Liver and					Classification	1.5a, NCC 2	Climate Zo	ne			
	Calcul Allow Building	lated Area-Weigl able Area-Weigh total U-Value	nted U-Valu ited U-Valu allov anc	ue ue ce met	0.00		Calculate Allowabl Buildin	ed Representative Air- Energy Value e Representative Air-(Energy Value g total SHGC allow	Conditioning Conditioning Pance met	0.0	
Use	Check Values	💌	₩all Requi	Element irements ance with the N	- VCC. The disc	aimer and a version up	date check	Display Glazing Requireme are available at the bo	j Element ents ttom of the pa	ae.	l
		Element Descript	ion			U-Value			SHGC and Sh	ading	
	Description (optional)		Facing	Area (m²)	U-Value	U-Value Element share of allowance used	SHGC	Glazing Height (m)	Shading Height (m)	Shading Projection (m)	SHGC Element share of allowance used
1	(Not counted					Not counted
2						Not counted					Not counted
3						Not counted					Not counted
4						Not counted					Not counted
5						Not counted					Not counted
6						Not counted					Not counted
7						Not counted					Not counted
8						Not counted					Not counted
9						Not counted					Not counted
10						Not counted					Not counted
Disc This if us qua Mac	Disclaimer: This calculator has been developed to assist in developing a better understanding of the glazing energy efficiency parameters of NCC 2019. While the author believes that the calculator, if used correctly, is likely to produce accurate results, it is provided "as is" and without any representation or warranty of any kind, including that it is fit for any purpose or of merchantable quality, or functions as intended or at all. Your use of this calculator is entirely at your own risk and the author accepts no liability of any kind. Made by Alex Zeller										
Ema	il alex.wallolazino	icalculator@oma	ail.com.with	anv suggesti	ons for improv	rement				Check	for version update

Figure 3 NCC 2019 Wall-Glazing Calculator

A Section J report outlining the compliance solution complying with the building fabric requirements above will be produced as the design develops.



4. Green Star Design & As-Built

4.1 Overview

The Green Star rating system is a comprehensive rating system for assessing environmental performance of Australian buildings.

The Green Star environmental rating system for buildings was created for the property industry in order to:

- Establish a common language;
- Set a standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Recognise environmental leadership;
- Identify building life-cycle impacts; and
- Raise awareness of green building benefits.

The Green Star framework incorporates ESD principles which are grouped into nine categories. Points are awarded across each category for credits that are incorporated into the project to improve.

The following sections outline the measures to be incorporated into commercial building in the proposed development to achieve the principles of a 5 Star rating under the Green Star Design and As Built v1.3 Submission Guidelines.

4.2 Rating Bands & Categories

Green Star awards achievement at 3 levels, depending on the points achieved after assessment by the independent panel:

- 4 Star 45-59 points, recognising industry "Best Practice"
- 5 Star 60-74 points, recognising "Australian Excellence"
- 6 Star 75+ points, recognising the project as a "World Leader"

The Green Star rating systems is made up of the following credit categories:

Category	Category Reference Code	Available Points
Management	Man	14
Indoor Environment Quality	IEQ	17
Energy	Ene	22
Transport	Tra	10
Water	Wat	12
Materials	Mat	14
Land Use and Ecology	Eco	6
Emissions	Emi	5
Innovation	Inn	10

These categories are divided into individual credits, each of which addresses an initiative that improves or has the potential to improve a design, project or building's environmental performance. Points are awarded in each credit for actions that demonstrate the project has met the overall objectives for Green Star and the specific aims of the rating tool.

All credits are assessed for each category and the percentage score for the category is calculated. A weighting factor is then applied to each of the category scores to reach a single weighted score. Each



category is weighted in line with current knowledge and industry practice to produce a rating that appropriately reflects ESD achievements obtained in a project.

4.3 Green Star Scorecard

5-star Green Star pathway have been included for this development. The following pages outline the measures that will be taken to achieve the requirements in each credit.



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Green Star - Design & As Built Scorecard V1.3

Core Points Available

100

5 Star Strategy

64

Project:	28 Elizabeth St
Targeted Rating:	5 Star - Australian Excellence

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
Management				14	
Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.1	Accredited Professional	1	1
		2.0	Environmental Performance Targets		Complies
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.1	Services and Maintainability Review	1	1
		2.2	Building Commissioning	1	1
		2.3	Building Systems Tuning	1	1
		2.4	Independent Commissioning Agent	1	
Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2

Cost Comment	NORTHROP COMMENTS
\$40,000	Green Star Accredited Professional – Design & As Built (GSAP), Northrop can fulfil this roll.
Would include setting performance targets for operation of systems. Likely able to be completed at minimal cost.	The Project must set targets for the environmental performance of the project. This can be documented through the production of a design intent report or an owner's project requirements to be prepared by the design team at the design phase stage and outline at least the following items: • Description of the basic functions, operations, and maintenance of the nominated building systems • The targets for the project energy and water consumption and energy and water budgets for all nominated building systems. • Description of how energy, water, and aspects of indoor environment quality are metered and monitored. Including a meter diagram that illustrates how energy and water budgets are confirmed in operation
\$5,000	Will need to include energy and water targets within documentation. A maintainability design review must occur pre tender and preconstruction that seeks input from the design team, the facilities manager and operations staff (if known), and any relevant suppliers and subcontractors (if engaged) for a design
Would require airtigntness testing circa \$15000	review. The review must address the following aspects for all nominated building systems: • Commissionability; • Controllability; • Maintainability; • Operability, including 'Fitness for Purpose'; and • Safety There is a cost involved with the airtightness testing. Will affect Mech sealing design.
Commitment for Altis to complete tuning - Minimal cost	Formal commitment to a tuning process should be made for the base building nominated building systems. Where the tenants are not known Tuning of tenant installed systems is exempted At a minimum, the commitment must include quarterly adjustments and measurement for the first 12 months after occupation and a review of building system manufacturer warranties. Commitment must include: • O&M manuals • building tuning blan • building tuning blan • building tuning team • Owner has engaged parties to tune the system
ICA - likely circa \$80k	ICA to be involved in design, construction, commissioning and tuning process.
aligns with TCFD Targets - circa \$10k	Where a climate change and adaptation risk assessment has been undertaken at a precinct level, the project will only require to prepare a project specific climate change adaptation plan and identify the design features that mitigate the risks already identified at the prescient level. The building design will incorporating adaptions to address high and extreme risks. May required additional capacity in mechanical and electrical system.



Green Star - Design & As Built Scorecard V1.3

Core Points Available

100

5 Star Strategy

64

Project:	28 Elizabeth St
Targeted Rating:	5 Star - Australian Excellence

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Information	1	1
Commitment to	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	1	1
Performance		5.2	End of Life Waste Performance	1	1
Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering		Complies
		6.1	Monitoring Systems	1	
	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan		Complies
Responsible Construction Practices		7.1	Environmental Management System	1	1
		7.2	High Quality Staff Support	1	1
Operational Waste	A. Performance Pathway	BA	Performance Pathway: Specialist Plan	1	1
		8B	Prescriptive Pathway: Facilities	0	
Total				14	12

Indoor Environment Quality			17	
	9.1	Ventilation System Attributes	1	1



Cost Comment	NORTHROP COMMENTS
Circa \$3k for logbook production	Demonstrate that comprehensive building operation and maintenance information is available to the facilities management team. O&M manuals and Building Log Book required
Setting of consumption targets or perfomance targets and reporting - minimal additional costs.	Monitoring system and reporting need to be put in for the building.
Aim for finishes and fixtures to have a life of >10 years - posible minor increase in construction costs	At leased 80% of the projects GFA has a formal commitment in place to reduce demolition waste at the end of life of an interior fitout or base building component. This should take the form of a contractual agreement and can be included as part of the lease clauses.
Metering per apartment (smart meters) for water and electricity.	Whereing shall be provided to allow for monitoring of the relevant areas or functions of the project. In most cases floor by floor metering will suffice if the entire floor has a single use. Where a load for a single item exceeds 5% of the total energy use for the building, or 100kW, it must be independently metered.
connection to a monitoring system (circa \$100k)	The monitoring strategy must be developed in accordance with a recognised standard, such as CIBSE TM39 Building Energy Metering. The same principles described in the standard shall be used for developing water metering and monitoring strategies.
EMP (BAU)	A project-specific best practice EMP must be developed and implemented, to assist the Principal/Head Contractor and its service providers manage environmental performance, conditions, and impacts arising from excavation, demolition and construction.
ISO14001 (BAU for major Builder)	Demonstrate that a formalised systematic and methodical approach to planning, implementing and auditing is in place during construction, to ensure compliance with the EMP.
Programs to support wellbeing for contractors (Circa \$10k)	Programs and policies must be provided to promote health and wellbeing on-site. The programs must target both physical and mental health outcomes. On-site, off-site or online training must be provided to site workers on project specific sustainable practices and Initiatives.
Circa \$5k for plan production.	A commitment to Operational Waste Management Plan (OWMP) by waste professional should be made the Tenant OWMP can be implemented during the operational phase of the building
	A guidance needs to be created for tenants via a Formal Agreement. Waste streams for offices spaces to include paper and cardboard, glass, plastic and one other waste stream.

ninimal costs	The entry of outdoor air pollutants is miligated - The building services must be designed to comply with ASHRAE Standard 62.1:2013 in regards to minimum separation distances between pollution sources and outdoor air intakes. The system is designed for ease of maintenance and cleaning; and The system has been cleaned prior to occupation and use.



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Green Star - Design & As Built Scorecard V1.3

Core Points Available

100

5 Star Strategy 64

Project:	28 Elizabeth St
Targeted Rating:	5 Star - Australian Excellence

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
Indoor Air Quality	To recognise projects that provide high air quality to occupants.	9.2	Provision of Outdoor Air	2	1
		9.3	Exhaust or Elimination of Pollutants	⊻ 1	1
		10.1	Internal Noise Levels	1	1
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.2	Reverberation	1	1
		10.3	Acoustic Separation	1	
		11.0	Minimum Lighting Comfort		Complies
		sneral ince and leduction	11.1.1 General Illuminance	- 1	1
Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.1 Ge Illumina Glare F	11.1.2 Glare Reduction		
		11.2	Surface Illuminance	1	
		11.3	Localised Lighting Control	1	1
	To recomise the delivery of well lit	12.0	Glare Reduction		Complies
Visual Comfort	spaces that provide high levels of visual comfort to building occupants.	12.1	Daylight	2	2
		12.2	Views	1	1

Cost Comment	NORTHROP COMMENTS
Office areas may attract premium (circa \$30k)	Outdoor air is provided at a rate 50% (1 Points) or 100% (2 points) greater than the minimum required by AS 1668.2:2012, or CO2 concentrations are maintained below 800ppm.
Potential increase in kitchen exhausts.	A dedicated exhaust riser must be provided for printing and photocopy equipment Removal of the pollutant is another option carbon filters or direct exhaust of kitchens
Testing - 5k	The ambient noise levels, in the nominated area, are no more than 5dB(A) above the "satisfactory" sound levels provided in Table 1 of AS/NZS 2107:2016.
Testing and increased acoustic absorbtion costs	Reverberation time in the Office space must be below the maximum stated in the 'Recommended Reverberation Time' provided in Table 1 of AS/NZ 2107:2016".
	The partition between the office spaces should be constructed to achieve a weighted sound reduction index (Rw) of at least 45. If there is no partition this point is claimed as not applicable.
minimal additional costs	Flicker-free lighting refers to luminaires that have either: • A minimum Class A1 & A2 ballast; • High frequency ballasts for all fluorescent lamps, or • Electronic ballasts in High Intensity Discharge (HID) lighting. Colour quality - light sources to have minimum CRI of 80
	Best practice lighting levels for each task within each space type is defined as lighting with a maintained illuminance that meets the levels recommended in the relevant Standard. For an office this standard is table 3.1 of AS1680.2
minimal additional costs	All bare light sources must be fitted with baffles, louvers, translucent diffusers, ceiling design, or other means that obscures the direct light source from all viewing angles of occupants, including looking directly upwards
dependant on lighting design - can be minimal costs.	A combination of lighting and surfaces improve uniformity of lighting.
DALI system for offices (\$30k)	Occupants have ability to control lighting in their immediate environment which includes turning the lights on and off and adjusting lighting levels. DALI System is available.
	In Office Glare in the nominated area from sunlight through all viewing façades is reduced through a combination of blinds, screens, fixed devices, or other means.
\$10k modelling costs	40% (1 point) or 60% (2 Points) of the nominated area receives high levels of daylight during 80% of the nominated occupied hours. Daylight modelling is already added in scope 3 - Buidling simulation
minimal additional costs	60% of the office space to receive high quality view, no obstruction within 8m of the building.



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Green Star - Design & As Built Scorecard V1.3

Project:	28 Elizabeth St	Core Points Available
Targeted Rating:	5 Star - Australian Excellence	100

CATEGORY	/ CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
			Paints, sives, tts and pets	13.1.1 Paints, Adhesives and Sealants	- 1	
Indoor Pollu	itants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1 P Adher Sealan Cari	13.1.2 Carpets	v	1
			13.2	Engineered Wood Products	⊻ □ 1	1
			14.1	Thormal Comfort	- 	1
Thermal Cor	mfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	mennar connort	- '	I
			14.2	Advanced Thermal	1	
				Comore		
Total					17	13

5 Star Strategy 64

Cost Comment	NORTHROP COMMENTS
minimal additional costs	At least 95% of all internal application (regardless of occupied and non occupied) space - paints, adhesives, sealants and carpets meet stipulated "Total VOC Limits", or, where no paints, adhesives, sealants or carpets are used in the building. Recommended products: Interface carpets, Enviro 2 for walls & ceilings.
minimal additional costs	At least 95% of all engineered wood products meet slipulated formaldehyde limits or no new engineered wood products are u
	Thermal comfort modelling would be required. 95% of the nominated area and 98% of the year a high degree of thermal comfort is provided for occupants between PMV +1 to -1. NCC Section J 2019 will satisfy this. Additional simulation and reporting is required for Green Star. Thermal comfort modelling is already added in scope 1 - Section J - JV3 Analysis for office areas.
	Thermal comfort modelling would be required. 95% of the nominated area and 98% of the year a high degree of thermal comfort is provided for occupants between PMV +0.5 to -0.5.

Energy				22	
		15E.0	Conditional Requirement: Reference Building Pathway		Complies
		15E.1	GHG Emissions Reduction: Building Fabric	4	1
		15E.2	GHG Emissions Reduction	16	5
Greenhouse Gas Emissions	E. Reference Building Pathway	15E.3	Off-Site Renewables	8	4
		15E.4	District Services	7	
		nal ssures	15E.5.1 Transition Plan	1	1
		E.5 Additio	15E.5.2 Fuel Switching	2	2

\$20k simulation costs	The Proposed Building greenhouse gas (GHG) emissions are less than those of the equivalent Benchmark Building.
	2% reduction from better fabric selection
	The more points the more costs associated with energy improvements. % improvement over benchmark targeted. 20% reduction with efficient services proposed. Strategies includes - Efficient mech system - Roof solar panel system serving base building electricity use - LED lighting along with light harvesting
Altis costs	A formal supply contract to procure 100% off-sile renewable electricity for a minimum period of 10 years immediately after Practical Completion. For contact procuring less than 100% or less than a 10 years period, points will be pro-rated. Embedded network or Green Power
	Procure 100% electricity from district services from a minimum period of 10 years.
strategy for removal of fossil fuels - circa \$3k	Reduce fossil fuel use and develop a transition plan to phase them out by 2030.
removal of gas for all but minor retail. Offsetting costs circa \$10k for café gas.	No fossil fuels are burned on site to generate electricity, heating or cooling. Depending on gas usage. No gas connection to office building, Back-up generator could use diesel

Water

Sustainable Transport B. Prescriptive Pathway

Transport

otal

Based on the percentage of people (5-9.99%) within the Greater Capital City Statistical Area (GCCSA) can access the site Minimal by public transport within 45 minutes during peak hour Need to demonstrate a reduction of car parking spaces for the proposed building, when compared to the maximum local planning allowance. must meet the following benchmarks: painting or the provision 15% of parking is for fuel-efficient vehicles (with a maximum of 5% for motorcycle parking): electric spots OR 5% of parking is for electric vehicles and charging infrastructure is provided for each space; Low emission parking - put a sign or paint on the floor End of trip facilities are defined as showers, changing amenities with appropriate drying space, and lockers. Showers and bike parking (circa \$10k) bathrooms provided to meet statutory accessibility requirements are not included in the calculation of end of trip facilities. bicycle storage is requried for office areas. At least 4 amenities are within 500m of the building, distance is to be measured from the centre of the project's site The provision of high-quality outdoor break out space may also be included as an amenity. The walk score is 28 % and 28% as transit score. Confirm 4 amenities are within walkable distance.

A green travel plan needs to be provided

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
		15 Presc	15E.5.3 On-Site Storage	1	
Peak Electricity Demand Reduction	B. Performance Pathway				
		16B	Modelled Performance Pathway: Reference Building	2	2
Total				22	15

17B.1

17B.2

17B.3

17B.4

17B.5

Access by Public

Reduced Car Parking

Low Emission Vehicle

Infrastructure

Active Transport

Neighbourhoods

Facilities

Walkable

Transport

Provision

5 Star Strategy

64

2

1

1

1

5

100

3

1

1

1

1

Green Star - Design & As Built Scorecard V1.3 Core Points Available Project: 28 Elizabeth St

5 Star - Australian **Targeted Rating:** Excellence

Cost Comment	NORTHROP COMMENTS
	On-site storage for renewable energy.
	The building's peak electricity demand is reduced by 30% when compared to that of the Reference Building.

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Green Star - Design & As Built Scorecard V1.3

Project:	28 Elizabeth St			Core Points Available	5 Star Strategy
Targeted Rating:	5 Star - Australian Excellence			100	64
					DOINTS
CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	TARGETED FOR 5 STAR
		18A	Potable Water - Performance Pathway	12	5
		18B.1	Sanitary Fodure Efficiency	0	
Potable Water	A. Performance Pathway	18B.2	Rainwater Reuse	0	



Cost Comment	NORTHROP COMMENTS
\$5k for modelling (six star option would require reuse system which would be costly)	Achieve 40% water use reduction with the proposed strategies: - Rainwater tank - Efficient water fixtures - Low water use landscape or efficient irrigation system - Fire protection system test water does not expel water for testing or have temporary storage for 80% of the routine test water or have isolation advecs/shut-off points for system by system testing if sprinkler systems are installed
	Sanitary fixtures are within 1 Star of the following: "Taps 6 Stars * Unnals 6 Stars * Toilets 5 Stars * Showers 3 Stars (>4.5 but <=6.0) * Clothes Washers 5 Stars * Dishwashers 6 Star
	Depending on the GFA, 10L/m2
	HVAC system must not use potable water for heat rejection.
	Either drip irrigation with moisture sensor override is installed, or no potable water is used for irrigation. The fire protection system does not expel water for testing; or * The fire protection system includes temporary storage for 80% of the routine fire protection system test water and maintenance drain-downs for reuse on-site. If sprinkler systems are installed, each floor must be fitted with isolation valves or shut-off points for floor-by-floor testing.

Materials				14	
		ete	19B.1.1 Portland Cement Reduction	2	1
		.1 Concr	19B.1.2 Water Reduction	0.5	0.5
Life Cuelo Impacto	B. Prescriptive Pathway - Life Cycle	196	19B.1.3 Aggregates Reduction	0.5	

	3 points are Life cycle assessment required. Assume 3 points minimum but additional points achievable. Additional cost for Completing this analysis
inimal	1 point for 30% reduction in Portland cement, and 2 points for 40% reduction.
il generally	At least 50% of the mix water used for all concrete are either captured or reclaimed water.
inimal	At least 40% of coarse aggregate in the concrete is crushed slag aggregate or another alternative material. OR At least 25% of fine aggregate (sand) inputs in the concrete are manufactured sand or other alternative materials.

Total



Green Star - Design & As Built Scorecard V1.3

Project:	28 Elizabeth St	Core Points Available	5 Star Strategy
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CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
rua olteia unhaera	Impacts	198.2 Steel	B. Reduced Use of Steel Reinforcement	1	1
		19B.3	Building Reuse	2	
				2	
		19B 4	Structural Timber		
		155.4		3	
		20.1 Structural and Reinforcing Steel	Structural and		Complies
Personalble Ruilding	To reward projects that include		1	1	
Materials	materials that are responsibly sourced or have a sustainable supply chain.	20.2	Timber	nber 1	
		20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1	1
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustainability	3	1
Construction and Demolition Waste	P. Parcentage Reachmark	22.0	Reporting Accuracy		Complies
	u. reicentage uehchmark	22B	Percentage Benchmark	1	1
Total				12	6.5

Land Use & Ecol	logy			6	
Ecological Value	To reward projects that improve the	23.0	Endangered, Threatened or Vulnerable Species	-	Complies
	ecological value of their site.	23.1	Ecological Value	3	1



Cost Comment	NORTHROP COMMENTS
\$2.5k report	One point is available when there is a reduction in the mass of steel reinforcement used in concrete slabs when compared to standard practice; Use fibre steel so reduce steel reinforcement.
minimal	all steel if from WSA Accredited suppliers
minimal	At least 95% of the building's steel is sourced from a Responsible Steel Maker.
	At least 95% of all timber used in the building and construction work is either: A) Certified by a forest certification scheme OR B) is from a reused source.
tracking costs - \$5k	At least 90% (by cost) of all permanent formwork, cables, pipes, flooring and blinds in a project is sources from a manufacturer that meet Best Practice Guidelines for PVC production or does not contain PVC (and have an Environmental Product Declaration).
concrete (\$5/cube)	Install 3% products (over total material cost) that meet the initiative of reused products, recycled content products, has EPD, certified to third party certification or has stewardship programs.
	90% of the waste generated during construction and demolition has been diverted from landfill.
	Innovation opportunity

	The project must demonstrate that no critically endangered, endangered, or vulnerable species, or ecological communities were present on the site at time of purchase.
anting area ssessment	Before state appears to have more hard surface. Introducing landscape will help increasing the ecological value of the site.



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Green Star - Design & As Built Scorecard V1.3

Project:	28 Elizabeth St	Core Points Available	5 Star Strategy
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CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
	To reward projects that choose to	24.0	Conditional Requirement		Complies
Sustainable Sites	develop sites that have limited ecological value, re-use previously developed land and remediate	24.1	Reuse of Land	1	1
	contaminate land.	24.2	Contamination and Hazardous Materials	1	1
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.1	Heat Island Effect Reduction	1	1
Total				6	

Emissions				5	
Stammatar	To reward projects that minimise peak atornwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Stormwater Peak Discharge	1	1
Stormwater		26.2	Stormwater Pollution Targets	1	1
		27.0	Light Pollution to Neighbouring Bodies	-	Complies
Light Pollution	To reward projects that minimise light pollution.	27.1	Light Pollution to Night Sky	1	1
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28	Legionella Impacts from Cooling Systems	1	
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.1	Refrigerants Impacts	1	
Total				5	з

Cost Comment	NORTHROP COMMENTS
	At the date of site purchase or date of option contract, the project site did not include old growth forest, prime agricultural land or wetland of 'High National Importance', or did not impact on 'Matters of National Significance'.
nil	75% of the site was Previously Developed Land
nil	Report to show that there is no contamination or hazardous material present onsite or if there is contamination, it is stabilised, removed and disposed in accordance with best practice guidelines.
white roof	At least 75% of the whole site area comprises of one or combination of vegetation; green roofs; light coloured roof SRI >64. Aligns with the project aim to address heating issue for the site.

Liverpool council requires	The post-development peak event discharge from the site does not exceed the pre-development event discharge using the local Council ARI requirements
Liverpool council requires	The Stormwater discharge from the site meets the required pollution targets within the Green Star Technical Manual.
don't shoot light into neighbours	Demonstrate that all outdoor lighting on the project complies with AS 4282:1997.
modelling costs - Potentially \$4k	Demonstrated that one of the following specified reductions in light pollution has been achieved; The direct illuminance from external luminaires on the project produces a maximum initial point illuminance value no greater than : • 0.5 lux to the site boundary and • 0.1 lux to 4.5 metres beyond the site into the night sky, when modelled using a calculation plane set at the highest point of the building. Calculations should be in accordance with AS 4282:1997; Illuminated signage could be an issue. To check with the lighting consultant.
leigionella risk management plan - Circa \$5k	Demonstrate the building cooling heat rejection systems do not use or contain water.



Green Star - Design & As Built Scorecard V1.3

Project: 28 Elizabeth St Targeted Rating: 5 Star - Australian Excellence

Core Points Available	5 Star Strate
100	64



CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED FOR 5 STAR
Innovation				10	
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world.	30A	Innovative Technology or Process		
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	30B	Market Transformation		
Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks	10	2
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge		2
Global Sustainability	Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star rating tools.	30E	Global Sustainability		
Total				10	4

Cost Comment	NORTHROP COMMENTS
	Demonstrating the initiative has led to market transformation or to increased adoption of the solution. The building is designed, built, commissioned, and tuned by a adopting a "Soft Landings" approach.
	Exceeding Green Star Benchmarks – Stormwater Pollution Targets (2 points) Ultra Low VOCs paints
	Financial Transparency, Occupant Engagement





5. Sustainability Initiatives

5.1 Passive Design Strategies

The first step towards an energy resourceful building starts with its shell and as such passive design is a key element when designing low energy buildings. Good passive design reduces the need for auxiliary heating or cooling by taking advantage of varying climate to achieve thermal comfort. The following initiatives will play a significant role in ensuring that the building's annual energy performance is lower that the set thresholds.

Key considerations include thermal performance of envelope, glazing selection and extent, external shading, daylight direction devices, thermal mass, surface properties and possible natural ventilation openings.

5.1.1 Local Climate

The local climate of Liverpool is warm and temperate with maximum summer temperatures peaking at 47°C during summer and lowest temperatures hitting -1.4°C during winter. The image below shows an extract from temperature profiles for the last 10 years.



Figure 4 Liverpool temperature profile for the last 10 years

The site has access to prevailing Southeast and Southern winds during summer and Southwest winds during winter. The image below shows the typical wind roses for all months of the year for Liverpool for the last 5 years.



Figure 5 Liverpool wind profile for the last 5 years



5.1.2 Natural Ventilation

Increasing the natural ventilation of the space is a method used to passively cool and ventilate the space without using mechanical air conditioning systems and thus an effective way to minimise energy consumption in the building. Ensuring that windows are openable and designed to capture prevailing winds into the dwelling will help to ensure that the natural ventilation can be utilised by occupants.

By specifically providing openings on multiple sides of an apartment or at low and high levels the building design will promote the flow of air though the dwellings bringing fresh air and passive heating and cooling into the home.

The following strategies can also be applied to achieve natural ventilation in a number of scenarios.

5.1.2.1 Cross ventilation

Cross ventilation achieves good air change rates driven by pressure differences across the building. This method uses controllable highcapacity inlets/outlets on two opposing building façades and can achieve **penetration depths of up to 5 times the floor-to-ceiling height.**

The development has incorporated openable windows on the façade and is meeting the crossventilation requirements from ADG.



5.1.2.2 Single-Sided Ventilation

Figure 6 indicates the L5 apartments meeting the cross-ventilation requirements from ADG.

Single-sided ventilation, usually through large façade opening devices, is mainly driven by wind turbulence. Relatively low ventilation rates are achieved except with **penetration depths of less than 2.5 times the floor-to-ceiling height**. Penetration depths are based on typical office low occupant densities and are not applicable to higher occupant densities such as teaching spaces and seminar rooms. Hybrid Plus versions of single sided ventilation systems are available to pre-warm incoming air in winter and assist with airflow during the warmer summer months.

5.1.2.3 Window operability

Having adequate window operability will provide great access to natural ventilation. This can be achieved by looking at window make ups and incorporating different types (casement, sliding, louvre, etc) to have larger overall operability percentages and to be able to catch breeze from varying angles.



This is especially important for units with windows located above the Ground floor

Figure 7 shows different window types to catch breeze.

opening directly to outside as there are usually restrictor in place for child fall protection. It is recommended that we aim for a high operability percentage to catch the breeze for passive cooling.



5.1.3 Shading

Direct solar radiation entering a residence can act as a heater in winter however can drastically increase air-conditioning loads throughout summer. To mitigate this, the development has west-facing apartments designed with balcony as shading to reduce direct solar radiation into the living space. Internal blinds can be installed at every apartment with approval by the strata which will improve flexibility and thermal comfort of the occupants.



Figure 8 Balcony as the shading device for west-facing apartments to reduce direct solar radiation into the living space.

Furthermore, planting of deciduous trees around the buildings lower levels will allow shading of the lower floors throughout summer and promote solar access throughout winter.

5.1.4 Materials Colour

The selection of materials colour and finish can have a significant effect on the overall heat gain or loss through sections of building. This is of particular importance for the selection of roof colour as this area is most exposed to solar heat gains throughout the day. Lighter colours for exposed building elements have been selected for this development to reduce heat island effect and to mitigate future climate risk for the site.



Figure 9 Light coloured façade from the external material finishes of the development. A light-coloured roof and wall are excellent colour selection to reduce heat island effect.



5.2 Efficient Building Services Systems

5.2.1 Electrification

The concept of electrification is one that has been gaining momentum globally over the last 5 years.

It refers to the process of replacing the use of fossil fuels (coal, oil, and natural gas) with electricity as the only source of energy. Depending on the resources used to generate electricity, electrification can reduce carbon dioxide (CO_2) emissions from the transportation, building, and industrial sectors.

Electrification results in emissions reductions due to current retailers using renewable energy and low carbon fuels to service the main electricity grids. While the electricity grid is expected to become cleaner over time, phasing out of other fuels such as Natural gas – typical in a residential development, can produce multiple benefits. This is due to its lack of efficiency in the energy production process, as well as reducing the amount of pollutants that are being directly emitted into the environment.



The graph below outlines typical carbon emissions of natural gas compared to electricity for residential dwellings in Australia.

Figure 10 compares the annual emissions for residential dwelling in Australia.

The development will go for electrification for all of its operation.

5.2.2 Heating Ventilation & Air Conditioning (HVAC) Systems

Typically, apartment buildings in Sydney are served by individual reverse cycle split air conditioning systems for each dwelling. The project team will investigate the most feasible HVAC system for this development in design development stage. HVAC system installed will have high efficiency ratio and allows for control of air delivery to rooms that require air.



Figure 11 shows day/night zoning configuration.



5.2.3 Water Systems

Water Efficient fixtures and fittings will reduce the water consumption of the site. Product water efficiency is regulated under the Water Efficiency Labelling and Standards (WELS) Scheme. As an indication, the following is being targeted:

- Wash hand basin taps 6 star WELS
- Kitchen sinks 6 star WELS
- Shower heads 6-7.5L per minutes 4 Star WELS
- Toilet 4 star WELS
- Dishwasher 2 Star WELS

The current provisions for hot water systems within the development is an air sourced electric heat pump serving all apartments and common area amenities, which will further reduce the energy demand for the site due to its high efficiency ratio.

5.2.4 Lighting

Lighting energy use represents around 5-10% of a home's energy consumption and is one of the simplest energy demands to reduce. It is estimated that most households could reduce their lighting energy consumption by 50% or more through making smarter lighting choices and moving to more efficient lighting technologies.

Measures to improve lighting energy consumption within the development include:

• Use of LED lighting

The development will nominate LED lighting to be installed throughout the building.

Motion Sensors

The use of LED lighting will allow the use of integrated motion sensor dimming within common areas of apartment building including car parks, emergency stairwells, lifts, lobby areas and corridors. The use of dimmers in these areas ensures that adequate light levels are provided with minimal energy wasted when these spaces are unoccupied.

Kill Switch

Kill switch are included at all apartment entrances to turn off lighting circuits.

5.2.5 Appliance Efficiency

Appliance energy use represents around a third of household consumption and this is largely driven by the refrigerator, cooking appliances and entertainment systems. Appliances installed within dwellings will have high energy rating to minimise ongoing costs for the residents.

For appliances not provided by to the dwellings, a tenant handbook should be provided to the occupants to educate them on the appliance selection. Alternatively, incentive can also be provided to the occupants to encourage the selection of higher efficiency appliances.



Figure 12: Energy Star ratings help to assess appliance efficiency

MEPS will be specified for the following;

- Dishwasher 3.5 Stars
- Clothes Dryer 2 Stars
- Refrigerator 2.5 Stars



Additionally, small alterations to building design will result in further energy savings through improved operation of appliance systems. Sufficient ventilation to the refrigerator compressor will be provided within all apartment units to allow free movement of air to extract the heat given off by the outside of the fridge. According to the home energy audit toolkit, poor air circulation may double the electricity use of a fridge or freezer.



3 1 1 1 1 1 1

5.2.6 Cooktops Selections

The cooktops nominated for all apartment units are induction cooktops. The provision of induction cooktops will likely represent a marginal increase in overall energy use however this provide flexibility to the tenants to offset the energy use from the cooktops with renewable energy if they would like to.

5.3 Onsite Generation

5.3.1 Photovoltaic System

Rooftop solar power within the development has the potential to provide a portion of the building energy use across the year. Using a system connected to the base building systems will offset energy used by the central services such as lifts and common area lighting. Rooftop solar will also provide a benefit to the projects BASIX compliance levels.

A 60kW solar PV system will be installed on the rooftop of this development serving the common area lighting and ventilation for the apartment. As there is a potential for excess onsite renewable energy generation, an embedded network will be explored (detailed in section



Figure 14: Solar PV proposed location shown in hatched on the roof plan.

4.3.2) to allow the use of the output electricity in the precinct for residential loads in addition to the common areas loads.

5.3.2 Embedded Networks

A Micro grid is a private electricity network that uses local energy generation sources (e.g. rooftop solar) which can be connected to battery storage systems and supply loads within that network. An integrated micro grid would allow the precinct to manage the system within its borders and interact with the larger grid network as a single entity under an Embedded Network arrangement.

The development has started to explore the feasibility of providing an embedded network in place to serve each of the dwellings within the building and connect these to a central connection point. Under the embedded network arrangements, electricity can be purchased in bulk at a lower cost than is available to individual residents. Billing is then provided by either the building or through a third party (Origin, OC Energy, WIN Energy etc).

These systems can often provide assist in the distribution of onsite energy generation and storage, allowing the development to transition away from fossil fuel dependence.

Overall, the use of an embedded network would allow further exploration of PV generation and the installation of battery storage to reduce energy consumption and peak demand.

5.4 Water and Landscape

To achieve water-efficiency, low water use landscape will also be nominated for the landscape design. Specifying water conserving and drought tolerance plants will significantly reduce water demand.

Fire sprinkler test water will also be captured and recirculated back into the fire sprinkler tank.



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5.5 Waste Management

Full size general waste and recycling waste bins are

provided to enable occupants to sort their rubbish and recyclables. Glass bins are provided on each level to separate glass recycling from general recycling bins to reduce the probability of broken glass when dropped into the general recycling bins. This will increase the percentage of recyclable glass as broken glass are unable to be recycled.

Back of house areas will be sufficiently sized and conveniently located waste storage and sorting areas will be designed for ease of removal by waste contractors.



Figure 16: Proposed waste holding area at Ground Level.



6. Conclusion

The new development at 28 Elizabeth St, Liverpool will incorporate the sustainability initiatives listed in Chapter 5 to reduce the impact on the environment and enhance the liveability of the building and demonstrate compliance against the environmental benchmarks and relevant planning instruments applicable.

Future detailed design stages of the development will explore integrating core sustainability principles and providing further detail to the project implementation of best practice sustainability.

Through actioning the recommended ESD strategies, the project demonstrates it strong commitment to efficiency in the design, construction and operation of this project and meets the targets set out by Liverpool Council and Altis.