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SUSTAINABLE BUILDING CONSULTANTS
SYDNEY BRISBANE PERTH MELBOURNE JAKARTA

FORBES & KISHORN ROAD, APPLECROSS RESIDENTIAL TOWER

Sustainability Report for Development Application

Prepared for:

Apex View Pty Ltd

Architects:

WOHA Designs PTE LTD

MJA Studio

Project No: 18236
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FORBES & KISHORN ROAD, APPLECROSS **18236**
RESIDENTIAL TOWER

SUSTAINABILITY REPORT FOR DEVELOPMENT APPLICATION
ESD SERVICES

This register identifies each issue of and each amendment to this document by Revision No, Page No, the details of each amendment and date of issue.

AMENDMENT REGISTER

Rev. No	Section & Page No.	Issue/ Amendment	Author	Project Engineer	Checked	Date
P1	-	Original Issue	AM	TP	NZ	24/08/2018
A	-	Draft Development Application Issue	AM	TP	NZ	05/09/2018
B	-	Development Application Issue	AM	TP	NZ	21/11/2018

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EXECUTIVE SUMMARY

Floth Pty Ltd (Floth) has been commissioned by Apex View Pty Ltd to provide ESD Consultancy Services for the proposed residential development located at 10-14 Forbes Road & 40, A, B, C Kishorn Road, Applecross in Western Australia (WA).

This report presents the sustainability assessment for the proposed development as part of the Development Application from the local authority, City of Melville. The report addresses the City of Melville requirements for the Kintail Quarter development, specifically the *Modifications to be read as part of Canning Bridge Activity Centre Plan* dated 21 April 2016 clause 16 which requires a 5 Star Green Star Design rating to be achieved by the development.

The Forbes and Kishorn Road, Applecross Residential Tower development team has the vision to create a sustainable urban environment for the benefit of the building residents, the Kintail Quarter urban area and the wider City of Melville community. The environmental impact of the construction of the proposed development will be reduced through environmentally sustainable development initiatives undertaken during the design and construction of the project.

The ongoing environmental impact of the development will be minimized due to the good passive design features of the building architecture reducing the energy required for cooling and heating of the occupants. The building services will therefore further reduce the energy and water use of the building by incorporating energy and water efficient fixtures and fittings into the design and equipment selections.

The sustainable nature of the development is further enhanced by making it a place where people will want to live and work. This will be done by addressing issues such as the indoor environment, materials selection, transport and the development's sense of community using sustainable design initiatives.

Social benefits will be maximised by the proposed design. High indoor environment quality initiatives would optimise occupant health, wellbeing and satisfaction. Ample communal and recreation facilities including landscaped terraces will enhance interconnectedness and support active lifestyles. In doing so, the building will maximise environmental performance and generate significant resident benefits over its lifecycle.

This ESD performance will be achieved by the holistic integration of ESD elements throughout the building and site design. Wherever possible the ESD elements will be integrated into the building function to achieve the desired level of ESD performance.

Significant work has been undertaken to date to firmly establish best practice ESD design into the proposed development, as follows:

- The residential apartment component is proposed to exceed the minimum average NatHERS Rating of 6 Stars.
- The non-residential components of the development will meet the requirements of BCA Section J Energy Efficiency.
- The development is proposed to achieve a 5 star Green Star Design & As Built v1.2 rating.

Prior to Building Approval, the project is proposed to be formally registered with the Green Building Council for a 5 Star Green Star – Design & As Built v1.2 certified rating. The project will be specified to achieve a 5 Star rating for tender to contractors, following which Green Star Design Review rating is recommended to be based on the contractor's construction documentation prior to Practical Completion, in order to ensure the rating reflects the final design. The Green Star As Built certification will be based on final as constructed documentation and commissioning records, and will occur prior to Project Completion.

In conclusion, it is anticipated that the extent of ESD integration proposed in this project will firmly establish Applecross Residential Tower at the forefront of the Perth sustainable mixed-use residential sector.

CONTENTS

1. INTRODUCTION

1.1 SCOPE

This Sustainability Report has been prepared as part of the Development Application for the proposed Residential Tower at corner of Forbes and Kishorn Roads, Applecross.

The report addresses *Modifications to be read as part of Canning Bridge Activity Centre Plan* dated 21 April 2016 clause 16, which states:

> *Clause 21.4.2 of Element 21 being amended as follows: "The proposed development meets or exceeds the 6 star Green Star design rating under the Green Building Council of Australia or other equivalent rating system for the Cassey, Davilak and Mt Henry Quarters (that is the Quarters within the City of South Perth) or the 5 Star Green Star design rating under the Green Building Council of Australia for the Kintail and Ogilvie Quarters (that is the Quarters within the City of Melville). As evidence in support of compliance with the required rating, applicants shall submit as part of their development application either a Green Star Design Review Certificate or a qualified consultant's report supporting the developments achievement of the required level of performance. Under either approach any development approval granted will be conditional upon submission of a Green Star certificate, prior to commencement of the development, which confirms achievement of the required rating."*

As the proposed development is in the Kintail Quarter, this report proposes that the project will pursue a 5-star Green Star - Design & As Built v1.2 rating with the Green Building Council of Australia.

The sustainable design undertaken to date to firmly establish best practice ESD design into the proposed development are summarised as follows:

- The residential component is proposed to exceed the minimum average NatHERS Rating of 6 Stars.
- The non-residential components of the development will meet the requirements of BCA Section J Energy Efficiency.
- The development is proposed to achieve a 5-star Green Star Design & As Built v1.2 rating.

1.2 ENVIRONMENTAL IMPACT OF BUILDINGS

Buildings produce carbon dioxide emissions and other emissions that reduce air quality and contribute to global warming. Buildings also generate waste during construction and operation and can have poor indoor environment quality that harms occupants' health.

A green building minimises the environmental impact and is healthy and comfortable. The Green Building Council of Australia defines a green building as one that incorporates design, construction and operational practices that significantly reduce or eliminate the negative impact of development on the environment and occupants with strategies for addressing:

1. Energy efficiency
2. Greenhouse gas emission abatement
3. Water conservation
4. Waste avoidance, reuse and recycling
5. Pollution prevention – noise, water, air, soil and light
6. Enhanced biodiversity
7. Reduced natural resource consumption
8. Productive and healthier environments and
9. Flexible and adaptable spaces

1.3 THE GREEN STAR – DESIGN & AS BUILT RATING TOOL

Green Star is a comprehensive, national, voluntary environmental rating system administered by the Green Building Council of Australia1 that evaluates the environmental design and construction of buildings. With more than 26 million square meters of Green Star-certified space around Australia, and a further 538 registered projects, Green Star has transformed Australia's property and construction market.

The first tool released by the Green Building Council of Australia was Green Star Office Design v1.1 in 2003. It was superseded by the release of Green Star Office Design and As-Built version 2, itself subsequently superseded by Green Star Office version 3, and other tools for other building types were also released in 2006 to 2009.

Green Star - Design & As Built, released as v1 in November 2014, is the latest Green Star scheme which provides a united Design and As Built rating and is applicable to all building types (except Class 1, 7a & 10), including mixed-use residential buildings. The scheme was most recently revised to v1.2 in July 2017, incorporating a number of credit upgrades, which is currently mandatory for all new project registrations.

Green Star – Design & As Built covers the following nine categories to assess the environmental impact that is a direct consequence of a project site selection, design, construction and maintenance:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use & Ecology;
- Emissions; and
- Innovation.

Green Star – Design & As Built certification is subject to meeting four (4) eligibility criteria: Spatial Differentiation, Space Use, Conditional Requirements, and Timing of Certification. If one or more of the eligibility criteria are not achieved, the project cannot be certified.

Each category is divided into credits, each of which addresses an initiative that improves or has the potential to improve environmental performance. Points are awarded in each credit for actions that demonstrate that the project has met the overall objectives of Green Star.

The following Green Star certified ratings are available:

- 4 Star Green Star Certified Rating (45-59 points), signifies 'Best Practice' in environmentally sustainable design and/or construction;
- 5 Star Green Star Certified Rating (60-74 points), signifies 'Australian Excellence' in environmentally sustainable design and/or construction;
- 6 Star Green Star Certified Rating (75 points and above), signifies 'World Leadership' in environmentally sustainable design and/or construction.

The project is targeting a 5 Star Green Star certified rating, demonstrating 'Australian Excellence'. Green Star certification is subject to meeting the prescribed eligibility criteria and assessment of the design by the Green Building Council of Australia.

The Green Star Design Review rating is recommended to be assessed by the Green Building Council of Australia independent assessor on the basis of the For-Construction documentation, in order to ensure the rating reflects the final design. The Green Star As-Built rating is assessed on the basis of As-Built documentation together with Commissioning data.

Green Star certification is awarded by the Green Building Council of Australia on the basis of a Green Star Assessment undertaken by two Independent third party Assessors. The project team has identified initiatives

[1] http://www.gbca.org.au/

and design strategies that are believed to comply with the environmental rating requirements. Compliance with the environmental rating requirements is formally awarded by the GBCA independent third party assessor.

This Sustainability Report provides the list of initiatives originally targeted for the development, and nominates those design features that are required to be incorporated to demonstrate the design is articulated to target the nominated 5 Star Green Star rating, but it acknowledges that, should the GBCA independent third party assessor disagree with the project approach to compliance with the credit requirement, the Sustainability Report interpretation of the initiative would take precedence in so far as the interpretation was done “in good faith” and the design complies with the interpretation.

2. DEVELOPMENT DESCRIPTION

2.1 PROPOSED DEVELOPMENT

The proposed development will consist of predominately residential apartments (98 units) and short-stay accommodation (15 units), as well as retail and commercial tenancies on Ground and Level 1.

The composition of the proposed development is presented below:

Levels	Use
B3	Car Parking
B2	Car Parking
B1	Car Parking
Ground	1 x Retail tenancy, 1 x Retail (Food & Beverage), Commercial Office Space, Commercial End-of-Trip (EOT) Facilities, Refuse Facility and Loading Bay
1	Co-working Space, Car Parking
2	Short-Stay Accommodation
3 - 14	Residential Apartments
15	Recreation Area including Pool, Deck, Lounge, Gym and Spa
16 – 19	Residential Apartments
20	Rooftop Garden and Mechanical Plant

The subject site (ref: Nearmap) is presented below

2.2 PROPOSED SUSTAINABLE DESIGN APPROACH

A primary aim of the development is to create a mixed-use development with practical and cost-effective sustainable design and construction features. Significant work has been undertaken to date to firmly establish best practice ESD design into the proposed development. The development will achieve a 5-star Green Star Design & As Built v1.2 rating. The residential component will exceed the minimum average NatHERS Rating of 6 Stars. The car park, office, co-working, retail, short stay and common areas will meet the requirements of BCA Section J Energy Efficiency.

Social benefits will be maximised by the proposed design. High indoor environment quality initiatives would optimise occupant health, wellbeing and satisfaction. Ample communal and recreation facilities including landscaped terraces will enhance interconnectedness and support active lifestyles. In doing so, the building will maximise environmental performance and generate significant resident benefits over its lifecycle.

This ESD performance would be achieved by the holistic integration of ESD elements throughout the building and site design. Wherever possible the ESD elements would be integrated into the building function to achieve the desired level of ESD performance.

Key innovative aspects of the sustainable design would include the following:

- High-performance façades incorporating spectrally selective glazing, integral shading elements and thermally insulated constructions to minimise solar gains in summer and heat loss in winter, thereby passively providing excellent indoor thermal comfort and energy efficiency.
- High indoor environmental quality and comfort achieved through climate-responsive passive design approach, naturally ventilated dwellings, kitchen and toilet mechanical ventilation extract systems, low off-gassing materials and finishes, acoustical apartment constructions, and appropriate lighting levels.
- Performance-optimised air conditioning systems including high efficiency Variable Refrigerant Flow systems incorporating heat-reclaim technology via zoned fan coil units.
- Carbon monoxide sensors controlling efficient variable speed carpark mechanical ventilation systems to optimise carpark air quality while minimising associated energy consumption.
- High efficiency electrical systems incorporating low energy LED lighting and control systems, regenerative lift drives with sophisticated controls, and power factor correction to minimise demand on energy infrastructure. Occupant sensor controls in common spaces to save energy by switching off air conditioning and lighting when unoccupied. Individual apartment energy metering systems as well as energy efficient appliances will be provided.
- Centralised gas –fired hot water plant inclusive of a solar pre-heat system. Natural gas has inherent lower greenhouse gas emissions compared to electricity. The use of a central hot water system servicing all the apartments also saves energy, equipment and space compared to individual hot water systems.
- Water conservation features including air-cooled heat rejection, high WELS rated fixtures and fittings and fire test water recovery and reuse. Swimming pool water efficiency would be maximised by use of water efficient pool filtration technology and pool covers to reduce evaporation loss. Individual apartment water metering systems as well as water efficient appliances will be provided.
- Extensive common space and sustainable transport initiatives including communal waste recycling, indoor and outdoor recreation facilities, landscaped terraces, spaces for fuel efficient vehicles, bicycle end of trip and storage facilities to encourage the use of bicycles and design for improved pedestrian access to nearby public transport and local amenities.
- Sustainable construction management practices including extended building commissioning and tuning, provision of a detailed building users guide, ISO 14001 accredited environmental management and a high proportion of recycling of construction waste, independent commissioning agent, and services and maintainability reviews.
- Sustainable material selection and minimised emissions in selection and design of all building components, including by water sensitive urban design.

It is anticipated that the extent of ESD integration proposed in this project will firmly establish Applecross Residential Tower at the forefront of the Perth sustainable multi-unit residential sector.

3. SUSTAINABLE DEVELOPMENT INITIATIVES

3.1 INTRODUCTION

This section of the report examines the sustainability benefits of the new development proposal.

The report addresses the sustainability of the buildings with respect to:

- Nationwide House Energy Rating Scheme (NatHERS) ratings of apartments.
- BCA Section J Energy Efficiency compliance of carpark, retail, office, co-working, short stay and common areas.
- Green Star – Design & As Built v1.2 certification of the development.

3.2 SUSTAINABILITY RATINGS

The project is targeting to achieve the following minimum ratings:

- An average NatHERS rating across all of the residential apartments of 6 stars with no individual apartment having a rating less than 5 stars.
- A Green Star - Design & As Built v1.2 rating of 5 stars.

3.3 BUILT FORM

The built form of the tower has a large impact on the ability of the development being able to achieve its targeted sustainability ratings. That being the case the following passive design initiatives are being targeted to assist in achieving the sustainability ratings:

- Optimise window area for thermal performance, daylight and views
- Provide high performance facades with insulated low-e double glazing units.
- Thermally insulate envelope walls, floors and ceilings;
- Maximise access to natural ventilation paths within the apartments to the extent possible;
- Ensure sufficient window opening sizes for natural ventilation;
- Ensure sufficient sealing of building envelope;
- Providing balconies and terraces integrating shading with occupant amenity.

3.4 ENERGY AND WATER EFFICIENCY STRATEGIES

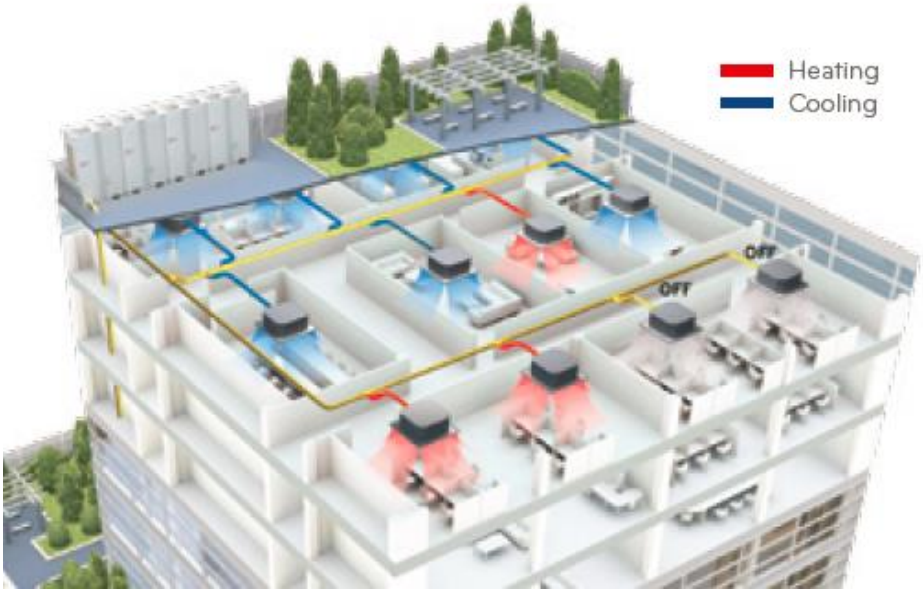
To complement the passive design initiatives incorporated into the built form the following efficiency measures will be implemented in the residential and hotel components of the development to minimise the utility consumption and therefore greenhouse gas emissions. The non-residential development areas will be designed to meet, and in many cases exceed, the minimum requirements of BCA Section J Energy Efficiency.

3.4.1 Mechanical Services

The air conditioning systems will be designed to respond to the environmental performance of the building's façade in order to maximize thermal comfort and reduce energy costs.

The following energy initiatives will be targeted:

- High efficiency air conditioning systems employing inverter-driven Variable Refrigerant Flow and heat reclaim technologies effectively transferring heat and coolth around the building as needed.



- Variable speed fans controlled so that they always operate at the minimum possible speed to satisfy the load.
- Unoccupied common areas are controlled to significantly reduce air conditioning to these areas.
- Major fans to have efficiencies greater than 69%.
- High efficiency motors used throughout.
- Low duct velocities are employed to reduce fan energy.
- Building Management System for central Mechanical Services Plant incorporated to optimize building control.

3.4.2 Electrical Services

The following energy initiatives will be adopted:

- Façade glazing system with a high visible light transmittance (VLT) providing good daylight penetration and minimising requirement for artificial lighting.
- Energy efficient fluorescent and LED lamps will be used for the lighting systems.

- Lighting in common areas will be activated by movement sensors in the access corridors.
- High power factor will be provided to reduce the kVA electrical demand of the building on the external electricity distributor's network.

3.4.3 Hydraulic Services

The energy used for the hydraulic services is high in a residential building. Domestic hot water will be provided by efficient, low CO_2 emission, solar-boosted, gas powered central plant meeting a minimum 5-star rating.

Energy efficient fittings and fixtures will reduce the pumping power otherwise required.

Variable speed booster/circulating pumps will further reduce energy consumption.

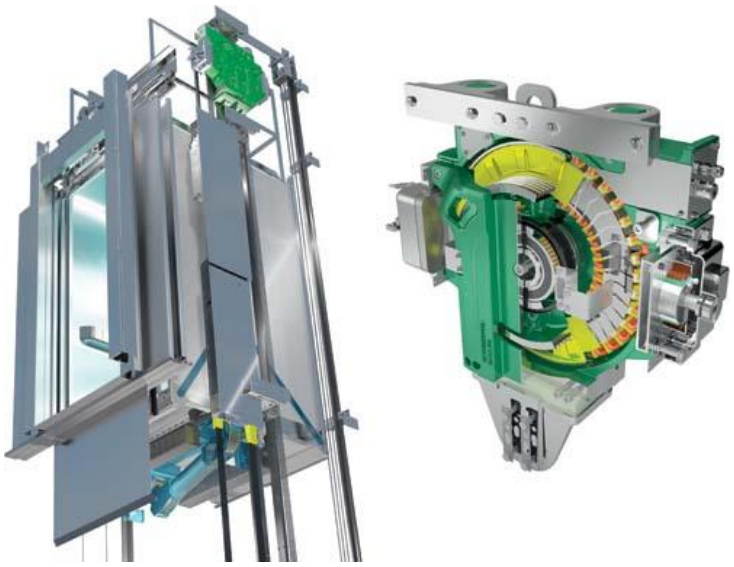
The following features have been incorporated to significantly reduce potable water consumption:

- Minimum 3 star WELS rated tapware for showers.
- Minimum 6 star WELS ratings for other sanitary ware.
- Minimum 5 star WELS clothes washing machines.
- Minimum 6 star WELS dishwashers.
- Fire test water storage/reuse.

3.4.4 Lift Services

The lifts are not large energy consumers. Nevertheless, the following features are incorporated:

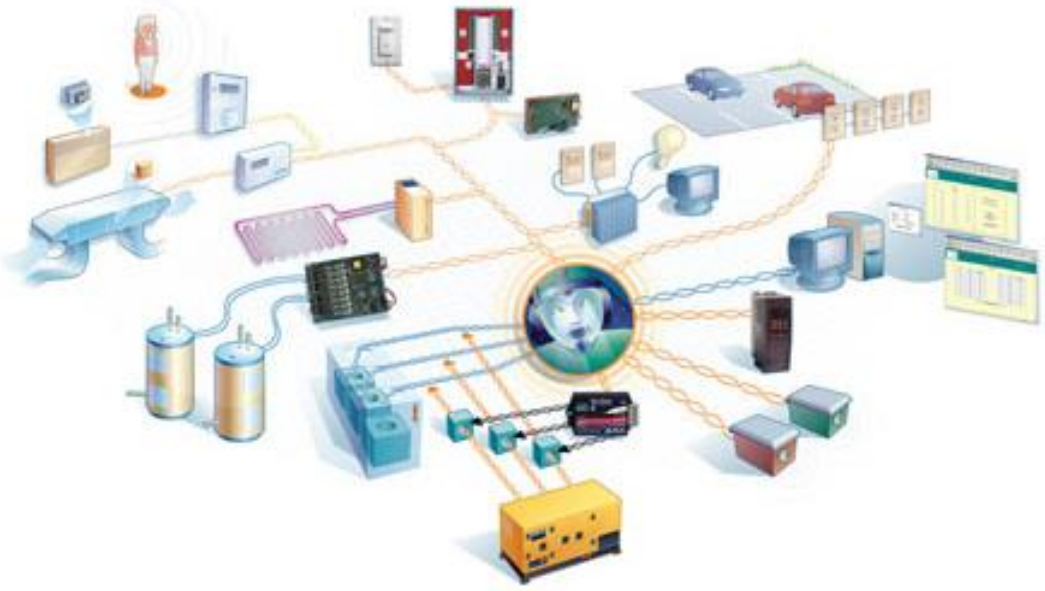
- High efficiency drives with a power factor greater than 0.9.
- Sophisticated control system to optimize the movement of the lifts.
- Re-generative electrical control which reduces energy usage.



3.4.5 Control Systems

The following control facilities are incorporated in the design to assist the building managers optimise the operation of the various building services systems and therefore avoid energy and water wastage.

- Building Management and Control System (BMCS) incorporated to optimize building control.
- Energy and water meters connected to an Energy Metering and Monitoring Systems (EMMS) to meter and monitor major and minor energy and water uses.
- Facility for offsite monitoring of the building performance via the internet.



3.5 GREEN STAR INITIATIVES

In order to quantify these fundamental principles of ESD, the Green Star – Design & As Built Version 1.2 rating system (as promulgated by the Green Building Council of Australia) has been adopted as a means of benchmarking the Ecological Sustainability of the proposed development.

Appended is a preliminary Green Star Matrix identifying the particular credits that are targeted.

In this section, the design initiatives that are proposed to be adopted (and identified in the Credit Summary Sheet) are summarised according to the following nine categories adopted in the rating tool:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use and Ecology;
- Emissions; and
- Innovation

3.5.1 Management

The development is committed to the appropriate management and implementation of the projects, including:

- The involvement of Green Star Accredited Professionals throughout the design and documentation process.
- Setting of environmental performance targets nominated under Owner Project Requirements as 5 Star Green Star certification.
- Thorough commissioning and tuning of all building services and building envelope to obtain optimum performance and energy savings throughout their operational life, to be overseen by an Independent Commissioning Agent.

- Preparation of "Service and Maintainability Report' with coverage of commissionability, controllability, maintainability, operability and safety, led by the Independent Commissioning Agent.
- Implementation of a Climate Adaptation Plan to AS 5334:2013 for resilience to the impacts of a changing climate.
- Providing comprehensive facilities management information in the form of operations and maintenance manuals and building log book and that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.
- Building owner and tenants/strata management to commit to performance targets and measure and report on a min of 2 indicators out of energy, water, indoor environment and waste.
- Building owner and tenants to commit to best practice 'make good' clauses in the lease in accordance with RICS Greening Make Good.
- A simple Building Users' Guide, which includes information relevant for the building residents and management, will be developed and made available to the building owner and residents.
- Energy and water meters connected to an Energy Metering and Monitoring Systems (EMMS) to meter and monitor major and minor energy and water uses down to individual apartment level.
- Energy metering integrity by validation and monitoring of accuracy of Energy Metering and Monitoring System (EMMS) to ensure that data captured is valid and notifying the building manager in the case of any out-of-range readings.
- Construction environmental management accredited to ISO14001, including high quality staff support practices to promote positive mental and physical health and enhance site workers knowledge of sustainable practices.
- In order to encourage and facilitate the recycling of waste material generated on site and therefore reduce the volume of waste going to land fill, dedicated facilities and storage areas shall be provided for the separation, collection and recycling of waste.

3.5.2 Indoor Environment Quality

In order to ensure that the indoor environment quality throughout the schools is maintained to a high standard, a number of initiatives shall be adopted, including:

- Design ventilation systems to comply with ASHRAE 62.1 separation distances between pollution sources and outdoor air intakes, design for ease of maintenance and cleaning, and ensure clean ductwork at handover via Construction Indoor Air Quality Plan.

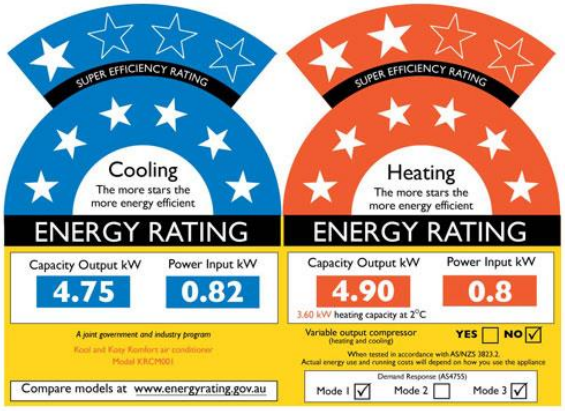
- Provide improved access to natural ventilation for all apartments.
- Limit source pollution or exhaust directly to the outside, nominated pollutants include: printing equipment, cooking equipment and vehicle exhaust.
- Internal noise levels cannot exceed 5 dB(A) for airconditioned or 10 dB(A) for natural ventilation above the "satisfactory" sound levels provided in Table 1 of AS/NZS 2107:2000, to be verified by acoustic testing prior to completion.
- Bounding apartment construction to habitable areas to result in an airborne noise isolation standard of Rw + Ctr ≥ 55.

- Floor construction above habitable rooms of adjacent dwellings (i.e. floor cover) to result in an impact isolation standard of Ln,w+Cl ≤ 55.
- Rw30 apartment doors and acoustic testing prior to completion.
- Lighting systems to have electronic ballasts with minimum CRI of 80.
- Retail and commercial lighting levels to AS1680.2 and compliance with luminaire selection system per section 8.3.4 of AS1680, to ensure well-lit spaces that provide a high degree of comfort to users.
- Residential lighting design includes or permits good maintained illuminance with no exposed light sources for all resi rooms with rated colour variation not exceeding 3 MacAdam Ellipses (decorative fittings exempt), to ensure well-lit spaces that provide a high degree of comfort to apartment occupants.
- Retail and commercial occupants have ability to control lighting in their immediate environment.
- Residential areas are provided with appropriate task lighting for kitchen, bathroom and service areas, and sufficient power outlets for future task lighting.
- The use of building materials and architectural finishes with low Volatile Organic Compound (VOC) content or emissions to minimise the detrimental impact on occupant health from internal air pollutants.
- The use of low emission formaldehyde composite wood products for the reason described above.
- Ensure high levels of residential thermal comfort by providing improved apartment envelope thermal constructions.

3.5.3 Energy

In order to minimise energy consumption and the associated CO2 emissions, the following strategies shall be implemented:

- Improved energy efficiency in design leading to significantly reduced predicted building energy consumption and greenhouse gas generation below BCA Section J and NatHERS compliant reference building, with at least 40% reduction estimated.
- All areas within the building, excluding the dwelling units, includes automated controls to minimise air conditioning and lighting energy use when unoccupied.
- All installed air-conditioning equipment and appliances are within one star of the best available energy star rating (www.energyrating.gov.au).

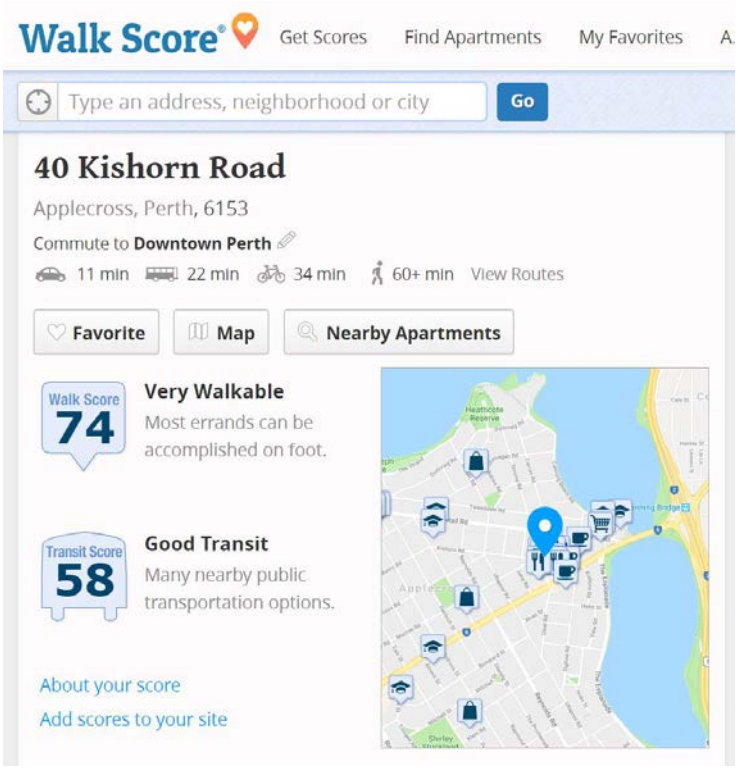


3.5.4 Transport

In order to reduce dependence on high polluting transport systems and encourage active transport, the following strategies shall be implemented:

- Provision of full cyclist end of trip facilities and cycle storage areas with appropriate accessibility.
- Good public transport access afforded by the site's proximity to public transport routes.

- Pedestrian routes giving very good access to public amenities within walking distance of the development.



3.5.5 Water

In order to minimise potable water consumption, the following initiatives shall be implemented:

- Fixtures shall be selected for their water efficiency, including high WELS rated tap ware and low capacity toilets.
- Air-conditioning heat rejection plant shall be air-cooled to avoid the use of water for this purpose.
- 80% of the routine fire protection system test water and maintenance drain-downs to be stored for reuse on-site and each floor fitted with a sprinkler system has isolation valves or shut-off points for floor-by-floor testing.
- Where landscape irrigation systems are provided they shall be automatically controlled via a system, of timers and sensors to minimise water consumption.

3.5.6 Materials

In order to maximise the reuse of materials, the following initiatives shall be considered:

- At least 20% Portland cement replacement, 50% reclaimed water content and 25% alternative aggregates in all concrete to the extent possible.
- The use of structural steel sourced from responsible steel maker and a high proportion of reinforcing steel made using energy reducing processes and assembled using off site optimal fabrication techniques to the extent possible.
- At least 90% of the total cost of PVC in permanent formwork, pipes, flooring, blinds, cables on the project is replaced by a non-PVC product or is best practice PVC compliant.
- At least 95% of new timber used in the construction of the building shall be PEFC or FSC certified.

- A target of 9% of the project construction value in specified materials (including concrete, steel, flooring, joinery and internal walls used in the project) to have a reduced environmental impact as determined by the Sustainable Products Calculator.

- Attention to the management of waste throughout the construction process including the reuse and recycling of waste materials.

3.5.7 Land Use and Ecology

Where existing site conditions permit:

- Every effort will be made to ensure that the ecological value of the site is improved through appropriate landscaping.
- The project is on a previously developed site, thereby preserving green, undeveloped spaces.

3.5.8 Emissions

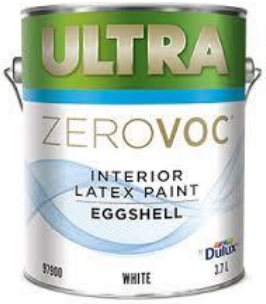
In order to minimise emissions from the various sites, the following initiatives shall be incorporated:

- The use of refrigerants in air-conditioning systems and thermal insulants which have zero ozone depletion potential.
- Stormwater drainage detention and treatment system to manage a post-development peak 1.5 year Average Recurrence Interval (ARI) event such that discharge from the site does not exceed the pre-development peak 1.5 year ARI event discharge and all stormwater discharged from site meets the minimum Pollution Reduction Targets.
- The implementation of external lighting designs that reduce light pollution by ensuring that no light beam is directed beyond the site boundaries or upwards into the night sky.
- The use of air-cooled heat rejection systems in lieu of evaporative heat rejection systems that might otherwise present the risk of Legionella.

3.5.9 Innovations

The following innovations are proposed to be considered beyond minimum Green Star requirements to further distinguish the developments leading environmental aspirations:

- Improved stormwater pollution reduction targets recognised as an innovation by GBCA to reward projects that reduce pollutants entering public sewer infrastructure.
- Commissioning and Tuning supplementary or tenancy systems review recognised as an innovation by GBCA to encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.
- Ultra low VOC paints with 50% of internally applied paints having no more than 5g/L TVOC content recognised as an innovation by GBCA to reward projects that safeguard occupant health through the reduction in internal air pollutant levels.



- Local Procurement recognised as an innovation by GBCA to reward projects that demonstrate that a significant percentage of the products and materials were produced in Australia and/or that services and skilled labour employed come from the local area surrounding the site.
- Financial Transparency recognised as an innovation by GBCA to reward projects that agree on a disclosure template that comprehensively itemises design, construction, documentation and project costs, and that partake in yearly GBCA report using anonymised data.
- Marketing excellence recognised as an innovation by GBCA to reward projects that research and provide information on the benefits of sustainability in a public and prominent way (e.g. on hoarding and within sales office).
- Design for active living by developing solutions the encourage health and social interaction and inform occupants of gym, pool and external recreation areas and associated health benefits.

APPENDIX A – GREEN STAR ANALYSIS

The following matrix details the targeted minimum ESD performance characteristics subject to further refinement during the building's design and construction stages

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SUSTAINABLE BUILDING CONSULTANTS

Green Star - Design & As Built v1.2 Pathway

PROJECT: FORBES & KISHORN ROAD, APPLECROSS **Project Number:** 18236

Rev: **Development Application Issue** **Date:** 24-Aug-18

Credit	Aim of the Credit	Code	Criteria	Points Available	5 Star Points Targeted	To Be Confirmed	Remarks
Management							
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		GSAP contractually engaged since early design stages. GSAP must deliver workshop and hold follow up meetings. Floth staff are Green Star Accredited Professionals.
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental PerformanceTargets	Credit Condition	Complies		Targets to be nominated under Design Intent / Owner Project Requirements
		2.1	Services and Maintainability Review	1	1		"Service and Maintainability Report' with coverage of commissionability, controllability, maintainability, operability and safety. (expected from ICA where appointed)
		2.2	Building Commissioning	1	1		Includes 'Commissioning Plan' (expected from ICA where appointed). Commissioning Plan includes Air Permeability Performance Testing.
		2.3	Building Systems Tuning	1	1		Includes 'Building Tuning Plan' (expected from ICA where appointed)
		2.4	Independent Commissioning Agent	1	1		Appoint ICA or FM to advise, monitor, and verify commissioning from design to tuning phases.
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		Adaptation Plan' to AS 5334:2013 required and incorporated into design.
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.	4.0	Building Information	1	1		Comprehensive operations and maintenance information is developed and made available and relevant and current building user information is developed and made available.
Commitment to Performance	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 Reporting	1	1		Building owner & tenants/strata management to commit to performance targets and measure and report on a min of 2 indicators: energy, water, indoor environment and waste. Innovation point claimable for all 4. Compliant building owner and tenants/strata management commitments required.
		5.2	End of Life Waste Performance	1	1		Building owner & tenants to commit to best practice 'make good' clauses in the lease in accordance with RICS Greening Make Good. Residential Strata Management to commit to extending life of finishes for at least 10 years. Compliant building owner and tenants/strata management commitments required.
Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	Credit Condition	Complies		Water and Energy metering and monitoring system to be in place. Common uses for energy includes anything greater than 5% of the total energy or 100kW. Also meters for anything greater than 10% of the water use.
		6.1	Monitoring Systems	1	1		
Responsible Construction Practices	To reward responsible construction practices that manage environmental impacts, enhance staff health and wellbeing and improve sustainability knowledge onsite.	7.0	Environmental Management Plan	Credit Condition	Complies		Create and implement a Construction Environmental Management Plan. Regular inspections must take place during construction.
		7.1	Formalised Environmental Management System	1	1		The system must be certified against one of the following standards: AS/NZS ISO 14001, BS 7750 or European Community's EMAS, or if a project is less than 10M auditor verification is adequate
		7.2	High Quality Staff Support	1	1		High quality staff support practices are in place to promote positive mental and physical health and site workers knowledge of sustainable practices are enhanced.
Operational Waste	To recognise projects that implement waste management plans that facilitate the re-use, upcycling, or conversion of waste into energy and stewardship of items to reduce the quantity of outgoing waste	8.1	Waste in Operations	1	1		Two options: Waste Management Plan by Qualified Auditor OR prescriptive approach inc separation of waste streams, dedicated area, access to area. 85sqm bin rooms area indicated would meet requirements subject to identification of appropriate recycling waste bin provision.
Total				**14**	**14**	**0**	
Indoor Environment Quality							
Quality of Indoor Air	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1	1		Design to comply with ASHRAE 62.1 separation distances btw pollution sources & outdoor air intakes, design for ease of maintenance & cleaning, clean ductwork. Achievable subject to compliant final mechanical design and Construction Indoor Air Quality Plan.
		9.2	Provision of Outside Air	2	1	0.6	1 /2 points for 50%/100% O/A improvement on AS1668.2:2012 for airconditoning or 2 points for natural ventilation (NV) to AS1668.2:2012. Expected to be achieved by NV for all apartments, GBCA approved TQ required to recognise partial points
		9.3	Exhaust or Elimination of Pollutants	1	1		Limit source pollution or exhaust directly to the outside, nominated pollutants include: printing equipment, cooking equipment, vehicle exhaust.
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1	1		Internal noise levels cannot exceed 5 dB(A) for airconditioned or 10 dB(A) for natural ventilation above the "satisfactory" sound levels provided in Table 1 of AS/NZS 2107:2000. May not be achieved in all apartments due to natural ventilation. Acoustic testing prior to completion.
		10.2	Reverberation	1		1	Reverberation time below max. recommended in Table 1 of AS/NZS 2108, or 50% of combined floor and ceiling area with NRC of at least 0.5. Additional acoustic treatments required foir retail, not applicable to residential.
		10.3	Enclosed Spaces	1	1		Residential - Rw55 discontinuous intertenancy and corridor walls, Ln,w+CI floors < 55, Rw30 apartment doors and acoustic testing prior to completion. Significant additional acoustic treatments and additoional commissioning testing required.

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Green Star - Design & As Built v1.2 Pathway

PROJECT: FORBES & KISHORN ROAD, APPLECROSS **Project Number:** 18236

Rev: **Development Application Issue** **Date:** 24-Aug-18

Credit	Aim of the Credit	Code	Criteria	Points Available	5 Star Points Targeted	To Be Confirmed	Remarks
Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort	Credit Condition	Complies		Electronic ballasts, Minimum CRI of 80
		11.1	General Illuminance and Glare Reduction	1	1		Retail & Commercial - Lighting levels to AS1680.2 & compliance with luminaire selection system per section 8.3.4 of AS1680 Residential - lighting design includes or permits good maintained illuminance with no exposed light sources for all resi rooms with rated colour variation not exceeding 3 MacAdam Ellipses (decorative fittings exempt). Care required in lighting design and specification
		11.2	Surface Illuminance	1			Retail & Commercial - Compliant surface illuminance values calculated per AS/NZS 1680 Appendix B. Luminaires with direct/indirect lighting components required to achieve. Residential - At least one wall in each living space, kitchen and bedrooms are provided with at least one specific wall-washing or a wall mounted fitting. Care required in lighting design and specification
		11.3	Localised control	1	1		Retail & Commercial - Occupants have ability to control lighting in their immediate environment. Achievable by DALI and tenant fitout guide. Residential - appropriate task lighting for kitchen, bathroom and service areas, and sufficient power outlets for future task lighting.
Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	Credit Condition			Requires shading or blinds to all facades as part of base building. Probable cost of blinds high, proposed to be excluded from base building for provision by tenant fitout.
		12.1	Daylight	2			2% DF for 40% of NLA for 1 point or 60% for 2 points. 1 point claimable if shading or blinds to all facades provided as part of base building - refer above
		12.2	Views	1			1 point for 60% of NLA within 8 metres of vision glazing. 1 point claimable if shading or blinds to all facades provided as part of base building - refer above.
Reduced Exposure to Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, adhesives, sealants and carpets	1	1		Adhere to VOC limits for paints, adhesives, sealants and carpets.
		13.2	Engineered wood products	1	1		All engineered wood products meet low formaldehyde limits.
Thermal Comfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	1	1		Retail & Commercial - Thermal comfort modelling verifies PMV within +/-1. Residential - average 7 star NatHERS.
		14.2	Advanced Thermal Comfort	1			Retail & Commercial - Thermal comfort modelling verifies PMV within +/-0.5 Residential - average 8 star NatHERS
Total				**17**	**10**	**1.6**	
Energy							
Greenhouse Gas Emissions	To encourage the reduction of greenhouse gas (GHG) emissions associated with the use of energy in building operations.	15.B or E	Conditional Requirement	Credit Condition	Complies		The minimum number of points to be achieved in this credit for a 5 Star target rating is 3 points, the minimum number of points for 6 Star target is 6 points.
		15.B or E	GHG emissions reduction	20	6	2	GHG emissions reductions achieved based on Section J DTS reference, can include 10 year Green Power commitment for a maximum of 50% of the points. Improved 7+ star NatHERS average required, with high eff'y HVAC, lighting and DHW design indicated points by NatHERS Pathway calculator achievable. Higher points possible via Modelled Performance Pathway and with ~30kWp PV system..
Peak Electricity Demand Reduction	To encourage the reduction of peak demand load on the electricity network infrastructure.	16.1-A	Deemed to Satisfy Pathway	1			15% peak energy demand reduction for 1 point limit
		16.1-B	Reference Building Pathway	2		2	20%/30% for 1/2 points. Based on Modelled Performance Pathway
Total				**22**	**6**	**4**	
Transport							
Sustainable Transport	To reward projects that implement design and operational measures that reduce the carbon emissions arising from occupant travel to and from the project, when compared to a benchmark building. This also promotes the health and fitness of commuters, and the increased liveability of the location.	17-A.1	Modelled Pathway	10			The points are determined by the transportation calculator.
		17-B.1	Access by Public Transport	3	3		Points are determined by the Public Transport calculator. This project achieves 3 points due to its location.
		17-B.2	Reduced Car Parking Provision	1		1	The number of carparks required is determined by the accessibility rating of the project and peak occupancy. Subject to maximum building occupancy to be determined by Certifier.
		17-B.3	Low Emission Vehicle Infrastructure	1		1	15% fuel eff. car (min 10% small car, up to 5% m/c), carshare or 5% elec car parks. Based on 177 carparks, requires min. 18 small fuel efficient vehicle parks and 9 m/c parks which may result in spatial saving, subject to client acceptance.
		17-B.4	Active Transport Facilities	1	1		Cycle facilities: residents rate varies subject to dwelling number and for visitors is 5% of dwellings. 7.5% Retail and commercial staff cycle parks, changeroom, showers and lockers required + 5% visitors. Requires 80 residential cycle parks, 8 Retail/Commercial Staff cycle parks, 11 Visitors cycle parks, 4 Staff Showers,15 Staff lockers with changing amenities with appropriate drying space. Architecure required to comply to achieve credit.
		17-B.5	Walkable Neighbourhood	1	1		8 amenities within 400m or Walkscore of at least 70. This project achieves a walkscore of 74 due to its location.
Total				**10**	**5**	**2**	

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Water							
Potable Water	To encourage building design that minimises potable water consumption in operations.	18-A.1	Potable Water - Modelled Pathway	12			Points to be verified based on a percent reduction via potable water calculator using WC (4 Star WELS), Urinal (6 Star WELS), Showers (6 lpm), Taps (2lpm), rainwater & condensate harvesting. Detailed water analysis required to confirm points.
		18-B.1	Sanitary Fixture Efficiency	1	1		Min. WELS efficiency of taps is 6 Star, urinals is 6 Star, Toilet is 5 Star, Showers is 3 Star, Clothes washing machines is 5 Star and Dishwashers is 6 Star
		18-B.2	Rainwater Reuse	1		1	Requires 10L/m2 rainwater tank. Inclusion and acceptance of <120kL rainwater tank appropriate to development subject to GBCA TQ approval.
		18-B.3	Heat Rejection	2	2		Requires no potable water use for cooling towers
		18-B.4	Landscape Irrigation	1	1		Drip irrigation with moisture sensor or no potable water use in irrigation
		18-B.5	Fire System Test Water	1	1		No water is expelled for fire water testing, or fire system includes storage and reuse of 80% of routine fire protection test water and annual maintenance draindowns. Sprinkler systems include isolation valves or shut-off points for floor-by-floor testing.
Total				**12**	**5**	**1**	
Materials							
Life Cycle Impacts	Life Cycle Assessment Model	19.A.1	Comparative Life Cycle Assessment	6			130%+ cumulative Lifecycle Analysis impact reduction required. Note: max of 7 points are available for option 19.A.
		19.A.2	Additional Reporting	4			Requires using the LCA to inform design by: additional life cycle impact reporting, material selection improvent, construction process improvements and/or LCA design review.
		19.B.1	Concrete	3	1	1	20%/40%reduction in Portland Cement content in concrete compared to reference for 1/2 points, 50% reclaimed mix water for 0.5 point, 25% manufactured sand fine aggregate or 40% crushed slag coarse aggregate for 0.5 points.
		19.B.2	Steel	1	1		5% reduction in reinforcing steel compared to reference structural design. Sructural design to comply.
		19.B.3	Building Reuse	4			Façade reuse OR structure reuse
Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Responsible Steel Maker and Fabricator	1	1		Certified steel contractor required
		20.2	Timber	1	1		At least 95% of timber is certified or from a reused source
		20.3	Cables, pipes, floors and blinds	1	1		All permanent formwork, pipes, flooring, blinds, cables meet Best Practice PVC or do not contain PVC and have an Environmental Product Declaration.
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Sustainable Products	3	3		1/2/3 points for 3/6/9% sustainable products based on manufacturer documentation. Higher points found to be cost neutral with care in final building product selections.
Construction and Demolition Waste	To reward projects that reduce construction waste going to landfill by reusing or recycling building materials	22.1	Reduction of Construction and Demolition Waste	1		1	1 point for 90% diversion OR less than 10 kg/m2 of GFA. Waste contractor must have a Compliance Verification Summary or provide a comlpiant Disclosure Statement. Waste contractor to waste tracking and reporting to comply. Subject to Waste Contractor performance
Total				**14**	**8**	**2**	
Land Use & Ecology							
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	-	Complies		There may be no critically endangered or vulnerable species, or ecological communities present on the site at the time of purchase.
		23.1	Ecological Value	3			1%/10%/20% improvement for 1 /2/3points. This is determined using the Ecological Value calculator. Points subject to detailed comparison of pre- and post-development planting
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement	-	Complies		The project site does not contain a wetland, old growth forest or any "Matters of National Significance"
		24.1	Reuse of Land	1	1		75% of the site was previously developed
		24.2	Contamination and Hazardous Materials	1	1		hazardous materials audit and stabilsation of removal in accordance with best practice guidelines of any asbestos, lead paints, PCB found in existing structures on site. Best practice remediation of site contamination present at time of purchase
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.0	Heat Island Effect Reduction	1			At least 75% of total project site area comprises building or landscaping elements that reduce impact of heat island effect. Requires >82% solar reflectance for a flat roof or green roof. eg. Colorbond "Coolmax - Whitehaven" with a SRI of 95 or Tremco Alucobond trafficable concrete roof membrane. PV area is excluded from the roof SRI calculations.
Total				**6**	**2**	**0**	
Emissions							
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Reduced Peak Discharge	1	1		Design the site so that there is increase in peak discharge based on climate change scenarios or Council flood levels guidance, typically achieved by complying with Council requirements.
		26.2	Reduced Pollution Targets	1	1		Additional points available for improved pollution reduction for TSS, Gross Pollutants, Total Nitrogen, Total Phosphorus, Total Petroleum Hydrocarbons, Free Oils. Innovation points available for improvement, typically achieved by complying with Council requirements.

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Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Properties	-	Complies		Outdoor lighting to comply with AS 4282:1997 Control of Obtrusive Effects of Outdoor Lighting
		27.1	Light Pollution to Night Sky	1	1		Upward Light Output Ratio (ULOR) no more than 5% or no more than 0.5Lux to site boundary and 0.1Lux to 4.5m into night sky. Care in external lighting and signage design to achieve.
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28.0	Legionella Impacts from Cooling Systems	1	1		No evaporative heat rejection or Constant water movement, no water stored btw 20-50deg.C & no aerosol spray (drift eliminators not acceptable). OR Legionella Plan and risk management.
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.1	Refrigerant Impacts	1			Assessed by refrigerant impact calculator which limits global warming potential and ozone depletion potential.
Total				**5**	**4**	**0**	
Innovation							
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.	30.A	Innovative Technology or Process	10			Examples of Potential Credits **(proposed innovations):** *Individual Comfort - 1 pt for providing individual comfort control in all primary spaces. *Onsite Renewable Energy - up to 2 pts for a min 10% renewable energy system. *Building Integrated Photovoltaics - 1 pt for BIPV for a min of 15% *Heat rejection - 1 pt where for reducing potable water in heat rejection system *Passive Design - 1 pt for projects that use passive water treatment systems
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.	30.B	Market Transformation				Examples of Potential Credits **(proposed innovations)** : *BSRIA Soft Landings Framework for building commissioning and tuning *Sustainable sourcing of concrete aggregates
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.	30.C	Improving on Green Star Benchmarks		3		Examples of Potential Credits (proposed innovations): ***Stormwater Pollution Targets - improved to B for 1 point or C for 2 points** ***Commissioning and Tuning - Supplementary or tenancy systems review** *Commitment to Performance - all 4 indicators *Visual Comfort - Daylight to 80% area ***Indoor Pollutants - Ultra Low VOC paints** *Greenhouse Gas Emissions - Reference Building Pathway + 5% export *Sustainable Transport - No new car parks onsite *Potable Water - <10% Discharge to sewer
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30.D	Innovation Challenge		3	1	Examples of Potential Credits **(proposed innovations):** * Carbon Neutral Buildings * Community Benefits *** Local Procurement: Demonstrate that a significant percentage of the products and materials were produced in Australia (for 1 point) and/or that services and skilled labour employed come from the local area surrounding the site (for 1 point).** * Integrating Healthy Environments * Culture, Heritage & Identity: adaptive re-use and uptake of heritage listed site features, celebrating the heritage value of the asset with signage/app. *** Marketing Excellence: Perform market research and provide information on the benefits of sustainability in a public and prominent way (eg. on hoarding and within leasing office)** * Reconcilitaion Action Plan * Market Intelligence: Occupant Satisfaction Survey *** Financial Transparency: Agree on a disclosure template that comprehensively itemises design, construction, documentation and project costs. Agree to partake in yearly GBCA report using anonymised data.** * High Performance Site Office: Demonstrate that a site shed(s) that complies with at least 75% of the requirements in the HPSO Checklist has been used for majority of siteworks. * Affordable Housing
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.	30.E	Global Sustainability			1	Examples Potential Credits **(proposed innovations)**: *Beauty and Spirit (Living Building Challenge 3.1) *Inspiration and Education (Living Building Challenge 3.1) *LEED Integrative Design Process *Green Star Performance: Green Cleaning *Green Star Performance: Procurement and Purchasing
Total				**10**	**6**	**2**	
TOTAL				**110**	**60**	**12.6**	Minimum required for 5 Star is 60 points, achievable with buffer from credits to be confirmed