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2-12 Wilkinson Street
Brunswick

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1.0 Introduction

Ark Resources has been engaged by Haven Home Safe to provide advice in relation to environmentally sustainable development outcomes from the proposed development at 2-12 Wilkinson Street, Brunswick.

The proposed mixed-use development at 2-12 Wilkinson Street, Brunswick has been designed to meet Clauses 15.01-2S (Building Design Policy) and 53.18 (WSUD Policy) of the City of Merri-bek Planning Scheme. This report demonstrates how the development meets policy objectives of Clauses 15.01-2S and 53.18 of the Planning Scheme.

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This report contains a summary of:

- Environmental objectives adopted for the development
- Sustainable design initiatives integrated into the design of the project.

Performance outcomes in this report are based on:

- Discussions and correspondence with Aaron Lo, MGS Architects.

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Architectural drawings prepared by MGS Architects set out below.

COVER PAGE	SK000	P1	27.02.2024
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LEVEL 4 FLOOR PLAN	SK205	P5	27.02.2024
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LEVEL 6 FLOOR PLAN	SK207	P5	27.02.2024
BUILDING ELEVATIONS (SOUTH)	SK401	P1	27.02.2024
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SHADOW DIAGRAM – SPRING EQUINOX	SK701	P1	27.02.2024

SHADOW DIAGRAM – SPRING EQUINOX	SK702		
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SHADOW DIAGRAM – SPRING EQUINOX	SK704		
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2.0 Site Description

The building comprises the following uses:

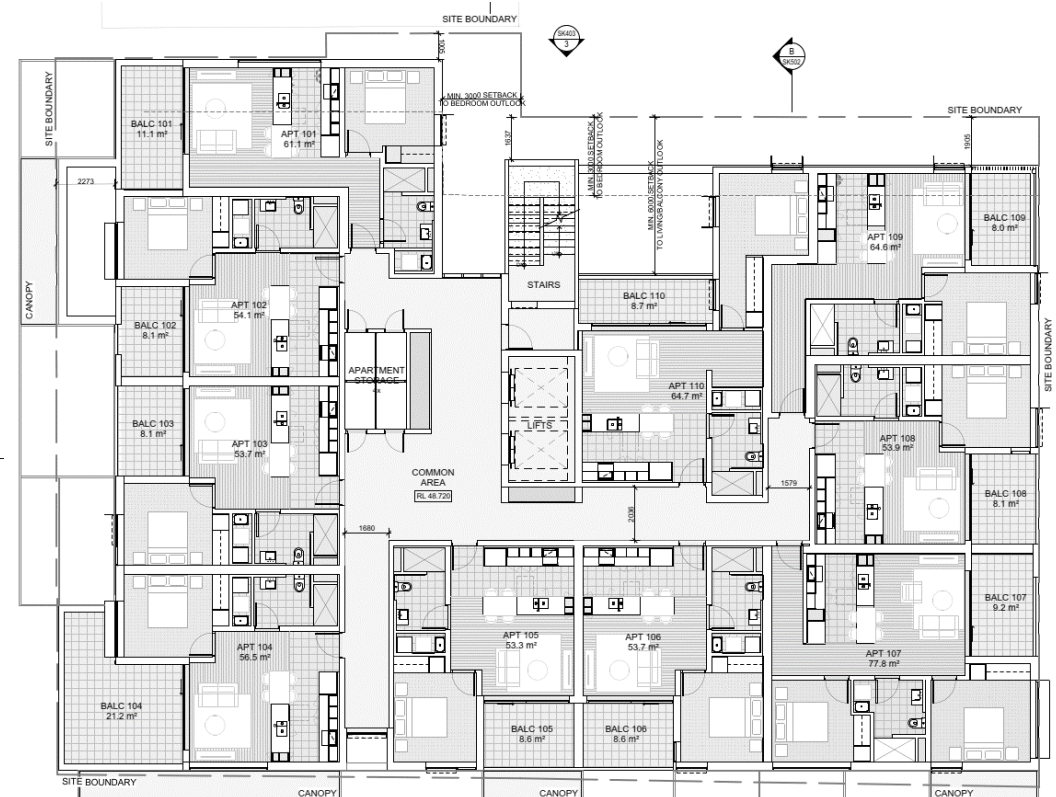
- 39 apartments / 55 bedrooms
- 94 residents (approximately)
- 4 commercial tenancies, directly connected to residences
- Located within the Merri-bek City Council
- Site area 1005m² (approximately)
- Surrounds predominantly commercial use

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A plan of level 1 of the proposed development is provided below.

An image of the site and the surrounding locale is provided on the following page.

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3.0 Key ESD Initiatives

A detailed analysis has been undertaken in order to nominate the ESD initiatives required and confirm the performance outcomes achieved. The results of this analysis are set out in the remainder of this report.

The following key sustainable design initiatives have been incorporated into this project:

<p>Energy</p> <p>Commitment to 100% Green Power</p> 	<p>Stormwater</p> <p>The development meets the Best Practice standard for stormwater quality.</p> 
<p>Water</p> <p>Rainwater harvesting system for toilet flushing</p> 	<p>Performance</p> <p>High-performance glazing and energy efficient building services, appliances and fixtures</p> 

An assessment of sustainable design outcomes of the proposed development has been undertaken with Green Star Buildings, FirstRate 5 and MUSIC benchmarking tools. The information presented in this report demonstrates that:

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<p>Green Star Buildings</p> <p>The development achieve a 5 Star Green Star Buildings performance standard</p> <p>4 star</p>	<p>NatHERS</p> <p>The project will have a development average of</p> <p>7.5 star</p>
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4.0 MUSIC Modelling

To assess the quality of stormwater runoff from the site, an analysis has been undertaken using MUSIC Modelling software.

The proposed development exceeds the pollutant load reduction targets set out in the Best Practice Environmental Management Guidelines (BPEMG)

Reduction in Total Suspended Solids (TSS) load: 90.8%	Reduction in Total Phosphorus (TP) load: 66.6%
Reduction in Total Nitrogen (TN) load: 65.4%	Reduction in Gross Pollutants (GP) load: 100%

The results indicate that the project meets the requirements of Planning Scheme Clause 58.13 as the post development stormwater peak discharge does not exceed the pre-development peak.

Refer to Appendix B for the MUSIC rating results, Appendix B.5 for rainwater harvesting and reliability results and Appendix D for the WSUD Maintenance Manual.

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A rainwater harvesting system will be installed comprising:

- Rainwater harvesting from all roofs and all terrace areas on levels 2, 3, 5, 7 roof (approx. 819m²):
- Filtration and treatment of all rainwater prior to draining into the tank
- Total storage volume of 30kL rainwater tanks
- Re-use of captured water for flushing of all toilets
- Re-use of captured water for irrigation of all podium landscaping

In addition to the harvesting and re-use of rainwater, the following features will be incorporated into the proposed design to facilitate treatment of stormwater runoff:

An Atlan Vortceptor gross pollutant trap (or equivalent primary treatment device) located near stormwater Legal Point of Discharge to capture suspended solids and litter generated onsite.

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5.0 Daylight Modelling

Daylight modelling has been undertaken to determine Internal Daylight Levels to bedrooms and living/ kitchen areas on Ground Floor, Level 1 & 2, as these have the greatest daylight constraints.

When the results of the daylight modelling from the lower levels are extrapolated to the upper levels with improved daylight access, it is confirmed that:

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The daylight modelling confirms that:

Kitchen/living areas meet the Best Practice standard

87%

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Bedrooms meet the Best Practice standard

100%

Results of daylight assessment are based on the BESS standard for daylight modelling as follows:

Residential developments:

- At least 80% of dwellings achieve a daylight factor greater than 1% to 90% of the floor area of each living area, including kitchens;
- At least 80% of dwellings achieve a daylight factor greater than 0.5% to 90% of the floor area in all bedrooms.

The modelling results and software input assumptions are provided in Appendix H.

6.0 NatHERS Energy Ratings

FirstRate5 Version 5.3.2b (3.21) energy ratings have been undertaken for a representative sample of the apartments.

The development achieves a 7 star average NatHERS rating which exceeds the Councils 'best practice' standard of 6.5 stars and represents a high standard of thermal efficiency.

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NatHERS Rating

The project will have a development average of:

7.5
star

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Heating Load

The average heating load for the development will be

65.0
MJ/m²

Cooling Load

The maximum cooling load for the development will be

18.0
MJ/m²

Please refer to Appendix C for details of energy ratings and building construction assumptions.

The energy ratings set out above indicate that the development will exceed the standard required by the National Construction Code 2019 in relation to residential sustainability.

7.0 Green Star Building

The Green Star Buildings (v1 Rev B) tool has been used as a benchmarking framework for the proposed scheme and demonstrates that the development has the preliminary design potential to achieve a 4 Star standard.

A detailed Green Star assessment has been undertaken to confirm the credits achievable by the proposed scheme.

The initiatives which contribute to the 5 Star Green Star Buildings rating are detailed in Appendix A below.

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Green Star Building Rating

4 star

Total Points Targeted

21 pts

Note that a minimum of 15 points must be achieved for a 4 star Green Star Buildings rating to be achieved. A points margin of 10-20% has been incorporated into the pathway presented in this report as a contingency to allow for the inevitable change to the pathway inclusive of attrition which typically occurs during the detailed design and construction phases. This does not imply that the applicant commits to delivering more than the points required for the rating targeted.

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Summary of Green Star Building credits targeted.

Credit	Target	Points	
1	Industry Development	Credit Achievement	1
2	Responsible Construction	Credit Achievement	1
3	Verification and Handover	Minimum Expectation	
4	Operational Waste	Minimum Expectation	
5	Responsible Procurement		
6	Responsible Structure		
7	Responsible Envelope		
8	Responsible Systems		
9	Responsible Finishes	Credit Achievement	1
10	Clean Air	Minimum Expectation	
11	Light Quality	Minimum Expectation	
12	Acoustic Comfort	Minimum Expectation	
13	Exposure to Toxins	Minimum Expectation	
14	Amenity and Comfort		
15	Connection to Nature		
16	Climate Change Resilience	Credit Achievement	1
17	Operations Resilience		
18	Community Resilience		
19	Heat Resilience	Credit Achievement	1
20	Grid Resilience		
21	Upfront Carbon Emissions	Minimum Expectation	
22	Energy Use	Credit Achievement	3

23	Energy Source	Exceptional Performance	6
24	Other Carbon Emissions		
25	Water Use	Minimum Expectation	
26	Life Cycle Impacts		
27	Movement and Place	Credit Achievement	3
28	Enjoyable Places		
29	Contribution to Place		
30	Culture, Heritage and Identity		
31	Inclusive Construction Practices	Minimum Expectation	
32	Indigenous Inclusion		
33	Procurement and Workforce Inclusion		
34	Design for Inclusion		
35	Impacts to Nature	Credit Achievement	2
36	Biodiversity Enhancement		
37	Nature Connectivity		
38	Nature Stewardship		
39	Waterway Protection	Credit Achievement	2
40	Market Transformation		
41	Leadership Challenges		

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Refer to Appendix A for details of credit requirements

8.0 Conclusion

This report provides details of a comprehensive package of sustainable design features which will be integrated into the design and specification of the proposed mixed-use development in order to improve environmental outcomes during occupation.

In terms of performance outcomes, the analysis presented in this report demonstrates that the proposed development will:

- attain a 4 star Green Star standard based on the Buildings rating tool (V1 Rev B);
- Achieve a 7.0 average star rating for the apartments; and
- attain the Best Practice standard for urban stormwater quality

Accordingly, the sustainable design outcomes from the proposed development are considered to be consistent with the objectives of Clauses 15.01-2S (Building Design Policy) and 53.18 (WSUD Policy) of the City of Merri-bek Planning Scheme. This report demonstrates how the development meets policy objectives of Clauses 15.01-2S and 53.18 of the Planning Scheme.

Please note that this analysis is based on the best information currently available in relation to the technical and commercial feasibility of the initiatives proposed. Further investigation will be undertaken during design development which may result in change to the package of initiatives specified in order to meet the 4 star Green Star Buildings

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Green Star

The combination of design features and services initiatives meets all the standards for a Green Star Building Rating of:

4 star

NatHERS Energy Rating

The development will achieve an average NatHERS rating of:

7.0

star

Best Practice

The development meets the Best Practice standard for stormwater Quality



Appendix A. Green Star Building Pathway

The key design elements and processes which underpin the preliminary Green Star rating are summarised in the table below. The design attributes will be incorporated into the design in accordance with the technical criteria for each credit set out in the Green Star Buildings Technical Manual (v1 Revision B, 10 December 2021).

Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
<p>1 Industry Development</p> <p>The development facilitates industry transformation through partnership, collaboration, and data sharing</p>	<p>The building owner or developer appoints a Green Star Accredited Professional (GSAP).</p> <p>The building owner or developer discloses the cost of sustainable building practices to the GBCA. The project team must complete, and include in the submission, the Green Star Financial Transparency disclosure template. The template requires and enables the project team to submit the cost of sustainable building practices of the project including design, construction, and documentation to the GBCA.</p> <p>The building owner or developer markets the building's sustainability achievements. The project team must:</p> <ul style="list-style-type: none"> – Provide information from the project's marketing team must answer the questions in the submission form for a Green Star Case Study. The case study seeks information on the sustainability initiatives that the building targeted to enable it being featured on the GBCA's website – Detail how the building will detail its sustainability achievements to its stakeholders. The stakeholders are defined as the typical building occupants and visitors. <p>The building owner or developer appoints a Green Star Accredited Professional (GSAP).</p>	<p>1</p>	<p>Strategy Brief Concept Design Tender Construction Handover Use</p>
<p>2 Responsible Construction</p> <p>The builder's construction practices reduce impacts and promote opportunities for improved environmental and social outcomes</p>	<p>The builder must have an environmental management system (large builders will need to be ISO14001 accredited).</p> <p>The site must have a project specific Environmental Management Plan (EMP). The EMP must be developed to cover the scope of construction activities to assist the head contractor and its service providers to manage environmental performance conditions and impacts arising from demolition, excavation, and construction. It must be implemented from the start of construction and include all works within the project scope.</p> <p>80% of Construction and demolition waste must be recycled.</p> <p>The builder must have an environmental management system (large builders will need to be ISO14001 accredited).</p> <p>Sustainability training is provided to construction workers. The head contractor must provide the following training:</p>	<p>MINIMUM EXPECTATION</p>	<p>Tender Construction</p>

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Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
	<ul style="list-style-type: none"> - Information on the sustainable building certification(s) sought, including: <ul style="list-style-type: none"> · the sustainability attributes of the building and their benefits · the value of certification · the role site worker(s) play in delivering a sustainable building 		
	90% of construction and demolition waste is diverted from landfill, and waste contractors and facilities comply with the Green Star Construction and Demolition Waste Reporting Criteria	1	
<p>3 Verification and Handover</p> <p>The building has been optimised and handed over to deliver a high level of performance in operation</p>	<p>The building is set up for optimum ongoing management due to its appropriate metering and monitoring systems.</p> <p>The building must have accessible energy and water metering for all common uses, major uses, and major sources.</p> <p>The meters must be connected to a monitoring system capable of capturing and processing the data produced by the meters. The monitoring system must accurately and clearly present the metered data and include reports on consumption trends for the automatic monitoring system.</p> <hr/> <p>The building has set environmental performance targets, designed and tested for airtightness, been commissioned, and will be tuned.</p> <p>The project team must perform the following:</p> <ul style="list-style-type: none"> - Prior to construction: <ul style="list-style-type: none"> · Set environmental performance targets · Perform a services and maintainability review · Design for airtightness - During construction and practical completion: <ul style="list-style-type: none"> · Commission the building · Engage building tuning service provider · Test for airtightness - After practical completion: <ul style="list-style-type: none"> · Tune the building over the next 12 months <hr/> <p>The project team create and deliver operations and maintenance information to the facilities management team at the time of handover. Information is available to building users on how to best use the building.</p> <p>The project team must provide operations and maintenance information for all nominated building systems to the building owner (or designated representative). This means:</p> <ul style="list-style-type: none"> - Appropriate content for all nominated building systems has been developed and provided 	MINIMUM EXPECTATION	<p>Design</p> <p>Tender</p> <p>Construction</p> <p>Handover</p> <p>Use</p>

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Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
	<ul style="list-style-type: none"> The appropriate user group has access to the information they require to deliver best practice environmental outcomes Guidance on keeping information up to date is provided to the facilities management team in these documents 		
<p>4 Operational Waste</p> <p>Operational waste can be separated and recovered in a safe and efficient manner</p> <p>The building must have appropriate spaces for waste management and an appropriately sized loading dock</p>	<p>The building is designed for the collection of separate waste streams.</p> <p>The building must provide bins or storage containers to building occupants to enable them to separate their waste. These bins must be labelled and easy to access, and evenly distributed throughout the building. They must also allow for separating the following as a minimum:</p> <ul style="list-style-type: none"> General waste going to landfill Recycling streams to be collected by the building's waste collection service, including: <ul style="list-style-type: none"> paper and cardboard glass plastic One additional waste stream identified by the project team. This may include collecting any of the following waste types: <ul style="list-style-type: none"> organics, e-waste, batteries etc. <p>The building provides a dedicated and adequately sized waste storage area.</p> <p>A dedicated area, or areas, for the storage and collection of the applicable waste streams must be provided. The storage area must be sized to accommodate all bins or containers, for all applicable waste streams, for at least one collection cycle.</p> <p>The building ensures safe and efficient access to waste storage areas for both occupants and waste collection contractors.</p> <p>A waste specialist and/or contractor must sign-off on the designs to confirm they are adequately sized and located for the safe and convenient storage and collection of the waste streams identified.</p>	ADVERTISED PLAN MINIMUM EXPECTATION	Design Handover Use
<p>9 Responsible Finishes</p> <p>The building's internal finishes are comprised of responsibly manufactured products</p>	<p>40% of all internal building finishes (by cost) meet a Responsible Products Value of at least 7.</p> <p>Internal finishes include flooring, plasterboard, paints, ceilings, partitions, doors, internal windows or similar. Joinery used as part of a wall finish may be counted, e.g. wall panelling or fixed shelving/cupboards that make up a partition. Sealants and adhesives used for finishes are also included.</p> <p>Loose furniture is not included.</p>	1	Design Tender Construction
<p>10 Clean Air</p> <p>Pollutants entering the building are minimised, and a high level of fresh air is provided to</p>	<p>Non-residential building ventilation systems must be designed to comply with ASHRAE Standard 62.1:2013 or AS 1668:2012 (whichever is greater) regarding minimum separation distances between pollution sources and outdoor air intakes.</p> <p>All new and existing ductwork that serves the building must be cleaned prior to occupation in accordance with a recognised Standard.</p>	MINIMUM EXPECTATION	Design Tender Construction Handover

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Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
ensure levels of indoor pollutants are maintained at acceptable levels	<p>The building must be provided with at an adequate amount of outside air.</p> <p>The regularly occupied areas must be provided with good access to outdoor air, appropriate for the activities and conditions by using one of the following options:</p> <p>Where ventilation is by mechanical means, the building must provide outdoor air as per AS1668.2:2012 for the default occupancy.</p> <p>Where ventilation is by natural means, the building must meet natural ventilation requirements as per AS1668.4:2012. Where active heating or cooling is provided, a dedicated and controlled outside air path must be constructed and commissioned at a rate of at least 2.5L/s per bedroom and living space, with a minimum of 5L/s per unit. Outside air must be provided to each space that is heated or cooled.</p>		Use
	<p>Point source pollutants must be exhausted directly outside (printers, kitchens).</p>		

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Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
<p>11 Light Quality</p> <p>The building provides good daylight and its lighting is of high quality</p>	<p>Lighting within the building meets minimum comfort requirements.</p> <p>Lighting within the building must meet the following requirements:</p> <ul style="list-style-type: none"> - All LED lighting installed has no observable effect as per the standard IEEE 1789-2015 - Light sources must have a minimum Colour Rendering Index (CRI) 85 or higher - Light sources must meet best practice illuminance levels for each task within each space type with a maintained illuminance that meets the levels recommended in AS/NZS 1680.1:2006 - The maintained Illuminance values must achieve a uniformity of no less than that specified in Table 3.2 of AS/NZS 1680.1:2006, with a maintenance factor method as defined in AS/NZS 1680.4 - All light sources must have a maximum of 3 MacAdam Ellipses deviation. <p>Good lighting levels suitable for the typical tasks in each space are available.</p> <p>The building provides adequate levels of daylight.</p> <ul style="list-style-type: none"> - Ensures regularly occupied areas are in reasonable proximity to glazed façades, windows, or skylights - Maximises daylight to spaces that prioritise learning, healing, and living: <ul style="list-style-type: none"> · For apartments, how in 95% of all apartments, the living rooms and all bedrooms have access to a view and daylight. 	MINIMUM EXPECTATION	<p>Concept Design Tender</p>
<p>12 Acoustic Comfort</p> <p>The building provides acoustic comfort for building occupants</p>	<p>Internal noise levels from services and the outside is limited through an acoustic comfort strategy.</p> <p>The Acoustic Comfort Strategy is to include:</p> <ul style="list-style-type: none"> - A summary of the Standards, legislation, guidelines, and other requirements that apply to the project - The proposed performance metrics for each of the Acoustic Comfort criteria relevant to the different uses within the building and whether this exceeds minimum legislative or best practice guidelines - Description of how the design solution is intended to achieve the proposed performance metrics 	MINIMUM EXPECTATION	<p>Design Tender Construction Handover</p>

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Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
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13 Exposure to Toxins

The building's occupants are not directly exposed to toxins in the spaces they spend time in

The building's paints adhesives, sealants, and carpets are low in TVOC or non-toxic. At least 95% of internally applied paints, adhesives, sealants (by volume) and carpets (by area) must meet stipulated 'Total Volatile Organic Compounds (TVOC) Limits' below.

Paints, Adhesives and Sealants

Product category	Max. Total Volatile Organic Compounds (TVOC) content in grams per litre (g/L) of ready to use product
General purpose adhesives and sealants	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes, and wood stains	75
Primers, sealers, and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

Carpets

Compliance option	Test protocol	Limit
	ASTM D5116 - Total VOC limit*	limit* 0.5mg/m ² per hour
ASTM D5116	ASTM D5116 - 4-PC (4-Phenylcyclohexene) *	0.05mg/m ² per hour
ISO 16000 / EN 13419	ISO 16000 / EN 13419 - TVOC at three days	0.5 mg/m ² per hour
ISO 10580 / ISO/TC 219 (Document N238)	ISO 10580 / ISO/TC 219 (Document N238) - TVOC at 24 hours	0.5mg/m ² per hour

The building's engineered wood products are low in TVOC or non-toxic. Either no new engineered wood products are used in the building, or at least 95% (by area) of all engineered wood products meet specified formaldehyde emission limits, as per the following:

Test protocol	Emissions Limit / Unit of Measurement
ASTM D5116 (applicable to high pressure laminates and compact laminates)	≤0.1 mg/m ³ hr
ISO 16000 part 9, 10 and 11 (also known as EN 13419), applicable to high pressure laminates and compact laminates	≤0.1 mg/m ³ hr (at 3 days)
ASTM D6007	≤0.12mg/m ³ **

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MINIMUM EXPECTATION

Design
Tender
Construction
Handover

Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage																		
	<table border="1"> <thead> <tr> <th data-bbox="495 209 891 248">Test protocol</th> <th data-bbox="913 209 1059 248">Emissions Limit / Unit of Measurement</th> </tr> </thead> <tbody> <tr> <td data-bbox="495 256 891 304">AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood</td> <td data-bbox="913 256 1059 304">≤1mg/L</td> </tr> <tr> <td data-bbox="495 312 891 360">AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16</td> <td data-bbox="913 312 1059 360">≤1.5 mg/L</td> </tr> <tr> <td data-bbox="495 368 891 416">AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16</td> <td data-bbox="913 368 1059 416">≤1mg/L</td> </tr> <tr> <td data-bbox="495 424 891 456">AS/NZS 4357.4 - Laminated Veneer Lumber (LVL)</td> <td data-bbox="913 424 1059 456">≤1mg/L</td> </tr> <tr> <td data-bbox="495 464 891 512">Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL</td> <td data-bbox="913 464 1059 512">≤1mg/L</td> </tr> <tr> <td data-bbox="495 520 891 568">JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460</td> <td data-bbox="913 520 1059 568">≤1mg/L</td> </tr> <tr> <td data-bbox="495 576 891 608">JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460</td> <td data-bbox="913 576 1059 608">≤1mg/L</td> </tr> <tr> <td data-bbox="495 616 891 663">JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates)</td> <td data-bbox="913 616 1059 663">≤0.1 mg/m³hr*</td> </tr> </tbody> </table> <p data-bbox="1249 488 1615 600" style="text-align: center; color: red; font-weight: bold; font-size: 24px;">ADVERTISED PLAN</p> <p data-bbox="495 679 1697 775">Occupants are not exposed to banned or highly toxic materials in the building. A comprehensive hazardous materials survey must be carried out on any existing buildings or structures on the project site, in accordance with the relevant Environmental and Work Health and Safety (WHS) legislation.</p>	Test protocol	Emissions Limit / Unit of Measurement	AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤1mg/L	AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1.5 mg/L	AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤1mg/L	AS/NZS 4357.4 - Laminated Veneer Lumber (LVL)	≤1mg/L	Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL	≤1mg/L	JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	≤1mg/L	JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	≤1mg/L	JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates)	≤0.1 mg/m ³ hr*		
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JIS A1901 (not applicable to Plywood, applicable to high pressure laminates and compact laminates)	≤0.1 mg/m ³ hr*																				
<p data-bbox="85 807 338 871">16 Climate Change Resilience</p> <p data-bbox="85 895 434 1015">The building has been built to respond to the direct and indirect impacts of climate change</p>	<p data-bbox="495 799 1697 855">The project team completes the climate change pre-screening checklist. The project team communicates the building's exposure to climate change risks to the applicant</p> <p data-bbox="495 1023 1697 1078">Climate Change Risk & Adaptation assessment undertaken during early stage aligned with AS5334 under RCP 8.5 for 2050 & 2080.</p>	<p data-bbox="1697 743 2235 1015" style="border: 2px solid red; padding: 5px; color: red; font-weight: bold;">This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright</p>	<p data-bbox="1951 799 2051 927" style="text-align: center;">Strategy Brief Concept Design</p>																		
<p data-bbox="85 1110 353 1142">19 Heat Resilience</p> <p data-bbox="85 1158 456 1222">The building reduces its impact on heat island effect</p>	<p data-bbox="495 1102 1783 1158">At least 75% of the whole site area comprises of one or a combination of strategies that reduce the heat island effect.</p> <p data-bbox="495 1166 1211 1198">The strategies that can be used to reduce the heat island are:</p> <ul style="list-style-type: none"> <li data-bbox="495 1206 640 1238">- Vegetation <ul style="list-style-type: none"> <li data-bbox="539 1246 719 1278">- Green roofs <li data-bbox="539 1286 1379 1318">- Roofing materials, including shading structures, having the following: <ul style="list-style-type: none"> <li data-bbox="629 1326 1312 1358">· For roof pitched <15°- a three-year SRI of minimum 64 <li data-bbox="584 1366 1200 1398">For roof pitched >15°- a three-year SRI of minimum 34 <li data-bbox="539 1406 1760 1437">- Unshaded hard-scaping elements with a three-year SRI of minimum 34 or an initial SRI of minimum 39 	<p data-bbox="1861 1102 1895 1126" style="text-align: center;">1</p>	<p data-bbox="1951 1102 2107 1206">Design Tender Construction</p>																		

Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
	<ul style="list-style-type: none"> – Hardscaping elements shaded by overhanging vegetation 		
<p>21 Upfront Carbon Emissions</p> <p>The building's upfront carbon emissions from materials and products have been reduced and offset</p>	<p>The building's upfront carbon emissions are at least 10% less than those of a reference building, calculated using the Upfront Carbon Emissions calculator.</p> <p style="text-align: center;">ADVERTISED PLAN</p>	MINIMUM EXPECTATION	<p>Strategy</p> <p>Brief</p> <p>Concept</p> <p>Design</p>
	<p>The building's energy use is at least 20% less than a reference building, calculated using the Upfront Carbon Emissions calculator.</p>	3	
	<p>Where an existing building less than 30 years old has been fully or partly demolished for construction, an embodied carbon calculation must be done for the demolished portion and these emissions offset.</p> <p>Where the existing building is between 30 to 50 years old, the contribution must be calculated and discounted at 10% for every two additional years past year 30.</p>		
<p>22 Energy Use</p> <p>(Residential Pathway)</p> <p>The building has low energy consumption</p>	<p>The building has a weighted-area average of NatHERS 7.5 stars</p> <p>The building meets at least NatHERS 5 stars for each sole-occupancy unit</p> <p>The building addresses domestic hot water demand</p> <p>Where a pool exists, it has a pool cover</p>	MINIMUM EXPECTATION	<p>Brief</p> <p>Concept</p> <p>Design</p> <p>Tender</p>
	<p>The building has a weighted-area average of NatHERS 7.5 Stars and at least NatHERS 5.5 Stars for each sole-occupancy unit</p> <p>The building addresses four out of nine following building services energy uses (to be determined during DD):</p> <ul style="list-style-type: none"> – Domestic Hot Water – Domestic Hot Water Generation – Heating and Cooling of Sole Occupancy Units – Clothes Drying – Ceiling Fans – Car Parking – Vertical Transportation – Lift Lobbies and Corridors 	3	

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Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
	– On-site solar PV		
23 Energy Source The building’s energy comes from renewables	The building provides a Zero Carbon Action Plan. The Zero Carbon Action Plan must include a target date by when the building is expected to operate as fossil fuel free. The Zero Carbon Action Plan must cover all energy consumption, procurement, and generation and cannot rely on procuring renewable fuels as its only solution. It must also include infrastructure provided for tenants or future occupants such as gas installations for cooking. 100% of the building’s electricity comes from renewable electricity 100% of the building’s energy comes from renewables	MINIMUM EXPECTATION	Brief Concept Design Tender
25 Water Use (Residential – Class 2 or 3) The building has low water use	The building installs efficient water fixtures: – Taps 5 star – Toilets 4 star – Urinals 5 star – Showers 3 star (<= 7.5 l/m) – Dishwashers 5 star – Washing machines 4 star	MINIMUM EXPECTATION	Design Tender Construction Use
27 Movement and Place The building’s design and location encourage occupants and visitors to use active, low carbon, and public transport options instead of private vehicles	There are showers, lockers, and change rooms in the building The facilities are accessible, inclusive, and located in a safe and protected space The building’s access prioritises cycling and includes bicycle parking facilities – 45 secure bicycle spaces – Cycle maintenance rack and foot-pump – changing area with benching & ironing facilities Clear, safe and inclusive access to cyclist facilities via 2 lifts. 2-way ramp also provided (non-dedicated) – gradients of 1:10 or greater to incorporate minimum slip resistance classification of P5 in accordance with AS 4586. Sustainable Transport Plan to be prepared and implemented.	MINIMUM EXPECTATION	Strategy Brief Concept Design Tender Construction

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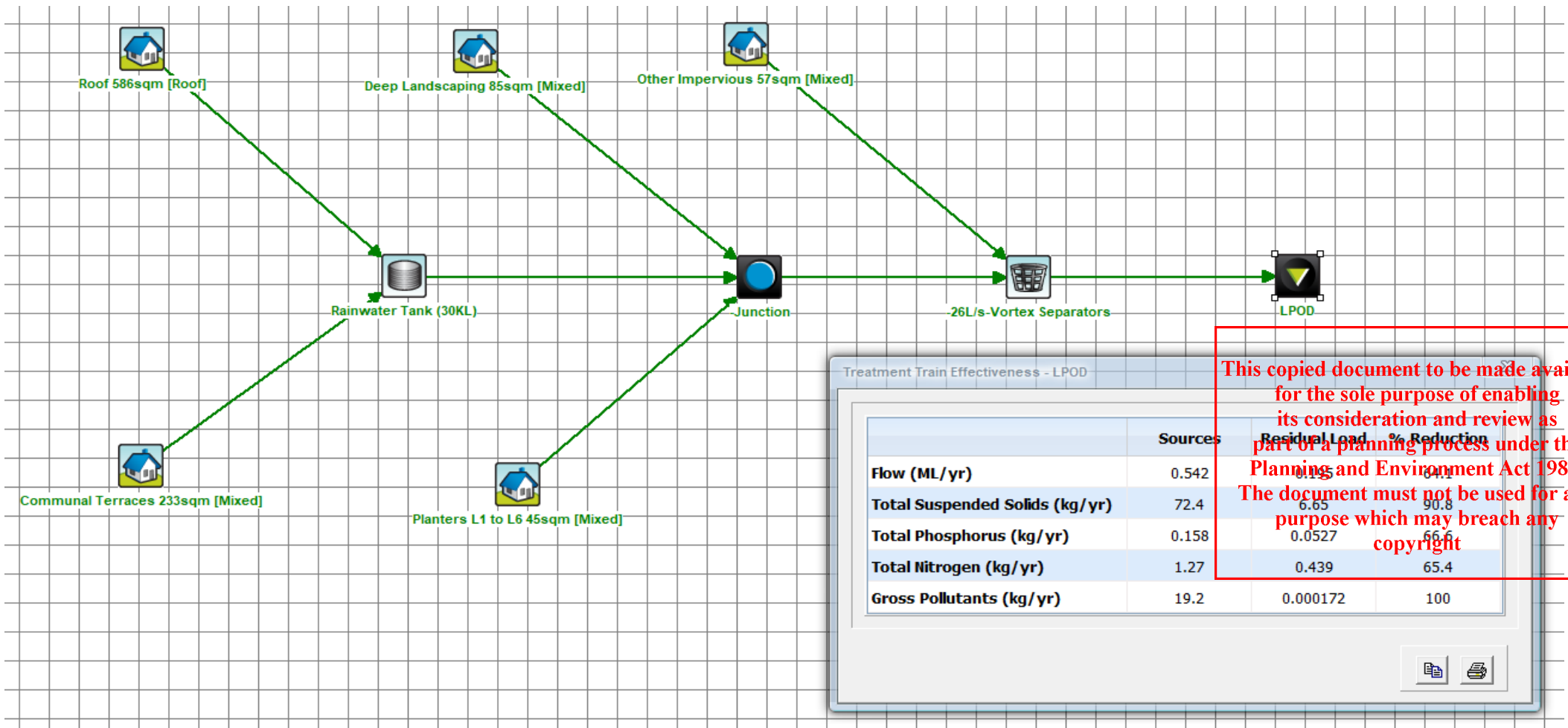
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Green Star Credit Project Outcomes	Credit outcomes	Target	Project Stage
	Transport options that reduce the need for private fossil fuel powered vehicles are prioritised.		
	Walkability encouraged via access to at least 10 amenities across 5 categories – Walkscore = 98		
31 Inclusive Construction Practices The builder's construction practices promote diversity and reduces physical and mental health impacts	There are provisions for providing gender appropriate facilities and personal protective equipment The head contractor also installs policies on-site to increase awareness and reduces instances of discrimination, racism, and bullying <div style="text-align: center; color: red; font-weight: bold; font-size: 1.2em;"> ADVERTISED PLAN </div>	MINIMUM EXPECTATION	Strategy Brief Tender Construction
35 Impacts to Nature Ecological value is conserved and protected	The building was not built on, or significantly impacted, a site with a high ecological value The building's light pollution has been minimised. All outdoor lighting on the project complies with AS/NZS4282:2019 Control of the obtrusive effects of outdoor lighting. There is ongoing monitoring, reporting, and management of the site's wetland ecosystem The project team must demonstrate how they have attempted to understand their site's historical and current ecological context by documenting the site's current ecological values by type and biomass. This includes terrestrial and aquatic ecological values, geologic features, and soils (including interaction with living things). When determining biodiversity value, the project must reference local, regional, state, and national priorities and strategies. If deemed necessary by an Ecologist, at least 50% of existing site with high biodiversity value is retained.	MINIMUM EXPECTATION	Strategy Brief Concept Design
39 Waterway Protection Local waterways are protected, and the impacts of flooding and drought are reduced	The project demonstrates a reduction in average annual stormwater discharge (ML/yr) of 40% across the whole site (Refer to Appendix B.4 for discharge rates). Specified pollution reduction targets are met (Refer to Section 4.0 and Appendix B for MUSIC modelling results and assumptions)	2	Concept Design Construction Handover
41 Leadership Challenges			
Total Green Star Points		21	
Green Star Rating		4 Star	

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Appendix B. MUSIC Modelling

B.1 MUSIC Schematic

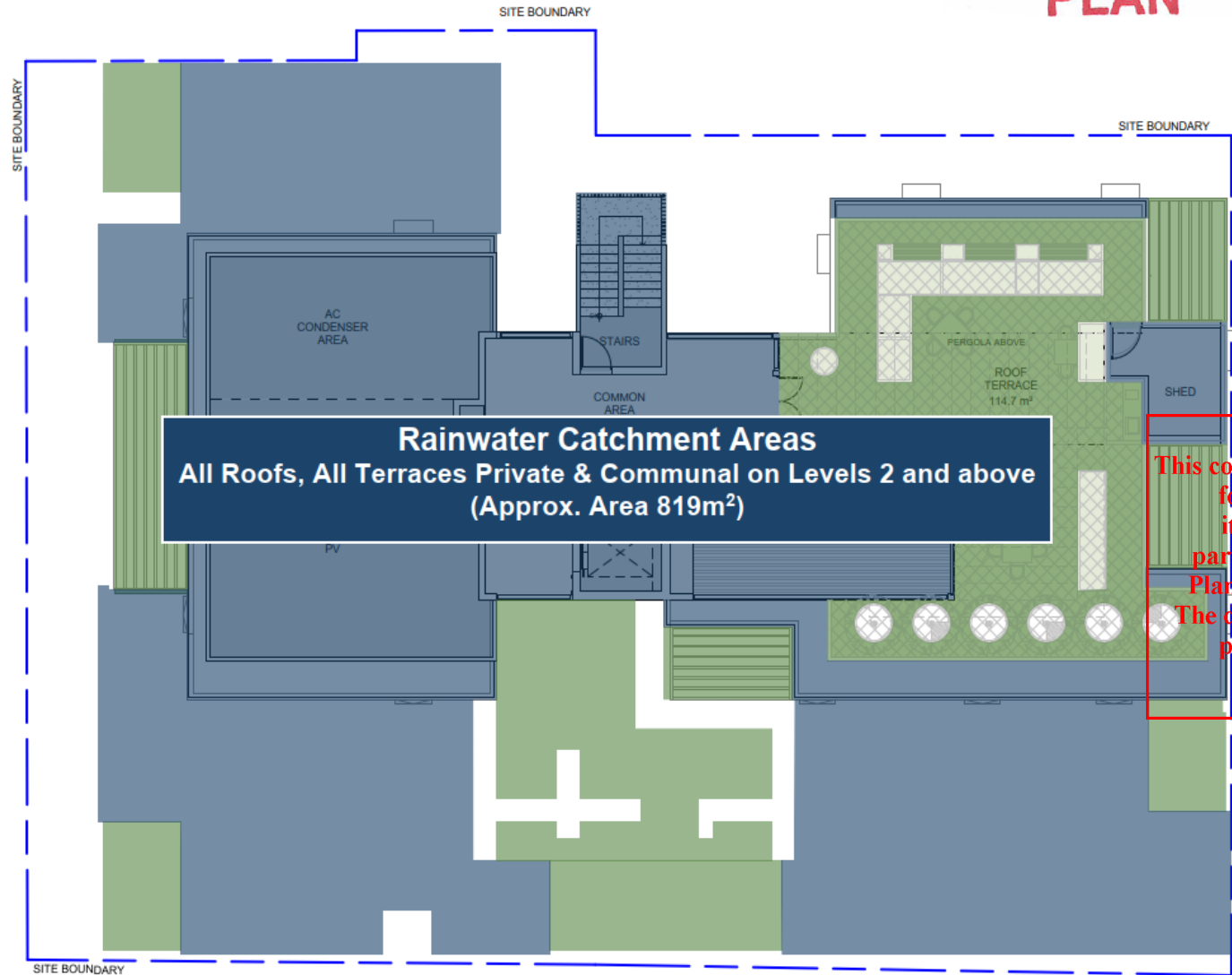


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B.2 Rainwater Catchment Areas

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PLAN**



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B.3 MUSIC Modelling Assumptions and Inputs

Area Name	Area [m ²]
Total Areas to Rainwater Tank	819
All roofs Level 1, Level 3 & Roof	586
Terraces - Levels 2, 3, 5 & 6	233
Pervious Landscape Areas	129
Landscaping/Planters over structure	45
Planting in terra firma	85
Remaining Area	57
Total Site Area	1,005

Treatment Devices Features	
Rainwater Tank	1 x 30kL
Est. daily water demand for Toilet Flushing (All toilets)	1.10 kL/day
Est. annual demand for irrigation (129m ²)	49.9 kL/yr
**Primary Treatment System 1 (Gross Pollutant Trap)	Atlan Vortceptor 26L/s (or equivalent)

NOTES:

****Nutrient reduction (Phosphorous and Nitrogen) not attributed to GPT as per Melbourne Water MUSIC guidelines.**

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Rainfall data	
Rainfall Range & Station Name	C - Melbourne City (650-750mm)
10 Year Period	C - 1952-1961
Mean annual rainfall	C - 708mm
Evapotranspiration	C - 995
Time step	6 minutes
Estimation method	Stochastically generated

Soil properties - Melbourne	
Soil store capacity	120mm
Field capacity	50mm

GPT Pollutant Removal Rates (Atlan Vortceptor)	
Total Suspended Solids	70%
Total Nitrogen	0%
Total Phosphorous	0%
Gross Pollutants	98%
Validation report	CRC for Catchment Hydrology

B.4 MUSIC Results

Pollutant	MUSIC Model Results	Green Star Building Targets (Credit Achievement)	Melbourne Water Targets
Reduction in Stormwater Discharge	64.1%	40.0%	-
Reduction in Total Suspended Solids (TSS)	90.8%	85.0%	80.0%
Reduction in Total Phosphorus (TP)	66.6%	65.0%	45.0%
Reduction in Total Nitrogen (TN)	65.4%	45.0%	45.0%
Reduction in Total Gross Pollutants	100.0%	90.0%	70.0%
Compliance with Project Targets		YES	YES

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B.5 Rainwater Harvesting and Tank Reliability

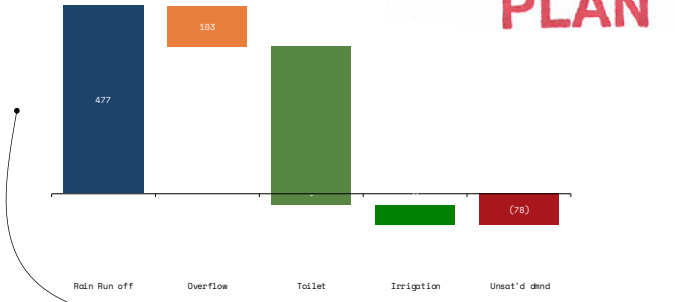
Inputs

PPL	55
Flush/Person/Day	5
Litres/Flush	4
Total Daily usage (litres)	1100
Roof area (m ²)	819
Collection Evaporation	5%
Tank Capacity (litres)	30,000
Irrigation Area (m ²)	129
T'off if Total Rain (mm) in the last	10
	5 days

Irrigation Schedule

l /m2	S	M	T	W	Th	Fr	S
Jan	y						
Feb	y						
Mar	y						
Apr	y						
May		y					
Jun			y				
Jul				y			
Aug					y		
Sep						y	
Oct							y
Nov							
Dec							

System components (kls per year)



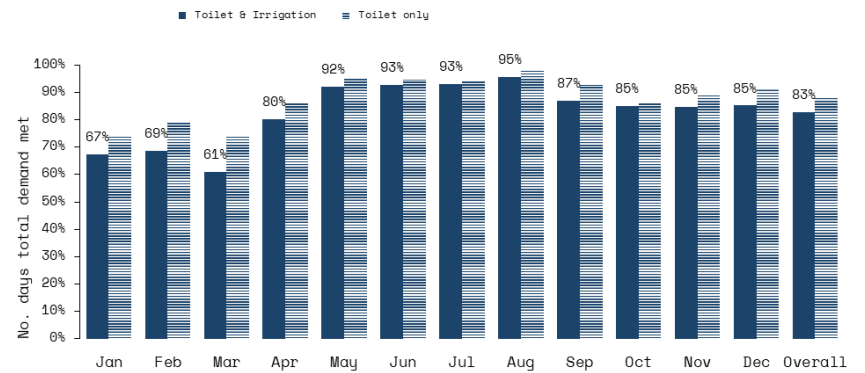
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System components (kls per year) based on 12 years of actual historical daily rainfall (2009 - 2020)

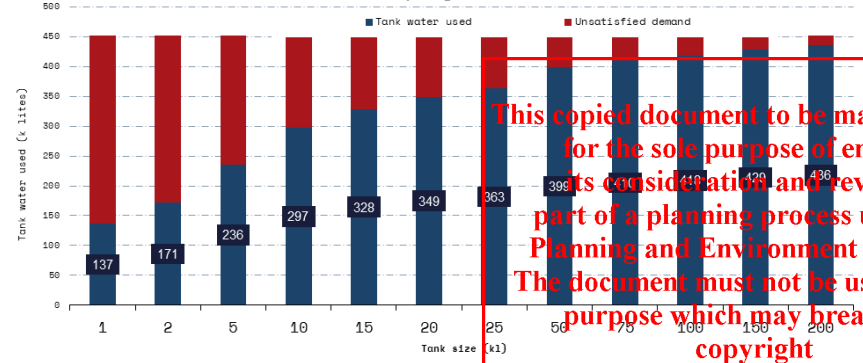
12 years of Averages (2009 - 2020)													Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rain Run off	32	33	29	50	40	41	37	42	40	37	52	44	477
Overflow	(5)	(7)	(5)	(3)	(7)	(9)	(3)	(6)	(7)	(6)	(6)	(8)	(23)
Rain Water saved	27	26	24	38	33	33	33	35	33	28	36	27	374
Toilet	(4)	(3)	(4)	(3)	(4)	(3)	(4)	(4)	(3)	(4)	(3)	(4)	(42)
Shower/Supplies below Irrigation	(7)	(5)	(10)	5	(4)	(6)	(4)	1	0	(6)	3	(7)	(28)
Irrigation	(8)	(8)	(9)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(92)
Unsatisfied Demand	(16)	(13)	(19)	3	(2)	(2)	(3)	(4)	(2)	(8)	(0)	(14)	(78)

Actual Years													Total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Rain Run off	390	607	602	490	528	369	379	525	486	435	325	593	5,728
Overflow	(63)	(208)	(23)	(5)	(28)	(3)	(6)	(26)	(22)	(9)	(2)	(79)	(6,242)
Rain Water saved	327	399	410	394	399	338	363	408	384	344	304	414	4,486
Toilet	(82)	(82)	(82)	(83)	(82)	(82)	(82)	(83)	(82)	(82)	(82)	(80)	(8,219)
Shower/Supplies below Irrigation	(74)	(2)	8	(8)	(2)	(64)	(38)	6	(8)	(57)	(97)	14	(333)
Irrigation	(5)	(5)	(6)	(9)	(8)	(52)	(50)	(8)	(8)	(54)	(62)	(82)	(599)
Unsatisfied Demand	(29)	(47)	(3)	(57)	(50)	(116)	(8)	(42)	(66)	(11)	(58)	(28)	(931)

Reliability of supply from tank (average across 2009 - 2020)

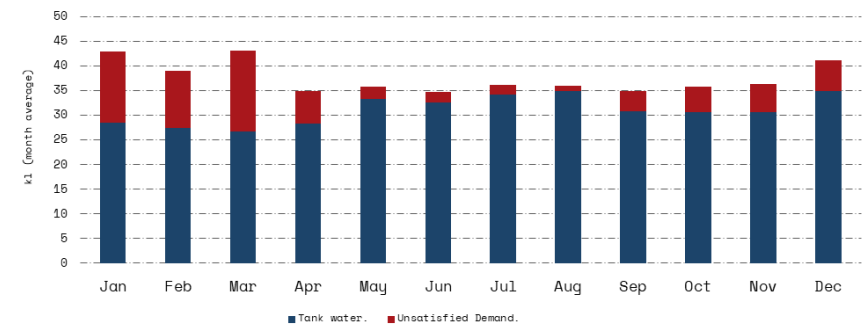


Tank water used (per year) v Tank size



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Tank water used v unsatisfied demand by month (kls per month)



Appendix C. NatHERS Energy Rating Assumptions

C.1 Results

Apartment	Star Rating	Energy Demand (MJ/m ²)		
		Total	Heating	Cooling
G.01	6.8	88.1	78.0	10.1
G.02	8.4	39.1	28.1	11.0
G.03	7.9	54.1	45.9	8.2
G.04	7.3	74.7	68.9	5.8
1.01	8.3	45.4	25.0	20.4
2.01	7.4	70.6	403.8	29.8
2.02	7.9	54.4	29.4	25.0
2.04	6.6	95.9	66.9	29.0
2.05	7.3	75.4	51.6	23.8
2.07	7.3	73.4	54.3	19.1
4.01	8.6	37.1	23.0	14.1
4.02	8.2	48.1	33.7	14.4
4.03	8.4	42.1	28.2	13.9
4.04	8.3	45.1	34.6	10.5
4.05	7.9	54.6	39.4	15.2
5.01	7.3	74.1	51.7	22.4
5.02	6.9	83.1	60.6	22.5
5.03	7.1	79.0	58.2	20.8
5.04	7.2	76.3	54.1	22.2
5.05	6.9	85.4	63.8	21.6
Estimated Development Average	7.5	64.8	65.0	18.0

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The results of the modelling confirm that:

- The development achieves a 7.5 star average NatHERS rating which exceeds the Councils 'best practice' standard of 6.5 stars and represents a high standard of thermal efficiency;
- All individual apartments have cooling loads of less than 30 MJ/m² and therefore meet the energy efficiency objectives set out in clause 58.03-1 of the Planning Scheme for the relevant climate zone (NatHERS Climate Zone 21 Melbourne);
- The average heating load of 65.0 MJ/m² and the cooling load of 18.0 MJ/m² are significantly less than the relevant threshold loads set out in NCC 2019 for Class 2 dwellings (average heating load <88 MJ/m², average cooling load <36 MJ/m²), and;
- The individual apartment heating and cooling loads are significantly less than the relevant threshold loads set out in NCC 2019 for Class 2 dwellings (heating load <120 MJ/m², cooling load <62 MJ/m²).

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C.2 Building Materials

Element	Description	R-Value
Floor Type	Ground Level: Concrete slab on ground Upper levels: Suspended concrete slab	
Floor Insulation	Concrete slab on ground: None	Nil
	Suspended concrete slab: (Levels 1 to 5) over substation, bin room or exposed to outside air below 50mm rigid board insulation	R 2.30
Wall Insulation	Lightweight party walls: Insulation R 1.5	R 1.5
	Lightweight corridor walls: Insulation R 1.5	R 1.5
	Precast concrete Lift & stairwell walls: Insulation R 0.7	R 0.7
	Precast concrete external walls: Insulation R 2.5	R 2.5

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Element	Description	Added R Value
	Lightweight clad walls: Insulation R 2.5	R 2.5
	Brick veneer walls: Insulation R 2.5	R 2.5
Wall Colours	Brick Veneer - Solar Absorptance – 0.50 (Medium) FC2 Green - Solar Absorptance – 0.50 (Medium) FC1 light grey - Solar Absorptance – 0.30 (Light) FC3 Cream - Solar Absorptance – 0.40 (Medium)	
Roof Insulation	Concrete roof: 50mm rigid board insulation R 2.30 insulation	R 2.30
	All apartment concrete ceilings shared with terraces above: 50mm rigid board insulation R 2.30 insulation	R 2.30
Roof Colour	Solar Absorptance – 0.50 (Medium)	
Window Frames	Aluminium frames to all windows and glazed doors	
Window Colour	Solar Absorptance – 0.90	
Sky Lights	None	

NOTES

The added insulation R value must be equal to or higher than that specified above to meet the energy rating results.

All insulation specified for construction must meet Fire Engineer requirements

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C.3 Glazing

Window Type		Description	Whole of Window Value		Location
		Futureline Thermally Broken Frames	U	SHGC	
Aluminium Hinged Door		CAP-115-04 Double glazed 6mm EnergyTech Clear/12mm Argon/6mm Clear	2.73	0.42	All Apartments unless otherwise specified in Table below
Aluminium Awning Window		CAP-116-04 Double glazed 6mm EnergyTech Clear/12mm Argon/6mm Clear	2.87	0.39	All Apartments unless otherwise specified in Table below
Aluminium Sliding Door	Specified Glazing	CAP-133-07 Double glazed 6mm EnergyTech Clear/12mm Argon/6mm Clear	2.40	All Apartments unless otherwise specified in Table below	All Apartments This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright
	Energy Rating Software Equivalent	REY-002-16 Reynaers CP 50 TB Sliding door DG 6mm Sunergy/12mm Argon gap/6mm Clear	2.46	All Apartments unless otherwise specified in Table below	
Aluminium Fixed Window		CAP-157-06 Double glazed 6mm EnergyTech Clear/12mm Argon/6mm Clear	2.16	0.51	All Apartments unless otherwise specified in Table below
Aluminium Sliding Window	Specified Glazing	CAP-132-07 Double glazed 6mm EnergyTech Clear/12mm Argon/6mm Clear	2.8	0.33	All Apartments unless otherwise specified in Table below
	Energy Rating Software Equivalent	AWS-037-51 731 Thermal Heart Sliding door DG 10.38mm TLam Grey/8mm Air gap/6mm Clear	2.85	0.33	

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Glazing Type		Description	Whole of Window Value		Location
Capral Futureline Thermally Broken Frames		Low SHGC Glazing (Insulglass)**	U	SHGC	
Lift & Slide Door	Specified Glazing	CAP-133-03 Double glazed 24mm Insulglass Max 564 - Air	2.40	0.19	Apt 2.01 west living sliding door Apt 2.04 west living sliding door
	Energy Rating Software Equivalent	GJA-068-10 GJames Type 448 TB AL door DG 6mm DLE55(S2)Azur/12mm Air gap/6m Clear	2.46	0.19	

GLAZING NOTES

The energy rating software accredited by the Australian Building Codes Board contains a relatively limited library of window systems. When the glazing systems specified are not available in the software, the protocol requires that the glazing type which most closely matches the specified glazing is selected for the purpose of calculating the energy rating.

The table above sets out the glazing specified for the purposes of calculating the energy rating.

The whole of window U – Value must be equal or lower than the energy rating software value and the whole of window SHGC – Value must be within +/-5% of the energy rating software value.

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General Rating Assumptions

Item	Details
Floor Coverings	Tiles to bathrooms and laundries Carpet to bedrooms Timber boards to kitchen, living and all other areas
Draught Proofing	Weather strips to all entry & external doors and windows. Seal all exhaust fans.
Down lights	Recessed down lights in ceiling /roof space to be fitted with fire proof unvented down light covers (external roof areas only) to provide air tightness and contact with insulation
General	All party walls are classed as neighbour walls.
Shading	Overshadowing from adjoining buildings has been incorporated into the energy ratings
Ceiling Calculation	Calculation for loss of ceiling insulation due to down lights, exhaust fans, ceiling speakers etc. have been incorporated into the energy rating where applicable

NOTES

Changes to any of the above stated specifications may affect energy performance and invalidate the energy ratings detailed in this report.

Sealing of gaps and cracks: inadequate sealing of gaps and cracks can negatively affect the energy performance of a dwelling. Provide sealing in accordance with NCC 2019 Part J3.

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Appendix D. WSUD Maintenance Manual

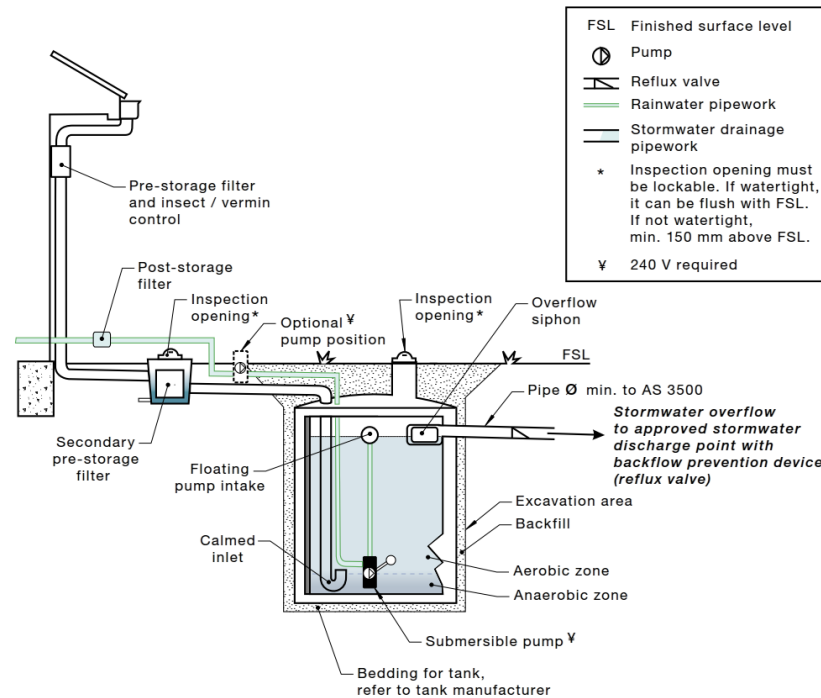
Once installed, a systematic maintenance program will be implemented by the owner's corporation maintenance contractor to ensure the rainwater harvesting system operates as designed and water quality is maintained.

The scope of the maintenance program will include inspection and rectification of issues associated with:

- Roof gutters and downpipes
- First flush screens and filtration devices
- Pumps
- Distribution pipework and reticulation systems
- Overflow systems

Inspections of the system and any maintenance works required will be undertaken on a quarterly basis or as per manufacturers guidelines.

The rainwater harvesting system will be installed in accordance with the guidelines set out in the Rainwater Design & Installation Handbook published by the National Water Commission¹. A schematic diagram of the rainwater tank installation is provided below.



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Rainwater Tank Element	Inspection Item	Y/N	Likely Maintenance Task
Roof gutters and downpipes	Is there leaf litter or debris in the gutters?		Remove by hand and dispose responsibly
First flush diverter	Is there anything blocking the first flush diverter (Leaves etc.)?		Remove by hand and dispose responsibly
Potable mains back up device	Is the potable mains back up switch operating correctly?		Repair or replace device. Consider a manual switching device.
Mesh cover	Has the mesh cover deteriorated or have any holes in is?		Replace mesh cover.
Tank volume	Is there large amounts of sediment or debris sitting in the bottom of the tank, reducing the volume available in the tank to store water?		Remove sediment and dispose responsibly
Pump	Is the pump working effectively? Have you heard it on a regular basis?		Check the potable mains back up device operation. Repair or replace pump.
Pipes and taps	Are pipes and taps leaking?		Repair as needed.
Overflow	Is the overflow clear and connected to the storm water network?		Remove blockages and/or restore connections to stormwater network.

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Maintenance Frequency												
	J	F	M	A	M	J	J	A	S	O	N	D
All tasks	X			X			X			X		

Appendix E. Solar Photovoltaics

During the construction phase, high-efficiency solar PV modules with a total capacity of 6.6 kWp will be installed at roof level as per the preliminary layout indicated below.

PV modules should be oriented in pairs to the east and west at 10-15° tilt and have at least 440Wp capacity (i.e. over 66% more efficient than traditional 300Wp 60-cell modules). High-efficiency modules deliver more compact arrays with inherently lower embodied ecological impact per unit of generation than standard efficiency modules.



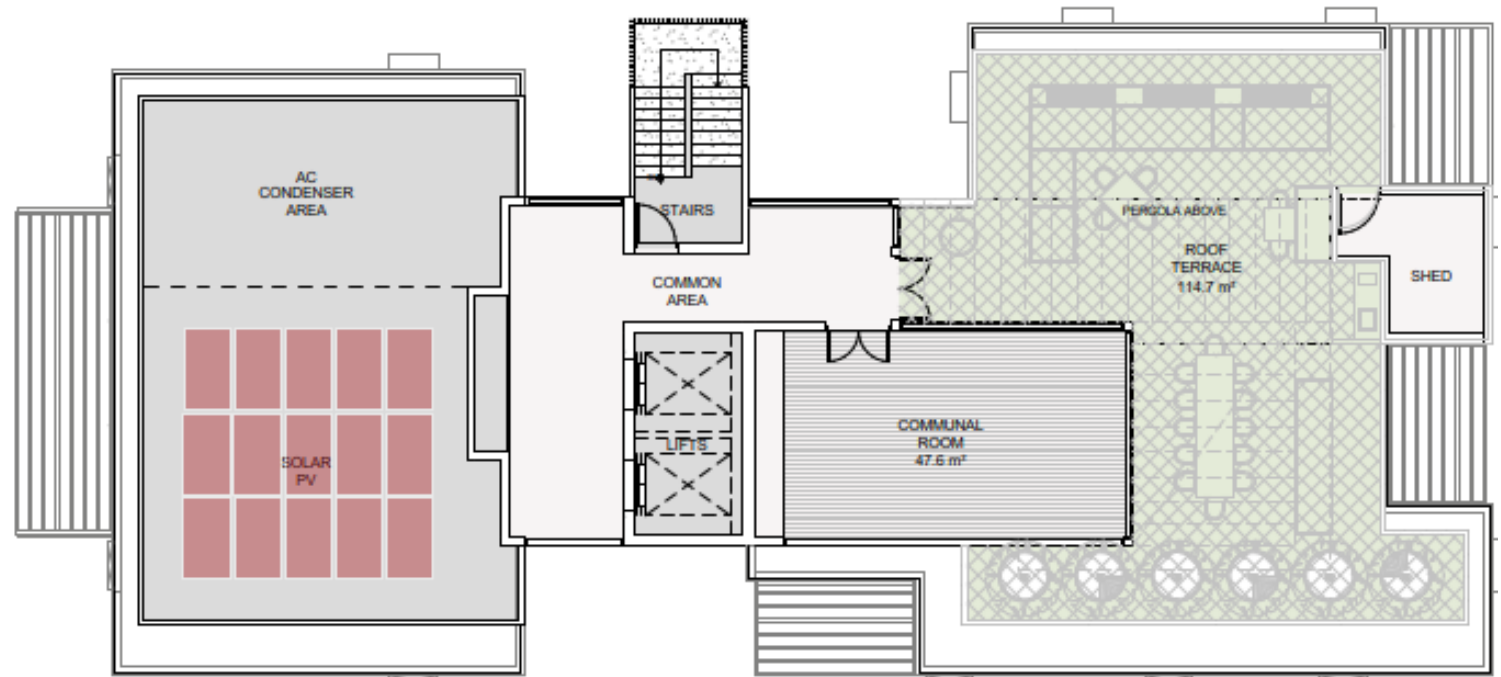
The undulating east-west configuration prevents self-shadowing of the array and provides a low-profile installation with maximised packing factor. It also helps maximise self-consumption due to its flatter and broader power output yield profile.

Total yield of this array will be approximately 7.8 MWh per annum equating to an estimated annual carbon emissions offset of 7.8 tonnes CO₂-e per annum.



Figure 1 Indicative Solar Photovoltaic array layout

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6.6 kWp Solar PV Array
 15 No. PV Modules
 440W 60 cell panels (1115x1920mm)
 dual tilted east-west alternatively at 13°
 on raised platform 1m high to avoid
 overshadowing from screen

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East facing array output

RESULTS

3,867 kWh/Year*

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)
January	6.79	518
February	5.95	417
March	4.79	381
April	3.26	251
May	2.18	175
June	1.86	145
July	1.90	155
August	2.63	216
September	3.80	299
October	4.84	387
November	5.44	417
December	6.64	507
Annual	4.17	3,868

Location and Station Identification

Requested Location	2-12 Wilkinson Street, Brunswick Australia	
Weather Data Source	Lat, Lng: -37.75, 144.98	1.6 mi
Latitude	37.75° S	
Longitude	144.98° E	

PV System Specifications

DC System Size	3.3 kW
Module Type	Standard
Array Type	Fixed (open rack)
System Losses	14.08%
Array Tilt	13°
Array Azimuth	95°

West facing array output

RESULTS

3,927 kWh/Year*

Month	Solar Radiation (kWh / m ² / day)	AC Energy (kWh)
January	6.95	531
February	6.09	426
March	4.85	385
April	3.34	256
May	2.27	184
June	1.97	155
July	1.93	157
August	2.68	219
September	3.87	304
October	4.81	385
November	5.54	423
December	6.62	504
Annual	4.24	3,927

Location and Station Identification

Requested Location	2-12 Wilkinson Street, Brunswick Australia	
Weather Data Source	Lat, Lng: -37.75, 144.98	1.6 mi
Latitude	37.75° S	
Longitude	144.98° E	

PV System Specifications

DC System Size	3.3 kW
Module Type	Standard
Array Type	Fixed (open rack)
System Losses	14.08%
Array Tilt	13°
Array Azimuth	275°

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Appendix F. Site Management Plan

During the construction phase, the key pollutants at risk of entering the stormwater system include:

- Sediments (soil, sand, gravel and concrete washings); and
- Litter, debris etc.

These pollutants arise from factors such as dirt from construction vehicles, stockpiles located close to surface runoff flow paths, and surface runoff from disturbed areas during earthmoving and construction works. It is therefore important to have measures that either prevent or minimise the pollutant loads entering stormwater system during construction.

In order to mitigate the impacts of the above pollutants on the stormwater system, the following stormwater management strategies will be implemented during the construction phase as appropriate:

- Installation of onsite erosion and sediment control measures. All installed control measures shall be regularly inspected & maintained to ensure their effectiveness. Such measures may include (but not limited to):
 - Silt fences
 - sediment traps
 - hay bales
 - geotextile fabrics
- Where possible, litter bins with a lid will be used to prevent litter from getting blown away and potentially entering stormwater drains.

Additionally, the following work practices shall be adopted to reduce stormwater pollution:

- Site induction by the head contractor/ builder to make personnel aware of stormwater management measures in place
- Employ suitable measures to reduce mud being carried off-site into the roadways such as installing a rumble grid/ gravel/ crushed-rock driveway (or equivalent measure) to provide clean access for delivery vehicles, removing mud from vehicle tyres with a shovel etc.
- Safe handling and storage of chemicals, paints, oils and other elements that could wash off site to prevent them from entering stormwater drains.
- Where practicable, stockpiles will be covered, located within the site's fence and away from the lowest point of the site where surface runoff will drain to. This initiative will minimise erosion.

Accordingly, the measures presented above are considered appropriate for the proposed development at this stage of the project. The measures will reduce the pollutants entering stormwater system from the site during construction works thereby protecting waterways.

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Appendix G. NCC J1.5 façade Calculator

Preliminary J1.5 Façade calculations have been carried out to determine window/wall ratios and thermal performance is achievable with the proposed design. NCC Section J compliance will be verified during detailed design via a dynamic thermal simulation in accordance with the NCC methodology.

NCC 2019 Wall-Glazing Calculator v3.0											
Wall and glazing energy efficiency in Class 2-9 buildings - Method 2 of Specification J1.5a, NCC 2019											
Building name and description				Classification				Climate Zone			
2-12 Wilkinson Street, Brunswick				Other				6			
Calculated Area-Weighted U-Value				Calculated Representative Air-Conditioning Energy Value				Calculated Representative Air-Conditioning Energy Value			
1.35				28.4				28.4			
Allowable Area-Weighted U-Value				Allowable Representative Air-Conditioning Energy Value				Allowable Representative Air-Conditioning Energy Value			
2.00				28.6				28.6			
Building total U-Value allowance met				Building total SHGC allowance met				Building total SHGC allowance met			
68%				100%				100%			
Check Values		Wall Element Requirements		Display Glazing Element Requirements		Display Glazing Element Requirements		Display Glazing Element Requirements		Display Glazing Element Requirements	
Visible		Met		Met		Met		Met		Met	
Use of this calculator does not guarantee compliance with the NCC. The disclaimer and a version update check are available at the bottom of the page.											
Element Description					U-Value			SHGC and Shading			
ID	Description (optional)	Element Type	Facing Sector	Area (m ²)	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		Wall	North	25.71	0.71	4% of building total					Not counted
2		Wall	East	31.73	0.71	5% of building total					Not counted
3		Wall	South	48.10	0.71	7% of building total					Not counted
4		Wall	West	36.04	0.71	6% of building total					Not counted
5		Wall	Internal	159.28	0.71	25% of building total					Not counted
6		Display Glazing	West	8.25	5.80	Not counted	0.81	2.5	2.5	0.75	Not counted
7		Display Glazing	West	4.50	5.80	Not counted	0.81	3	3	0.75	Not counted
8		Display Glazing	South	4.80	5.80	Not counted	0.81	1.2	1.2	2.1	Not counted
9		Display Glazing	South	11.55	5.80	Not counted	0.81	3	3	1.25	Not counted
10		Display Glazing	West	4.50	5.80	Not counted	0.81	3	3	0.75	Not counted
11		Display Glazing	West	10.75	5.80	Not counted	0.81	2.5	2.5	0.75	Not counted
12		Display Glazing	South	2.38	5.80	Not counted	0.81	2.5	2.5	1.4	Not counted
13		Display Glazing	South	4.50	5.80	Not counted	0.81	3	3	1.4	Not counted
14		Display Glazing	West	10.25	5.80	Not counted	0.81	2.5	2.5	17.15	Not counted
15		Display Glazing	East	9.63	5.80	Not counted	0.81	2.5	2.5	0.75	Not counted
16		Display Glazing	South	4.50	5.80	Not counted	0.81	3	3	1.25	Not counted
17		Display Glazing	South	4.38	5.80	Not counted	0.81	2.5	2.5	1.25	Not counted
18		Glazing	North	13.78	5.80	17% of building total	0.61	2.6	2.6	2.9	22% of building total
19		Glazing	East	12.25	5.80	15% of building total	0.61	2.5	0	0	42% of building total
20		Glazing	South	16.80	5.80	21% of building total	0.61	2.1	0	0	36% of building total
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											
Email alex.wallglazingcalculator@gmail.com with any suggestions for improvement											
Check for version update											

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Appendix H. Daylight Assessment

This appendix contains a summary of:

- Analysis of Internal Daylight Levels to bedrooms and living/ kitchen areas on Ground Floor, Level 1 & 2 within the proposed development.
- The model accounts for shading and obstructions provided by adjacent structures.

The daylight assessment set out in this report is based on:

- Architectural drawings set by MGS Architects issued to Ark Resources on 20/02/24 dated Rev. P4 12/02/2024.
- Equitable development scenario provided by Human Habits on 18/06/2024.

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H.1 Daylight Results

The BESS tool sets the following minimum performance standards for internal daylight within habitable rooms of residential developments:

- At least 80% of dwellings achieve a daylight factor greater than 1% to 90% of the floor area of each living area, including kitchens.
- At least 80% of dwellings achieve a daylight factor greater than 0.5% to 90% of the floor area in all bedrooms.

Additional points are allocated in the BESS tool if 100% of each room type achieve the daylight factor thresholds above however a 'best practice' outcome in BESS is achieved when 80% of rooms meet these thresholds.

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H.1.1 Development Summary

Living/Kitchen Areas

Level	Total of Rooms	Number Rooms meeting 'best practice'	% Rooms meeting 'best practice'
Ground Floor	4	2	50
Level 01	10	7	70
Level 02	10	10	100
Level 03	5	5*	100*
Level 04	5	5*	100*
Level 05	5	5*	100*
Total	39	34*	87%*

*Indicates extrapolation

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Bedrooms

Level	Total of Rooms	Number Rooms meeting 'best practice'	% Rooms meeting 'best practice'
Ground Floor	6	6	100
Level 01	11	11	100
Level 02	11	11	100
Level 03	9	9	100
Level 04	9	9	100
Level 05	9	9	100
Total	55	55*	100%*

*Indicates extrapolation

Results for level 3 and above have been extrapolated based on results for the levels below and confirm that, on a whole of development basis, **87%** of living/kitchen areas and **100%** of bedrooms in the development meet the best practice daylight standard and thus the development meet the daylight requirements of the BESS sustainability tool.

H.1.2 Individual Results

Kitchen/ Living Areas

Room	Level	DF % > 1
G01	Ground Floor	63
G02	Ground Floor	68
G03	Ground Floor	100
G04	Ground Floor	100
101	Level 01	92
102	Level 01	76
103	Level 01	79
104	Level 01	100
105	Level 01	100
106	Level 01	100
107	Level 01	100
108	Level 01	100
109	Level 01	100
110	Level 01	79
201	Level 02	100
202	Level 02	91
203	Level 02	98
204	Level 02	100
205	Level 02	100
206	Level 02	100
207	Level 02	100
208	Level 02	100
209	Level 02	100
210	Level 02	98

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Bedrooms

Room	Level	DF % > 0.5
G01. Bed 1	Ground Floor	98
G02. Bed 1	Ground Floor	100
G02. Bed 2	Ground Floor	100
G03. Bed 1	Ground Floor	100
G04. Bed 1	Ground Floor	100
G04. Bed 2	Ground Floor	100
101. Bed 1	Level 01	97
102. Bed 1	Level 01	100
103. Bed 1	Level 01	100
104. Bed 1	Level 01	100
105. Bed 1	Level 01	100
106. Bed 1	Level 01	100
107. Bed 1	Level 01	100
107. Bed 2	Level 01	100
108. Bed 1	Level 01	100
109. Bed 1	Level 01	100
110. Bed 1	Level 01	100
201. Bed 1	Level 02	100
202. Bed 1	Level 02	100
203. Bed 1	Level 02	100
204. Bed 1	Level 02	100
205. Bed 1	Level 02	100
206. Bed 1	Level 02	100
207. Bed 1	Level 02	100
207. Bed 2	Level 02	100
208. Bed 1	Level 02	100
209. Bed 1	Level 02	100
210. Bed 1	Level 02	100

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H.2 Model Images

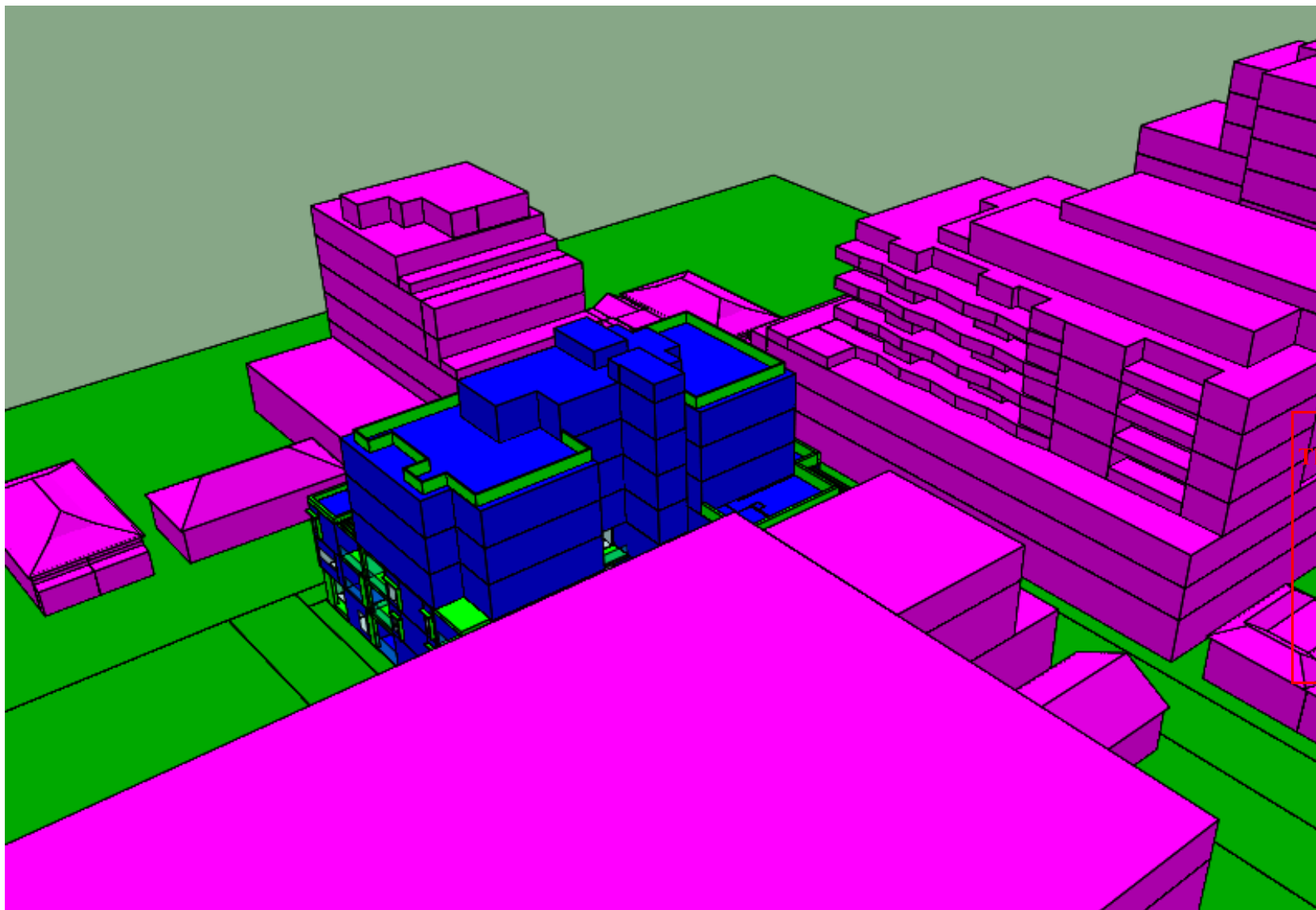


Figure 1 Model view from North-East

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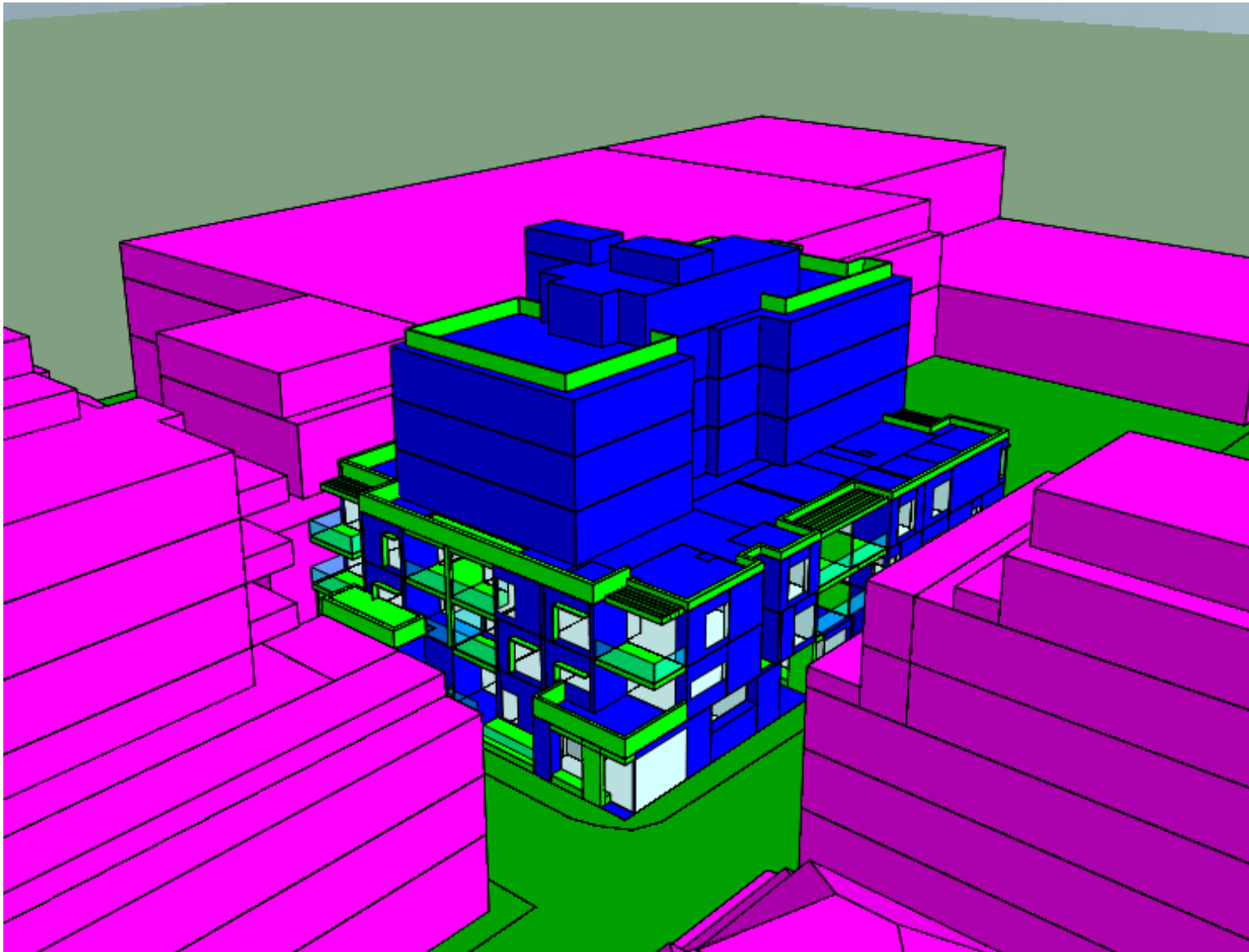


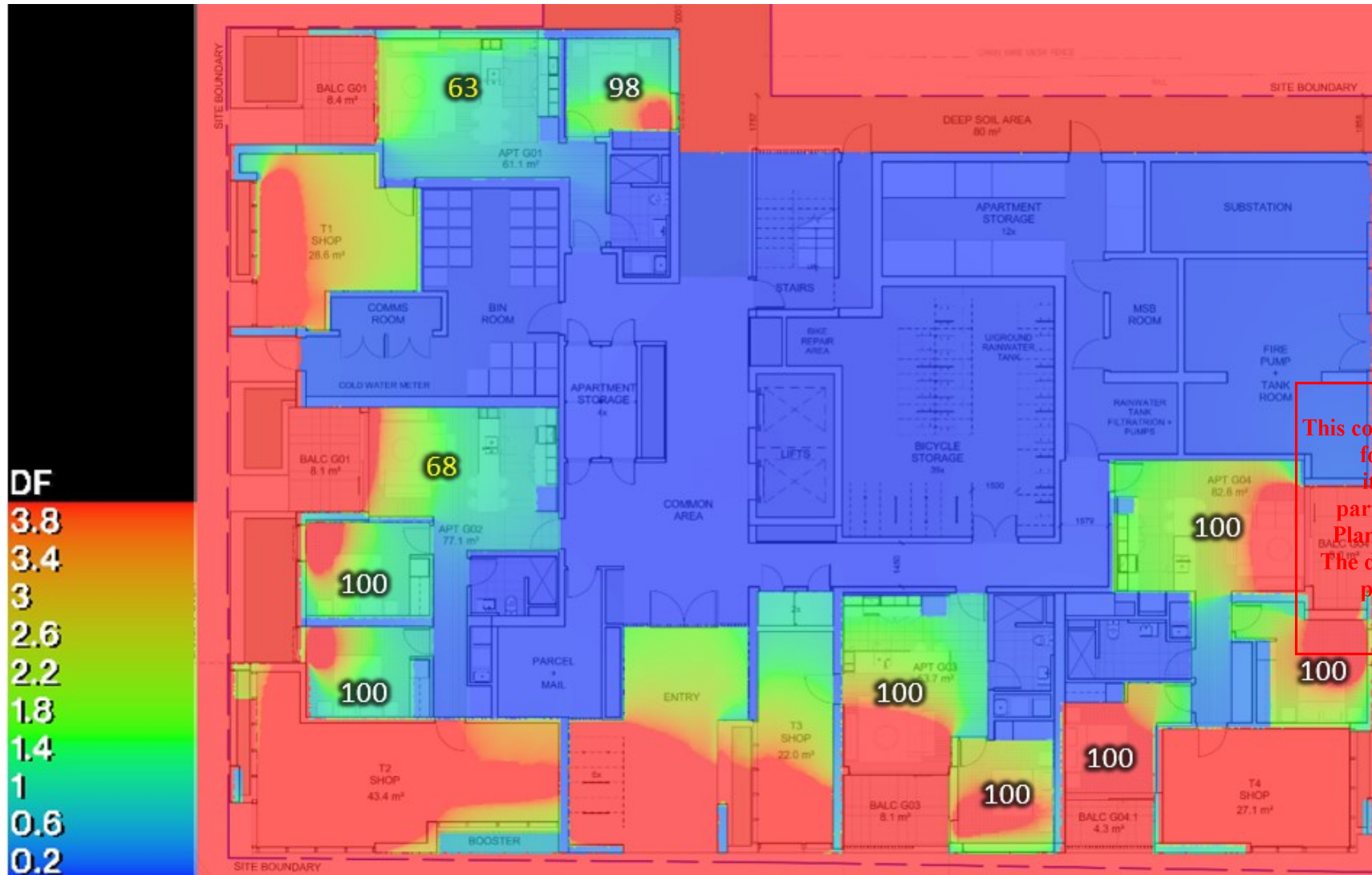
Figure 2 Model view from South-West

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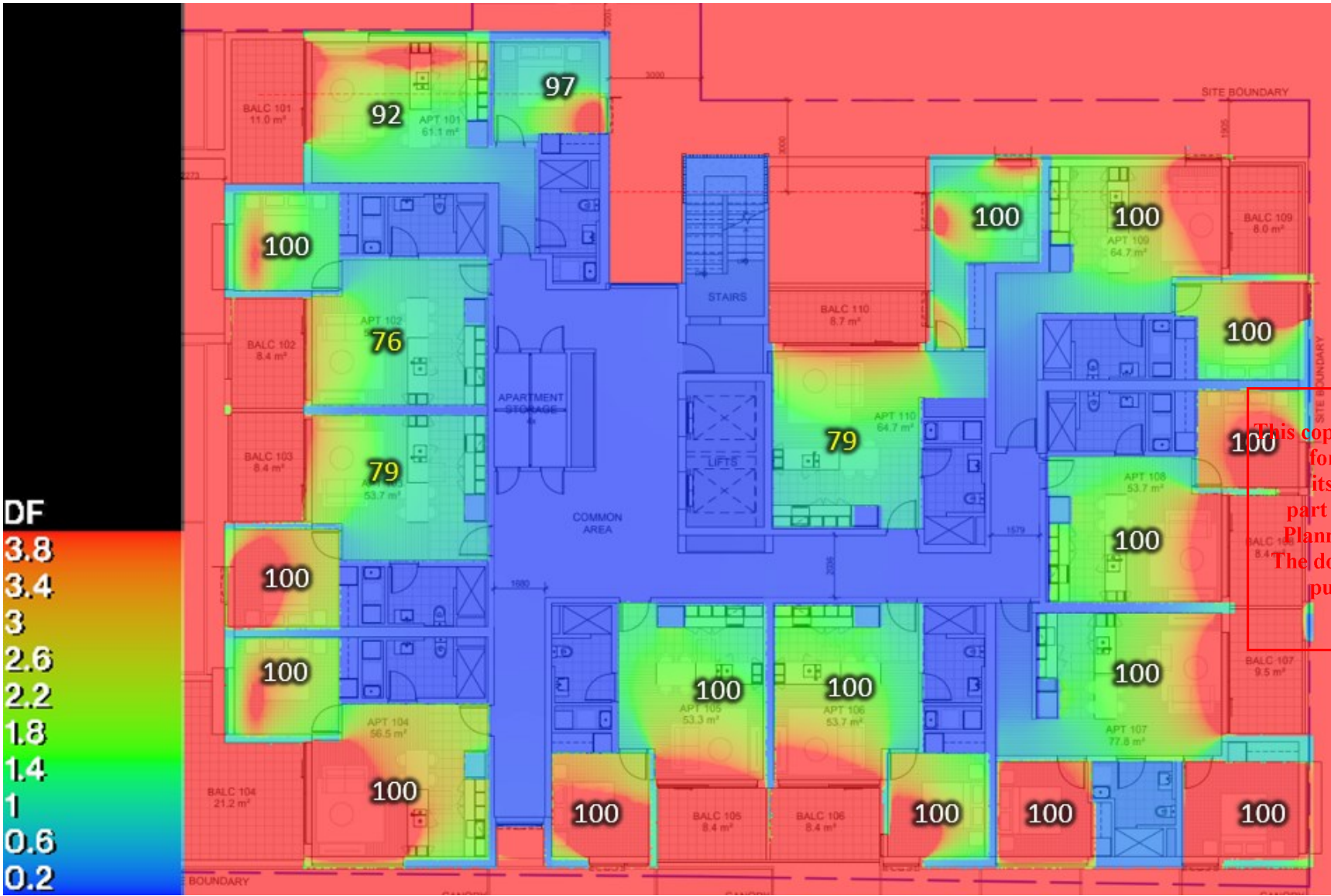
H.3 Daylight Contour Plots



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Figure 3 Ground Floor Contour Plot

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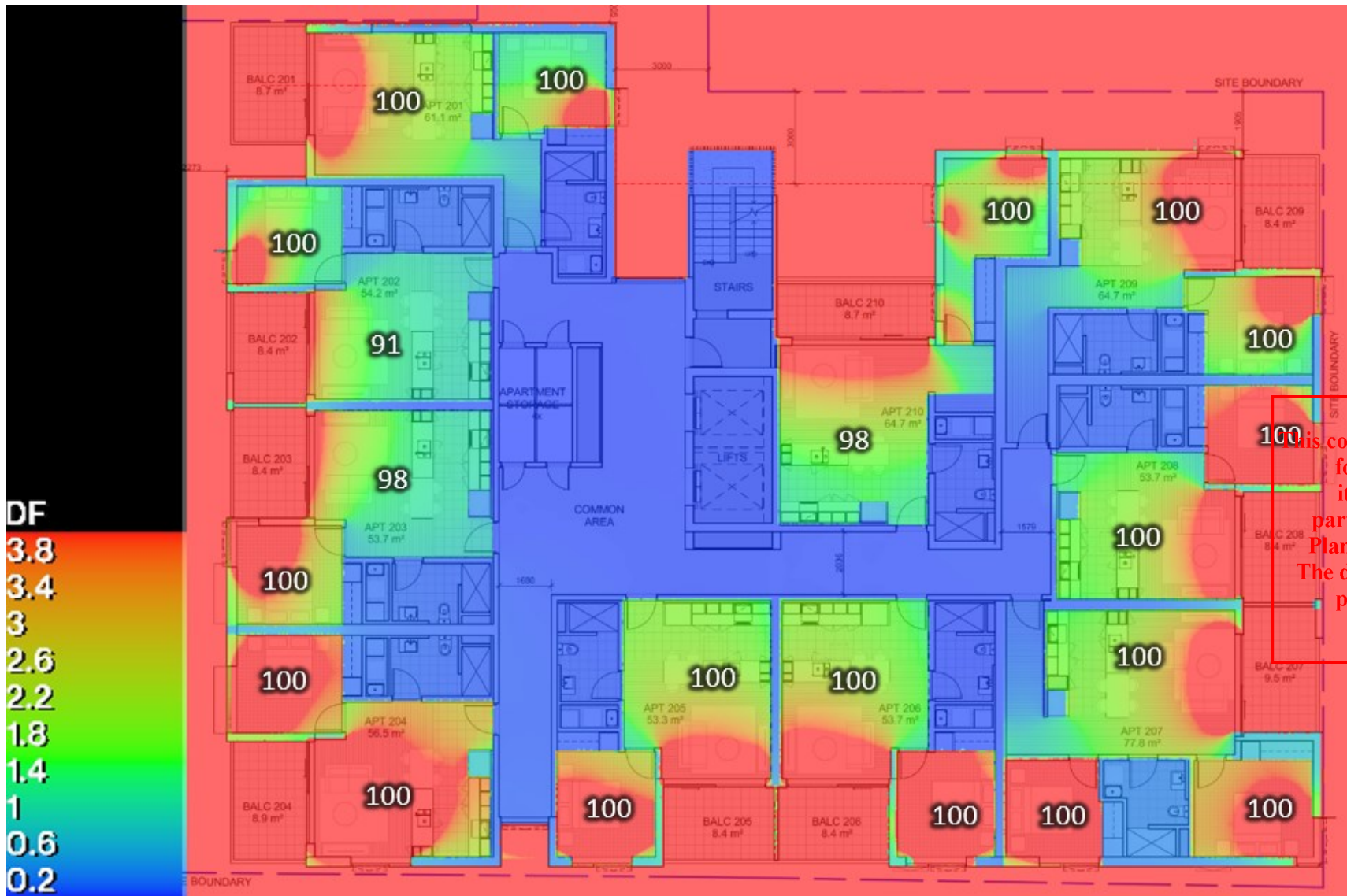


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DF
3.8
3.4
3
2.6
2.2
1.8
1.4
1
0.6
0.2

Figure 4 Level 01 Contour Plot

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Figure 5 Level 02 Contour Plot

H.4 Assumptions

The following assumptions have been made for the Visible Light Transmittance (VLT) values for all glazing applicable to this analysis:

Assumed Glazing Visual Light Transmittance

Glazing Type	Visible Light Transmittance (VLT)
	%
External Glazing. Clear, Double Glazing	70
Balustrade	65

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Assumed Surface Reflectances

Construction Element	Reflectance (%)	Description
Floors	30	Assumes a light-coloured timber/carpet
Internal Walls	85	Dulux Natural White paint
Ceilings	85	Dulux Natural White paint
External Walls BR1	60	Brick Venner- Cream Colour
External Walls BR2	40	Glazed Brick – Green Colour
External Walls FC1	40	Concrete
External Walls FC3	60	Fiber Cement- Cream colour
Window Shade AL1	10	Aluminium – Purple colour
Pergola AL2	40	Aluminium – Light green colour
Canopy AL3	70	Aluminium – Off white colour
Soffit	70	Light -coloured finish
Balcony/external Pavers	40	Medium-coloured finish
Adjacent Buildings	40	Medium-coloured finish
Adjacent Buildings. 342-348 Victoria Street, Brunswick (L1 -L7)	60	Light -coloured finish
Greenery	30	Park-Grass
Roads	10	Dark colour

Sky conditions: 10K Lux CIE overcast sky.

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