Sustainability Management Plan

18 & 20 Cottrell St, Werribee 3030

Environmental Well-being

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1 INTRODUCTION

The following Sustainability Management Plan (SMP) has been prepared by Odin Solutions to provide an overall and a wider approach to assessing the sustainability of the proposed development. It offers an overview from various perspectives (energy, material etc.) for the relevance council officials to assess. This development includes a wide range of holistic sustainability measures which have been carefully integrated into the design of the development so that the residents will have the opportunity to reduce their ecological footprint without compromising their quality of life.

1.1 STATUTORY FRAMEWORK

Wyndham City Council encourages the inclusion of Environmentally Sustainable Development (ESD) initiatives within the design process of new developments, which will result in more sustainable buildings within the community.

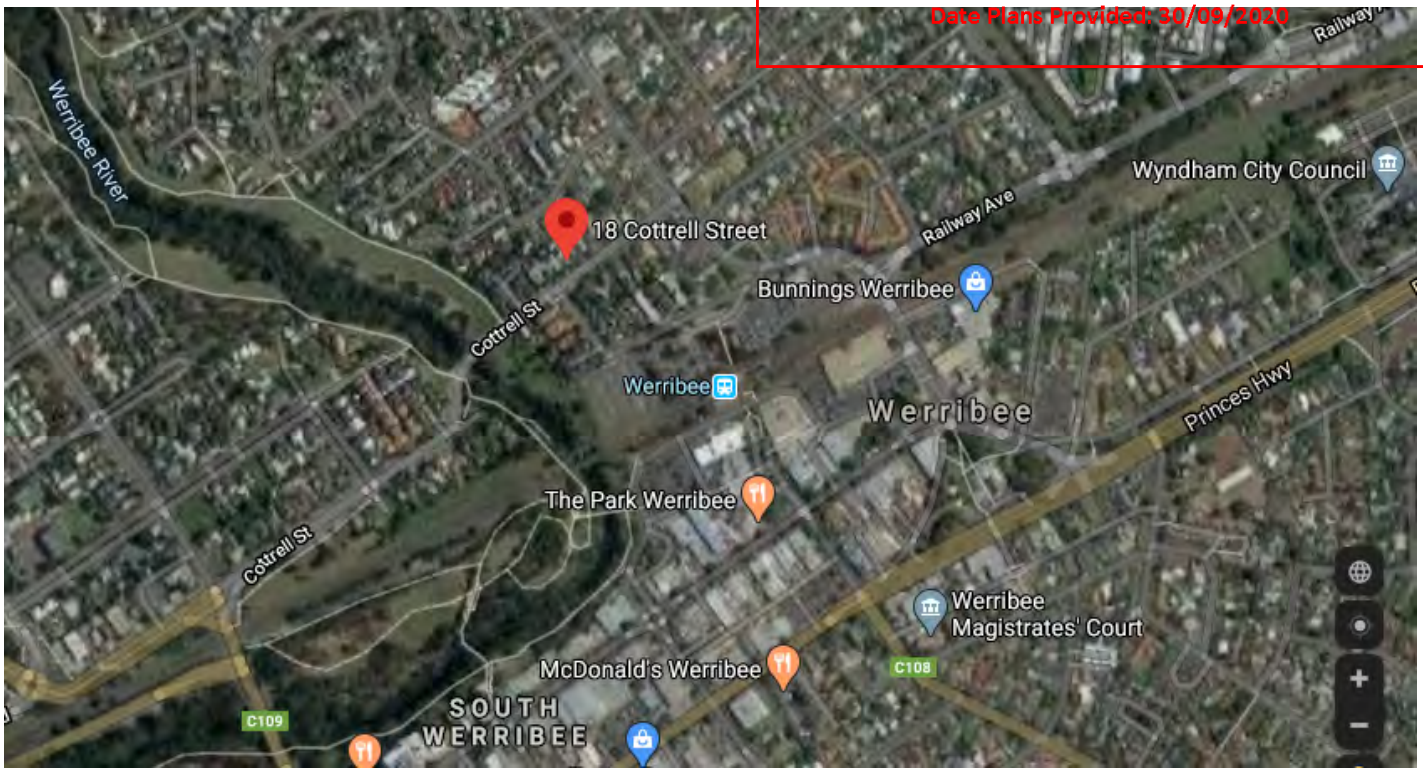
Odin Solutions have been engaged to undertake a Sustainability Management Plan for the proposed townhouses located at 18 & 20 Cottrell street, Werribee.

The SMP report has identified the following key categories to be addressed;

- Water Resources
- Energy Performance
- Stormwater Management
- Indoor Environment Quality
- Construction, Building & Waste Management
- Building Materials
- Transport and
- Urban Ecology

1.2 Site And Development Description

The subject property is located within Werribee, a suburb within the domains of Wyndham City Council. The site measures roughly 1076m2 where by two existing single storey dwellings is present. The proposed development will consist of 2 commercial offices, 9 apartments and 5 double storey townhouses.



Aerial view of the proposed development

2 ESD ASSESSMENT TOOLS

There are a number of calculators and modelling programs available to help assess proposed developments against benchmarks set by the Victorian State Government, City Councils and the Building Code of Australia. This report has utilised the Built Environment Sustainability Scorecard (BESS) system which covers the overall sustainability of the project, FirstRate5, which assesses the thermal performance of the building fabric of residential portion of the development (Class 2) and STORM, which analyses stormwater treatment onsite.

2.1 BUILT ENVIRONMENT SUSTAINABILITY SCORECARD (BESS)

All information and calculations necessary to produce the SDA report are provided by using the Built Environment Sustainability Scorecard (BESS). The BESS tool assesses energy and water efficiency, thermal comfort, and overall environmental sustainability performance of new buildings or alterations.
There are four mandatory categories with minimum score: Indoor Environment Quality (IEQ), Energy, Water, and Stormwater. The final BESS overall score is determined by the individual category scores:

- 'Best Practice' is defined within BESS as an overall score of 50% or above.
- 'Excellence' is defined within BESS as an overall score of 70%.

2.2 STORM

Stormwater Treatment Objective – Relative Measure (STORM) was developed by Melbourne Water to simplify the analysis of stormwater treatment methods within a development. The calculator assess Water Sensitive Urban Design (WSUD) measures on project sites and delivers a percentage result, determining whether best practice targets have been achieved. A score of 100% or higher means the treatment features meet all objectives.

2.3 FIRSTRATE5

The thermal performance of dwellings is assessed using FirstRate5, an energy modelling software programme that rates dwellings on a 10 star scale. Using Accurate (a nationally recognised energy benchmarking tool) to rate dwellings based on climate zone, building orientation, construction materials and building sealing. Victorian townhouses are required to achieve a minimum 6 star rating to comply with the NCC.

3 ESD ACHIEVEMENTS

The following tables outline the scores achieved in each assessment tool used. This development has achieved a 'Pass' score in each.

BUILT ENVIRONMENT SUSTAINABILITY SCORECARD (BESS)			
% of Total	**Category**	**Required Score**	**Project Score**
4%	Management	0%	100%
5%	Water	50%	57%
19%	Energy	50%	70%
14%	Stormwater	100%	100%
16%	IEQ	50%	98%
5%	Transport	0%	52%
6%	Waste	0%	100%
2%	Urban Ecology	0%	34%
0%	Innovation	0%	0%
	Final BESS Score	**50%**	**70%**

% of Total	Category	Score	Pass
4 %	Management	100 %	
5 %	Water	57 %	✓
19 %	Energy	70 %	✓
14 %	Stormwater	100 %	✓
16 %	IEQ	98 %	✓
5 %	Transport	52 %	
6 %	Waste	100 %	
2 %	Urban Ecology	34 %	
0 %	Innovation	0 %	

STORM RATINGS		
	Required Score	Project Score
Storm Score	100%	103%

PRELIMINARY 6 STAR ENERGY RATING RESULTS	
Dwelling 1	7.6
Dwelling 2	7.3
Dwelling 3	6.4
Dwelling 4	7.8
Dwelling 5	8.3
Dwelling 6	8.2
Dwelling 7	7.0
Dwelling 8	7.2
Dwelling 9	7.2
Dwelling 10	6.4
Dwelling 11	7.6
Dwelling 12	7.6
Dwelling 13	7.7
Dwelling 14	7.6

4 ESD INITIATIVES & IMPLEMENTATION

4.0 MANAGEMENT

DESIGN REQUIREMENT	IMPLEMENTATION STAGE	RESPONSIBILITY
Thermal Performance Modelling – Residential		
To encourage and recognise developments that use thermal modelling to inform passive design at the early design stage a preliminary NatHERS rating has been undertaken for all thermally unique dwellings. This credit contributes 25.1% towards this section's score.	Planning Stage	Architect/ ESD Consultant
Metering – Residential		
Utility meters will be provided for all individual dwellings. Separate metering facilities will be provided for individual dwellings for all utilities (electricity, water and gas if applicable). Individual meters allow building occupants to readily identify their consumption patterns and costs, which helps identify areas for improvement. This credit contributes 7.0% towards this section's score.	Planning Stage	Architect/ ESD Consultant
Metering – Commercial		
Utility meters areas will be for provided for all individual commercial tenants. This credit contributes 1.4% towards this section's score.	Planning Stage	Architect
Metering – Common Areas		
All major common area services to be separately submetered. Meters are located in areas which are easy to access to facilitate regular monitoring. For example, plant rooms, main distribution room or control room etc. This credit contributes 8.3% towards this section's score.	Planning Stage	Architect
Building Users Guide		
A building users guide to be produced and issued to occupants. Information such as, Green Travel Plans, help occupants help facilitate more sustainable behaviour by building occupants. This credit contributes 13.9% towards this section's score.	Planning Stage	Architect/ ESD Consultant

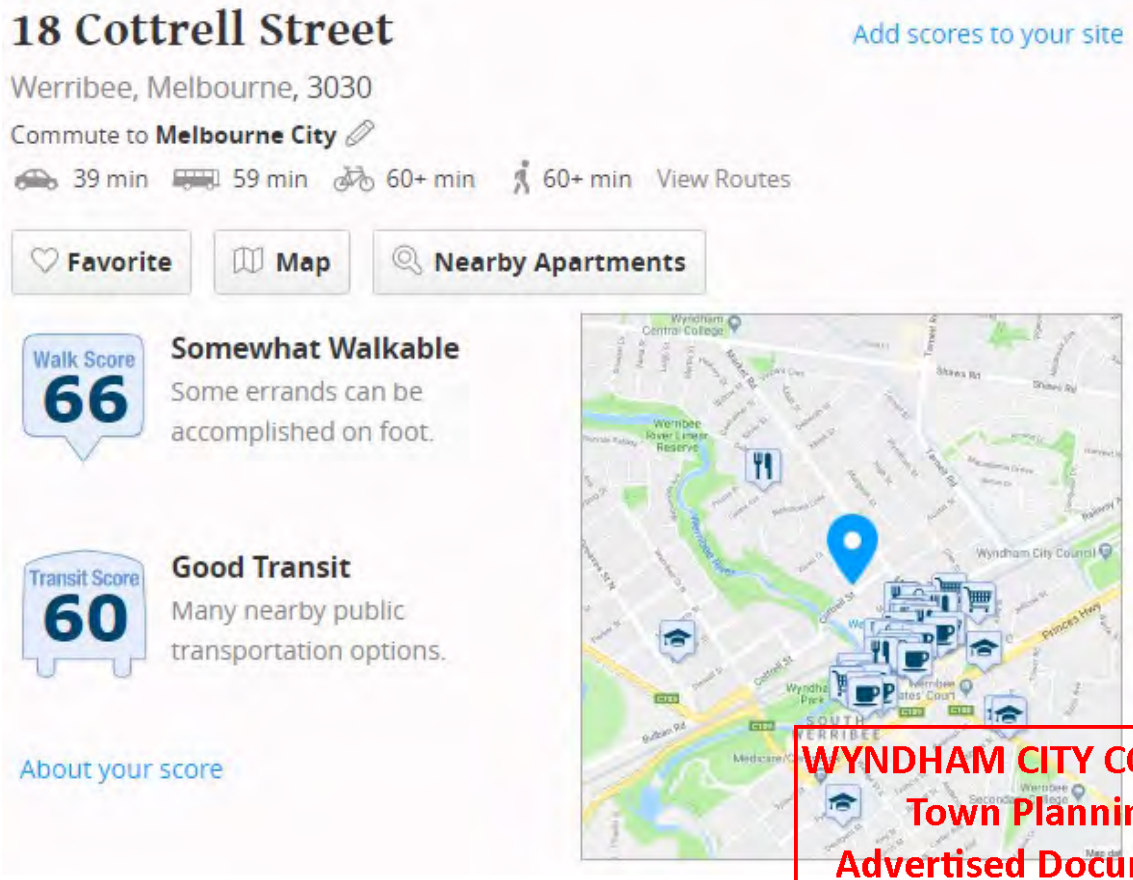
4.1 Energy Efficiency

Design Requirement	Implementation Stage	Responsibility
Thermal Performance Rating – Residential		
The average 6 Star Energy Rating for this development is 7.3 Stars, exceeding the NCC minimum requirement of a 6.0 star. This will be achieved through the installation of double glazed windows in habitable sections.	Planning Stage	Architect/ ESD Consultant
Heating & Cooling		
High efficiency reverse cycle air conditioning systems will be installed, giving occupants the ability to completely switch off the air conditioning when not required. All A/C units are to meet one of the following requirements: - VRV and have a minimum CoP of 3.0 - Split system and have a minimum CoP of 3.0 (if ineligible for an energy rating); or - Split system and have an energy rating of at least 5 Stars or be within 1 star of the best available.	Planning Stage	Mechanical Engineer
Hot Water System		
Gas storage & Instantaneous hot water systems will be installed into this development with a minimum 5 Star energy rating.	Planning Stage	
Appliances		
Appliances are a significant source of greenhouse gas emissions in a development. Every effort should be made to minimise the energy consumption of these items. Where appliances are provided in an apartment, they will be selected to be within one star of the best available in its product range, using the Energy Star rating system.	Planning Stage	Architect
Lighting		
Internal lighting achieves a maximum illumination power density of 4W/sqm or less throughout the development. Common area external lighting will be controlled by daylight sensors, motion sensors and/or time clocks.	Planning Stage	Architect
Clothes Lines		
Private outdoor clothesline on each dwelling balcony will be provided. The provided clotheslines will limit occupant energy consumption use from mechanical clothes driers.	Planning Stage	Architect

4.2 Sustainable Transport

Design Requirement	Implementation Stage	Responsibility
Walkable Location		
The walkability for the location has been assessed by walkscore.com. This site measures the walkability of any location in the world based on the distance to nearby amenities and pedestrian friendliness. The location is given a score out of a maximum of 100. This site achieves a walk score of 66, which is classed as 'Somewhat Walkable' – some errands can be accomplished on foot.n be accomplished on foot.		
Sustainable Transport Accessibility		
This development is within a short walk (less than 5 minutes) to Werribee train station. There also is a nearby bus stop for residents to commute to Werribee Plaza. Each dwelling will contain 'Towel Rail' bike rakes for occupant use.	Planning Stage	

Parking rail	Spatial requirements	
Ned Kelly Space effective due to staggered heights and vertical hanging. Front wheel and frame are easily locked and fully supported.	• wall mounted or free standing on framing • recommended rail spacing 0.4-0.5m • rails alternate in height; 1.75m and 2.05m (top of rail) • minimum ceiling height is 2.2m • bicycles will extend up to 1.2m from the wall • minimum access corridor width 1.5m	



4.3 Water Conversation

Design Requirement	Implementation Stage	Responsibility
Potable Water Use Reduction (Interior Uses)		
To improve water efficiency, efficient fixtures and fittings will be installed to ensure a reduction in the total water consumption at the premises. This will be achieved by installing appliances, fixtures and fittings are to meet the following water efficiency targets: - Showerheads: 4 Star WELS (>4.5 but <=6.0) - Kitchen Taps: 5 Star WELS - Bathroom Taps: 5 Star WELS - WC: 4 Star WELS	Planning Stage	Architect/ ESD Consultant
Rainwater Collection & Reuse		
Reducing potable (mains) water consumption through a rainwater collection and re-use scheme ensures cost savings and the efficient use of water. Each double storey dwelling will contain a 2000 litre rainwater tank, each roof area will drain to a minimum 69m^2 for reuse. Non-potable water source connected to all double storey dwelling toilets & laundry stops. A 2^m raingarden will use apartment catchment areas. Additional infomation is provided in the Water Sensitive Urban Design (WSUD) Response & Appendix C.	Planning Stage	Architect/ ESD Consultant

4.4 Waste

Design Requirement	Implementation Stage	Responsibility
Building Re-Use		
Least 30% of the existing building to be re-used. 30% or more area re-use gains 100% BESS score	Planning Stage	Architect/ ESD Consultant
Convenience of Recycling		
Recycling facilities will at least be as convenient for occupants as facilities for general waste. This credit contributes 33.3% towards this section's score.	Planning Stage	Architect/ ESD Consultant

4.5 Sustainable Building Materials

The choice of building materials for a project can have a significant impact on the projects overall environmental footprint. An overarching objective to select materials based on their probably environmental footprint has been implemented on this project. Materials will be selected based on the following attributes:

Design Requirement	Implementation Stage	Responsibility
Embodied Energy		
Total embodied energy is to be considered when selecting materials. High embodied energy materials, such as concrete, aluminium and zinc are to be avoided where possible. When these materials are necessary, suppliers that include a percentage of recycled materials must be selected.	Design Stage	Architect
Biodiversity and Habitat Destruction		
All timber used for the project must be from sustainably managed sources. This must be demonstrated through appropriate certification schemes, such as PEFC or FSC.	Design Stage	Architect
End of Life		
Consideration must be given to how materials may be disposed of. Recyclable materials must be chosen wherever possible. Preference must be given to suppliers with end-of-life recycling schemes.	Design Stage	Architect
Toxicity		
Materials which have health risks during manufacture and installation must be avoided where possible. Low VOC products, E0 or E1 wood products, best practice PVC must be selected wherever practical.	Design Stage	Architect
Durability		
Consideration must be given to the life expectancy of materials. Durable materials must be specified for relevant applications.	Design Stage	Architect
Maintenance		
Materials that are easily maintained must be specified. This is likely to increase the life expectancy of the material. Materials that require cleaning agents that have environmental impacts must be avoided.	Design Stage	Architect

MAX TVOC CONTENT LIMITS FOR PAINTS, VARNISHES AND PROTECTIVE COATINGS	
Carpet TVOC Emissions Limits	**Max TVOC EmissionLimit (mg/m2 per hour)**
Total VOC Limit	0.5
4-PC (4-Phenylcyclohexene)	0.05
Max TVOC Content Limits for Adhesives and Sealants	
Product Type	**Max TVOC Content (g/l of product)**
Indoor carpet adhesive	Latex primer for galvanized iron and zincalume
Carpet pad adhesive	Interior latex undercoat
Wood flooring and Laminate adhesive	Interior sealer
Rubber flooring adhesive	One and two pack performance coatings for Floors
Sub-floor adhesive	Any solvent-based coatings whose purpose is not covered in table
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall and Panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Architectural sealants	250
Max TVOC Content Limits for Paints, Varnishes and Protective Coatings	
Walls and ceilings – interior semi-gloss	16
Walls and ceilings – interior low sheen	16
Walls and ceilings – interior flat washable	16
Ceilings – interior flat	14
Trim – gloss, semi-gloss, satin, varnishes and wood stains	75
Timber and binding primers	30
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer	65
One and two pack performance coatings for Floors	140
Any solvent-based coatings whose purpose is not covered in table	200

4.6 Urban Ecology

Development in existing urban areas helps reduce the need for greenfield development and the associated environmental impacts, such as car dependency, increased need for infrastructure and displacement of agricultural land.

This development is a redevelopment of an existing commercial building, thereby increasing density in already established urban areas and reducing urban sprawl.

Design Requirement	Implementation Stage	Responsibility
Vegetation		
10% of the site is covered with vegetation, as expressed as a percentage of the total site area. 10% vegetated area (50% score).	Planning Stage	Architect/ ESD Consultant
Private Open Space - Balcony / Courtyard Ecology		
A tap and floor waste on every balcony / in every courtyard. This credit contributes 10.6% towards this section's score.	Planning Stage	Architect/ ESD Consultant

4.7 Indoor Environment Quality – IEQ

Design Requirement	Implementation Stage	Responsibility
Daylight Access		
All bedrooms incorporate an external window, providing high level of amenity and energy efficiency through design for natural light.	Planning Stage	Architect
Double Glazing		
Double glazed windows (or better) will be installed to all living areas and bedrooms to provide comfortable indoor spaces and reduce energy needed for heating and cooling.	Planning Stage	Architect
Effective Natural Ventilation		
To provide fresh air and passive cooling opportunities, the apartments have been designed to utilise natural ventilation. This has been achieved through the installation of ventilation openings.	Planning Stage	Architect
Orientation		
At least 50% of living areas are orientated to the north.	Planning Stage	Architect
External Shading		
Appropriate calls for shading to glazed surfaces to reduce peak energy demand, increase comfort and reduce the need to use mechanical cooling.	Planning Stage	Architect

5 WATER SENSITIVE URBAN DESIGN (WSUD) RESPONSE

Rainwater will be collected from each townhouse roof area and be stored in separate 2000L rainwater tanks located in the rear courtyards of the each dwelling. The rainwater will be used to flush toilets and laundry stops throughout the development, to part irrigate landscaped areas.
The use of raingardens for impervious roofing and ground areas will be treated via bioretention.

Melbourne Water recommends that proposed developments provide a Water Sensitive Urban Design Response with the following objectives (as outlined in Clause 22.18 Stormwater Treatment Policy):
To improve stormwater discharge quality:

- Suspended Solids – 80% retention of typical urban annual load
- Total Nitrogen – 45% retention of typical urban annual load
- Total Phosphorus – 45% retention of typical urban annual load
- Litter – 70% reduction of typical urban annual load

To promote stormwater re-use
To mitigate the detrimental effect of development on downstream waterways
To reintegrate urban water into the landscape to facilitate benefits such as microclimate cooling, local habitat and provision of attractive spaces for community use and well-being
To minimise peak stormwater flows and stormwater pollutants

A development is required to demonstrate that it meets the objectives of the clause by either:

- Meeting a 100% or higher rating on the STORM rating tool; or
- Meeting the required discharge quality using the MUSIC rating tool

Additionally, adequate maintenance and management procedures are required to ensure the stormwater treatment / reuse measures work as intended

5.2 STORM ASSESSMENT

A Melbourne Water STORM assessment on the property has been undertaken in order to demonstrate compliance with best practice stormwater treatment objectives as set out in the Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO, 1997).

Stormwater Treatment Objective – Relative Measure (STORM) was developed by Melbourne Water to simplify the analysis of stormwater treatment methods within a development. The calculator assesses Water Sensitive Urban Design (WSUD) measures on project sites and delivers a percentage result, determining whether best practice targets have been achieved. A score of 100% or higher means the treatment features meet all objectives.

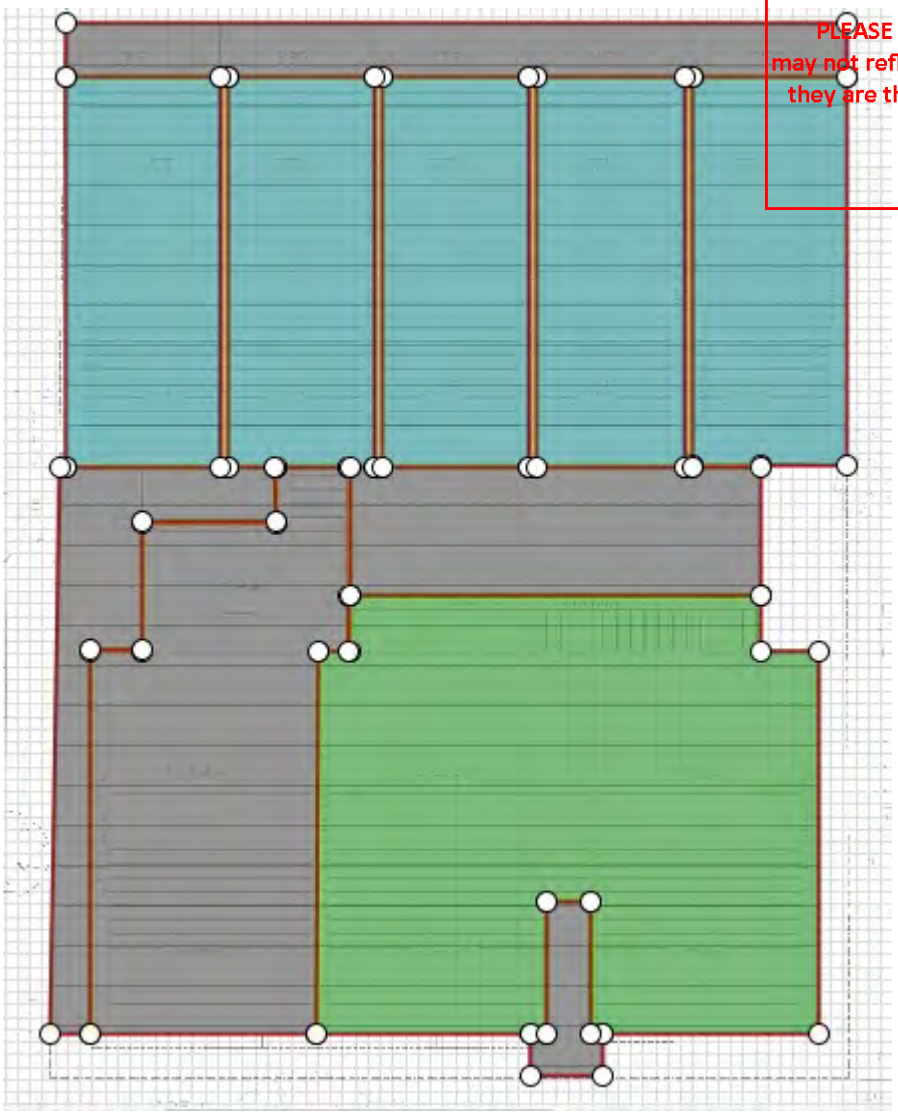
Melbourne Water STORM Rating Report

TransactionID: 982917
Municipality: WYNDHAM (North/East of Skeleton Ck)
Rainfall Station: WYNDHAM (North/East of Skeleton Ck)
Address: 18 - 20 Cottrell street

Werribee
VIC 3030
Assessor: Odin Solutions
Development Type: Residential - Multiunit
Allotment Site (m2): 1,076.00
STORM Rating %: 103

Description	Impervious Area (m2)	Treatment Type	Treatment Area/Volume (m2 or L)	Occupants / Number Of Bedrooms	Treatment %	Tank Water Supply Reliability (%)
Dwelling 10 RWT	74.33	Rainwater Tank	2,000.00	4	170.00	82.00
Dwelling 11 RWT	69.98	Rainwater Tank	2,000.00	4	170.00	82.00
Dwelling 12 RWT	69.98	Rainwater Tank	2,000.00	4	170.00	82.00
Dwelling 13 RWT	69.98	Rainwater Tank	2,000.00	4	170.00	82.00
Dwelling 14 RWT	74.33	Rainwater Tank	2,000.00	4	170.00	82.00
Apartment RG	83.02	Raingarden 100mm	2.00	0	129.95	0.00
Balconies	42.65	None	0.00	0	0.00	0.00
Untreated Roof	123.30	None	0.00	0	0.00	0.00
Concrete	87.06	None	0.00	0	0.00	0.00

Rainwater Catchment Areas



Legend

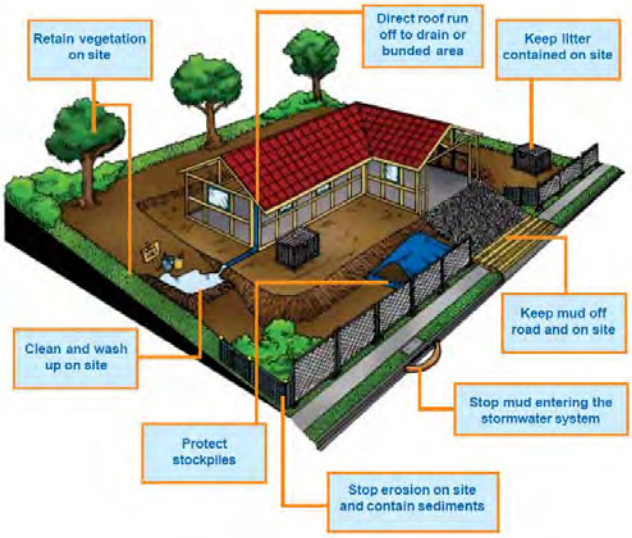
Description	Quantity	Unit
Rainwater Tanks	358.60	m^2
Raingardens	83.08	m^2
Impervious Areas	253.01	m^2

5.2 Construction Site Management Plan

The following requirements are to be met during onsite works to prevent excessive pollutants entering the local waterways.

- Temporary drains are to be installed to minimise overland water flows and prevent erosion, especially in areas where water is likely to pool;
- Temporary silt fences are to be installed on the lower end of the site to prevent excessive sedimentation from entering the stormwater system;
- Temporary side entry filters to be installed to council stormwater pits to prevent sediment entering the stormwater system at the kerb inlet;
- Stockpiles to be located away from the predominant overland stormwater pathway;
- All site litter to be collected and placed in bins (covered if appropriate) so that it cannot end up in the stormwater systems; and
- Waste bins to be provided onsite for workers.
- Least 30% of the existing building to be re-used; though recycling target of 70% (mass) for all demolition and construction waste to be considered.

The builder will follow the process outlined in "Keeping Our Stormwater Clean - A Builder's Guide"



Copies of “Keeping Our Stormwater Clean – A Builder’s Guide” booklet can be obtained from Melbourne Water by ringing on 131 722 or can be downloaded from the following website.

https://www.melbournewater.com.au/sites/default/files/Keeping-our-stormwater-clean-builders-guidelines.pdf

5.3 Maintenance Requirements

The following maintenance measures are required to be undertaken at 6 monthly intervals, when it is evident that a blockage has occurred or after a storm event. The individual property owners are responsible for the maintenance of the stormwater system.

- All screens to be checked for blockages and cleaned if necessary
- Sweep, wet vacuum or pressure hose courtyards and laneways to remove accumulated sediment and debris.
- Clear any drainage pipes in the courtyards and laneways that direct water to the stormwater system.

If used; all pumps or specialist equipment to be installed as part of this system are to be maintained in accordance with the manufacturer’s specifications.

6 MANAGEMENT, MAINTENANCE & MONITORING

To ensure that the initiatives outlined in this report are implemented and maintained over time a copy this report will be provided to the owners' corporation.

Inefficiently performing services impact on indoor environment qualities and may increase running costs and greenhouse gas emissions. The owners' corporation will monitor all sustainability initiatives on-site, and will schedule regular fine-tuning of building services and their ongoing maintenance, ensuring the building's maximum environmental performance is achieved at all times.

This development includes a wide range of holistic sustainability measures which have been carefully integrated into the design of the development so that the residents will have the opportunity to reduce their ecological footprint without compromising their quality of life. The proposed design and site specific initiatives will contribute to Wyndham City Council's sustainable development vision.

7 APPENDICES

7.1 APPENDIX A: PRELIMINARY 6 STAR ENERGY RATING RESULTS

The thermal performance of dwellings is assessed using FirstRate5, an energy modelling software programme that rates dwellings on a 10 star scale. Using Accurate (a nationally recognised energy benchmarking tool) to rate dwellings based on climate zone, building orientation, construction materials and building sealing. Victorian multi dwelling developments are required to achieve an average of 6 stars with a minimum of 5 stars to comply with the NCC.

This development achieves an average NatHERS Star Rating of 6.6. All relevant design features have been included in the energy calculations, such as orientation, form, shading, building fabric and glazing.

BUILDING MATERIALS (APARTMENTS 1 TO 6)

Building Element	Construction Assumptions	Added R-Value
Wall Insulation	Various cladding Added R1.5 bulk insulation	R1.5
	Lightweight party walls Between dwellings Added R1.5 bulk insulation	R1.5
Roof Insulation	N/A	
Window Frames	Aluminium	

BUILDING MATERIALS (APARTMENTS 7 TO 9 & TOWNHOUSES)

Building Element	Construction Assumptions	Added R-Value
Wall Insulation	Various cladding Added R1.5 bulk insulation	R1.5
	Lightweight party walls Between dwellings Added R1.5 bulk insulation	R1.5
Roof Insulation	Added minimum R3.5 bulk insulation at ceiling level & R1.3 minumum 'Bradford Anticon' or simular glasswool blanket.	R3.5
Window Frames	Aluminium	

GLAZING

Window Type	Window Parameters		
	U –Value (W/m2K)	SHGC	Typical Glazing Solution
Fixed Windows	≤ 6.23	0.66	Single glazed clear
Awning Windows	≤ 6.23	0.66	Single glazed clear
Fixed Windows	≤ 3.79	0.60	Double glazed clear
Awning Windows	≤ 3.79	0.60	Double glazed clear
Sliding Doors	≤ 4.06	0.62	Double glazed clear

GENERAL RATING INPUTS

Element	Description
Floor Coverings	- Floating timber to kitchens, living areas and corridors - Carpet to bedrooms - Tiles to bathrooms
Down Lights	- Recessed LED 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
Draught Proofing	- Weather strips to all entry and external doors and windows - Sealed exhaust fans

	Star Rating	Energy Usage (MJ/m2)		
		Total	Heating	Cooling
Dwelling 1	7.6	77.0	71.7	5.3
Dwelling 2	7.3	89.4	86.8	2.6
Dwelling 3	6.4	121.9	113.7	8.2
Dwelling 4	7.8	71.0	65.6	5.4
Dwelling 5	8.3	55.4	52.2	3.2
Dwelling 6	8.2	57.1	48.4	8.7
Dwelling 7	7.0	98.3	88.3	10.0
Dwelling 8	7.2	91.8	85.3	6.5
Dwelling 9	7.2	91.3	76.8	14.5
Dwelling 10	6.4	120.9	92.2	28.7
Dwelling 11	7.6	77.5	52.1	25.4
Dwelling 12	7.6	76.8	51.9	24.9
Dwelling 13	7.7	76.5	51.8	24.7
Dwelling 14	7.0	98.4	65.0	33.4
Estimated Average	**7.4**	**80.9**	**71.6**	**14.4**

The energy ratings detailed above shows that the development meets the standard required by the National Construction Code (NCC) of Australia 2019 in relation to residential energy efficiency.

7.2 APPENDIX B: BUILT ENVIRONMENT SUSTAINABILITY SCORECARD (BESS) REPORT

BESS Report

This BESS report outlines the sustainable design commitments of the proposed development at 18 Cottrell St Werribee VIC 3030. The BESS report and accompanying documents and evidence are submitted in response to the requirement for a Sustainable Design Assessment or Sustainability Management Plan at Wyndham City Council.

Note that where a Sustainability Management Plan is required, the BESS report must be accompanied by a report that further demonstrates the development's potential to achieve the relevant environmental performance outcomes and documents the means by which the performance outcomes can be achieved.

18 Cottrell St, Werribee 3030 Werribee

Site area: 1076 m^2 · Building Floor Area: 1543 m^2 ·
Date of Assessment: 26 Jun 2020 ·
Version: V5, 1.6.2-B.286 ·
Applicant: odinsolutions@outlook.com

Project Identifier
16358786

Published
http://bess.net.au/projects/16358786-V1

Your BESS score is

+ 70%

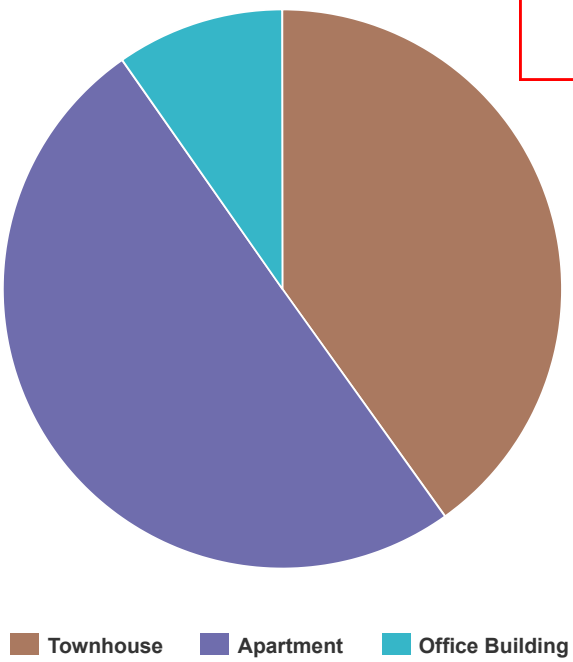
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

50% + Best Practice

70% + Excellence

% of Total	Category	Score	Pass
4 %	Management	100 %	
5 %	Water	57 %	✔
19 %	Energy	70 %	✔
14 %	Stormwater	100 %	✔
16 %	IEQ	98 %	✔
5 %	Transport	52 %	
6 %	Waste	100 %	
2 %	Urban Ecology	34 %	
0 %	Innovation	0 %	

Building Composition



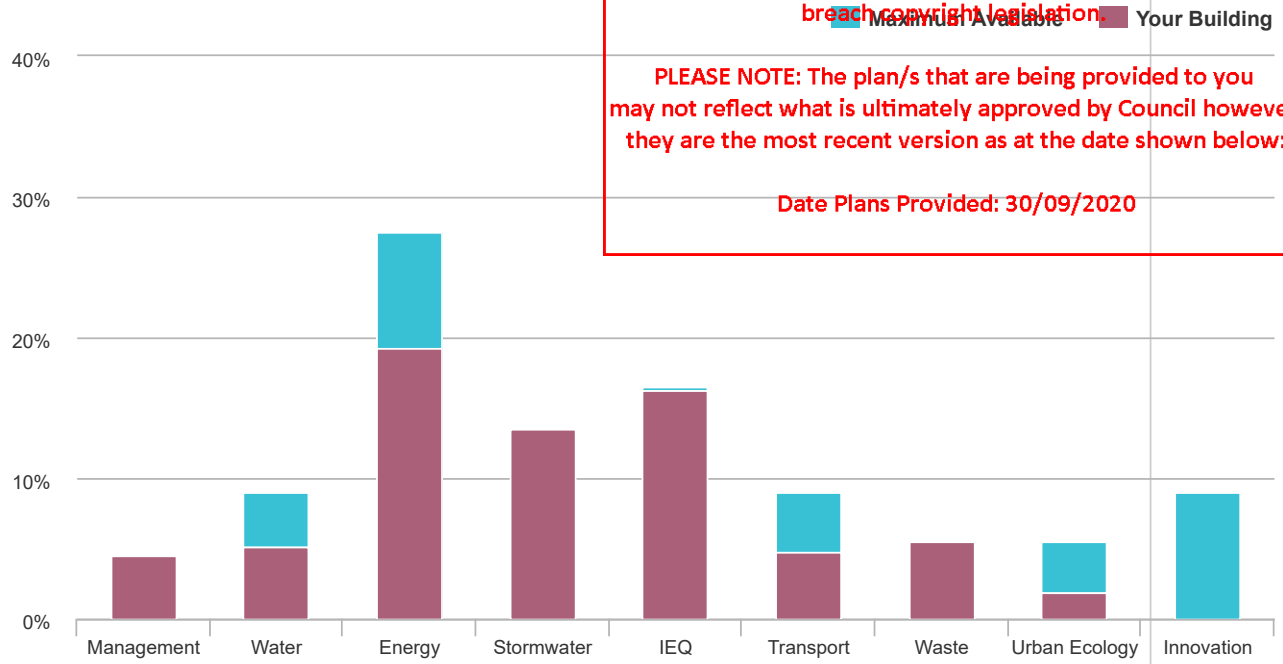
Dwellings

Type	Name	Quantity	Area
Apartment	Dwelling 1	1	84 m²
Apartment	Dwelling 2	1	90 m²
Apartment	Dwelling 3	1	84 m²
Apartment	Dwelling 4	1	84 m²
Apartment	Dwelling 5	1	90 m²
Apartment	Dwelling 6	1	84 m²
Apartment	Dwelling 7	1	84 m²
Apartment	Dwelling 8	1	90 m²
Apartment	Dwelling 9	1	84 m²
Townhouse	Dwelling 10	1	122 m²
Townhouse	Dwelling 11	1	125 m²
Townhouse	Dwelling 12	1	125 m²
Townhouse	Dwelling 13	1	125 m²
Townhouse	Dwelling 14	1	122 m²

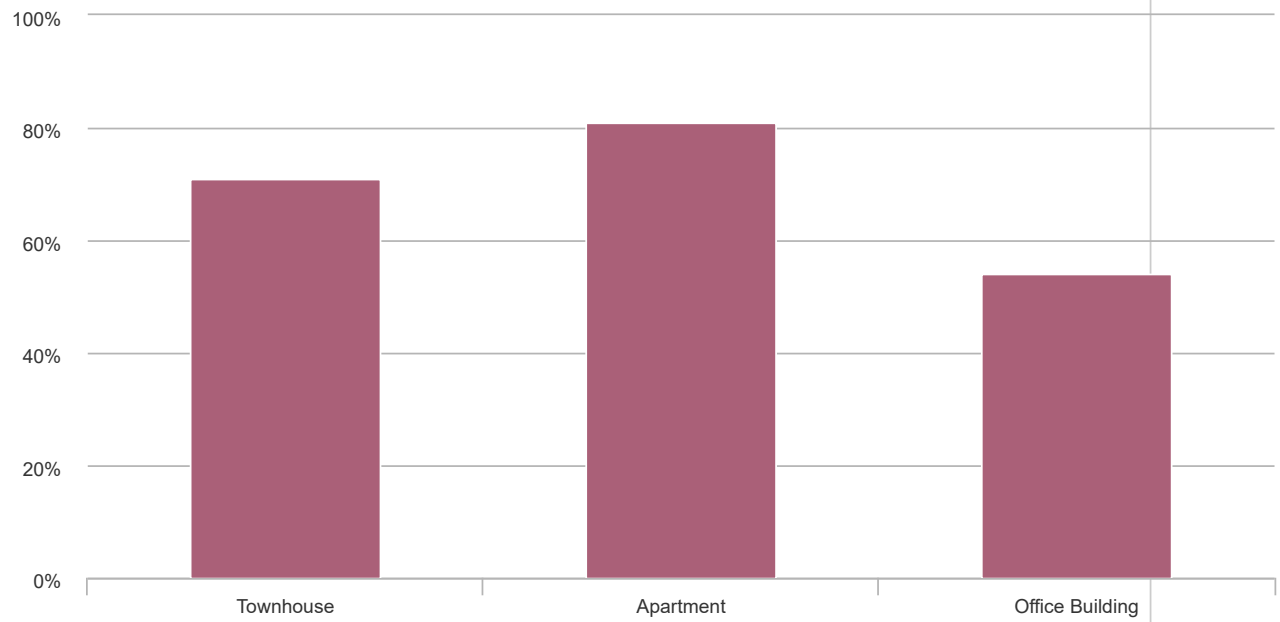
Non-Residential Spaces

Office Building	85 m²
Office Building	65 m²

How did this Development Perform in each Environmental Category?



How does each Dwelling or Non-Residential Space type perform?



Sustainable design commitments by category

The sustainable design commitments for this project are listed below. These are to be incorporated into the design documentation and subsequently implemented.

Management

100% - contributing 4% to overall score

Credit	Disabled	Scoped out	Score
Management 1.1 Pre-Application Meeting			100 %
Management 2.2 Thermal Performance Modelling - Multi-Dwelling Residential			100 %
Management 2.3 Thermal Performance Modelling - Non-Residential			100 %
Management 3.1 Metering			100 %
Management 3.2 Metering			100 %
Management 3.3 Metering			100 %
Management 4.1 Building Users Guide			100 %

Management 1.1 Pre-Application Meeting

100%

Score Contribution	This credit contributes 41.7% towards this section's score.
Aim	To encourage the involvement of suitably qualified ESD professionals in the project team from the early design stage.

Questions

Has an ESD professional been engaged to provide sustainability advice from schematic design to construction? AND Has the ESD professional been involved in a pre-application meeting with Council? *

Project wide
Yes

Management 2.2 Thermal Performance Modelling - Multi-Dwelling Residential

100%

Score Contribution	This credit contributes 25.1% towards this section's score.
Aim	To encourage and recognise developments that have used modelling to inform passive design at the early design stage

Questions

Have preliminary NatHERS ratings been undertaken for all thermally unique dwellings? *

Townhouse	Apartment
Yes	Yes

Management 2.3 Thermal Performance Modelling - Non-Residential

100%

Score Contribution	This credit contributes 2.7% towards this section's score.
Aim	To encourage and recognise developments that have used modelling to inform passive design at the early design stage

Questions

Has preliminary modelling been undertaken in accordance with either NCC2019 Section J (Energy Efficiency), NABERS or Green Star? *

Office Building

Yes

Management 3.1 Metering 100%

Score Contribution	This credit contributes 7.0% towards this section's score.
Aim	To provide building users with information that allows monitoring of energy and water consumption

Questions

Have utility meters been provided for all individual dwellings? *

Apartment

Yes

Management 3.2 Metering 100%

Score Contribution	This credit contributes 1.4% towards this section's score.
Aim	To provide building users with information that allows monitoring of energy and water consumption

Questions

Have utility meters been provided for all individual commercial tenants? *

Office Building

Yes

Management 3.3 Metering 100%

Score Contribution	This credit contributes 8.3% towards this section's score.
Aim	To provide building users with information that allows monitoring of energy and water consumption

Questions

Have all major common area services been separately submetered? *

Apartment	Office Building
Yes	Yes

Management 4.1 Building Users Guide 100%

Score Contribution	This credit contributes 13.9% towards this section's score.
Aim	To encourage and recognise initiatives that will help building users to use the building efficiently

Questions

Will a building users guide be produced and issued to occupants? *

Project wide
Yes

Water 57% - contributing 5% to overall score

Credit	Disabled	Scoped out	Score
Water 1.1 Potable water use reduction			40 %
Water 3.1 Water Efficient Landscaping			100 %
Water 4.1 Building Systems Water Use Reduction			100 %

Water Approachs

What approach do you want to use Water?	Use the built in calculation tools
Do you have a reticulated third pipe or an on-site water recycling system?	No
Are you installing a swimming pool?	No
Are you installing a rainwater tank?	Yes

Water fixtures, fittings and connections

	Dwelling 1	Dwelling 2	Dwelling 3
Showerhead	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)
Bath	Scope out	Scope out	Scope out
Kitchen Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating

	Dwelling 1	Dwelling 2	Dwelling 3
Bathroom Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Dishwashers	Default or unrated	Default or unrated	Default or unrated
WC	>= 4 Star WELS rating	>= 4 Star WELS rating	>= 4 Star WELS rating
Urinals	Scope out	Scope out	Scope out
Washing Machine Water Efficiency	Default or unrated	Default or unrated	Default or unrated
Which non-potable water source is the dwelling/space connected to?	-1	-1	-1
Non-potable water source connected to Toilets	No	No	No
Non-potable water source connected to Laundry (washing machine)	No	No	No
Non-potable water source connected to Hot Water System	No	No	No

	Dwelling 4	Dwelling 5	Dwelling 6
Showerhead	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)
Bath	Scope out	Scope out	Scope out
Kitchen Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Bathroom Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Dishwashers	Default or unrated	Default or unrated	Default or unrated
WC	>= 4 Star WELS rating	>= 4 Star WELS rating	>= 4 Star WELS rating
Urinals	Scope out	Scope out	Scope out
Washing Machine Water Efficiency	Default or unrated	Default or unrated	Default or unrated
Which non-potable water source is the dwelling/space connected to?	-1	-1	-1
Non-potable water source connected to Toilets	No	No	No
Non-potable water source connected to Laundry (washing machine)	No	No	No
Non-potable water source connected to Hot Water System	No	No	No

	Dwelling 7	Dwelling 8	Dwelling 9
Showerhead	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)
Bath	Scope out	Scope out	Scope out

	Dwelling 7	Dwelling 8	Dwelling 9
Kitchen Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Bathroom Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Dishwashers	Default or unrated	Default or unrated	Default or unrated
WC	>= 4 Star WELS rating	>= 4 Star WELS rating	>= 4 Star WELS rating
Urinals	Scope out	Scope out	Scope out
Washing Machine Water Efficiency	Default or unrated	Default or unrated	Default or unrated
Which non-potable water source is the dwelling/space connected to?	-1	-1	-1
Non-potable water source connected to Toilets	No	No	No
Non-potable water source connected to Laundry (washing machine)	No	No	No
Non-potable water source connected to Hot Water System	No	No	No

	Dwelling 10	Dwelling 11	Dwelling 12
Showerhead	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)
Bath	Medium Sized Contemporary Bath	Medium Sized Contemporary Bath	Medium Sized Contemporary Bath
Kitchen Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Bathroom Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Dishwashers	Default or unrated	Default or unrated	Default or unrated
WC	>= 4 Star WELS rating	>= 4 Star WELS rating	>= 4 Star WELS rating
Urinals	Scope out	Scope out	Scope out
Washing Machine Water Efficiency	Default or unrated	Default or unrated	Default or unrated
Which non-potable water source is the dwelling/space connected to?	Dwelling 10 RWT	Dwelling 11 RWT	Dwelling 12 RWT
Non-potable water source connected to Toilets	Yes	Yes	Yes
Non-potable water source connected to Laundry (washing machine)	Yes	Yes	Yes
Non-potable water source connected to Hot Water System	No	No	No

	Dwelling 13	Dwelling 14	Commercial 1
Showerhead	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)	4 Star WELS (>= 4.5 but <= 6.0)

	Dwelling 13	Dwelling 14	Commercial 1
Bath	Medium Sized Contemporary Bath	Medium Sized Contemporary Bath	Scope out
Kitchen Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Bathroom Taps	>= 5 Star WELS rating	>= 5 Star WELS rating	>= 5 Star WELS rating
Dishwashers	Default or unrated	Default or unrated	Default or unrated
WC	>= 4 Star WELS rating	>= 4 Star WELS rating	>= 4 Star WELS rating
Urinals	Scope out	Scope out	Scope out
Washing Machine Water Efficiency	Default or unrated	Default or unrated	Default or unrated
Which non-potable water source is the dwelling/space connected to?	Dwelling 13 RWT	Dwelling 14 RWT	-1
Non-potable water source connected to Toilets	Yes	Yes	No
Non-potable water source connected to Laundry (washing machine)	Yes	Yes	No
Non-potable water source connected to Hot Water System	No	No	No

	Commercial 2
Showerhead	4 Star WELS (>= 4.5 but <= 6.0)
Bath	Scope out
Kitchen Taps	>= 5 Star WELS rating
Bathroom Taps	>= 5 Star WELS rating
Dishwashers	Default or unrated
WC	>= 4 Star WELS rating
Urinals	Scope out
Washing Machine Water Efficiency	Default or unrated
Which non-potable water source is the dwelling/space connected to?	-1
Non-potable water source connected to Toilets	No
Non-potable water source connected to Laundry (washing machine)	No
Non-potable water source connected to Hot Water System	No

Rainwater Tanks

	Dwelling 10 RWT	Dwelling 11 RWT	Dwelling 12 RWT
Name	Dwelling 10 RWT	Dwelling 11 RWT	Dwelling 12 RWT
What is the total roof area connected to the rainwater tank? Square Metres	74.3	70.0	70.0

	Dwelling 10 RWT	Dwelling 11 RWT	Dwelling 12 RWT
Tank Size Litres	2000.0	2000.0	2000.0
Is connected irrigation area a water efficient garden?	No	No	No

	Dwelling 13 RWT	Dwelling 14 RWT
Name	Dwelling 13 RWT	Dwelling 14 RWT
What is the total roof area connected to the rainwater tank? Square Metres	70.0	74.3
Tank Size Litres	2000.0	2000.0
Is connected irrigation area a water efficient garden?	No	No

Water 1.1 Potable water use reduction 40%

Score Contribution	This credit contributes 71.4% towards this section's score.
Aim	Water 1.1 Potable water use reduction (interior uses) What is the reduction in total water use due to efficient fixtures, appliances, and rainwater use? To achieve points in this credit there must be >25% potable water reduction. You are using the built in calculation tools. This credit is calculated from information you have entered above.
Criteria	What is the reduction in total potable water use due to efficient fixtures, appliances, rainwater use and recycled water use? To achieve points in this credit there must be >25% potable water reduction.

Calculations

Reference (kL) *

Project wide

2495

Proposed (excluding rainwater and recycled water use) (kL) *

Project wide

1947

Rainwater or recycled water supplied (Internal + External) (kL) *

Project wide

179

Proposed (including rainwater and recycled water use) (kL) *

Project wide

1767

% Reduction in Potable Water Consumption * Percentage %

Project wide

29 %

Water 3.1 Water Efficient Landscaping 100%

Score Contribution	This credit contributes 14.3% towards this section's score.
Aim	Are water efficiency principles used for landscaped areas? This includes low water use plant selection (e.g. xeriscaping). Note: food producing landscape areas and irrigation areas connected to rainwater or an alternative water source are excluded from this section.

Questions

Will water efficient landscaping be installed? *

Project wide
Yes

Water 4.1 Building Systems Water Use Reduction 100%

Score Contribution	This credit contributes 14.3% towards this section's score.
Aim	Will the project minimise water use for building systems such as evaporative cooling and fire testing systems?

Questions

Where applicable, have measures been taken to reduce potable water consumption by >80% in the buildings air-conditioning chillers and when testing fire safety systems? *

Project wide
Yes

Energy 70% - contributing 19% to overall score

Credit	Disabled	Scoped out	Score
Energy 1.1 Thermal Performance Rating - Non-Residential			37 %
Energy 1.2 Thermal Performance Rating - Residential			[illegible] %
Energy 2.1 Greenhouse Gas Emissions			100 %
Energy 2.2 Peak Demand			0 %
Energy 2.3 Electricity Consumption			100 %
Energy 2.4 Gas Consumption			100 %

Energy 2.5 Wood Consumption	N/A
Energy 3.1 Carpark Ventilation	100 %
Energy 3.2 Hot Water	100 %
Energy 3.3 External Lighting	100 %
Energy 3.4 Clothes Drying	100 %
Energy 3.5 Internal Lighting - Residential Single Dwelling	100 %
Energy 3.6 Internal Lighting - Residential Multiple Dwellings	100 %
Energy 3.7 Internal Lighting - Non-Residential	100 %
Energy 4.1 Combined Heat and Power (cogeneration / trigeneration)	N/A

Use the BESS Deem to Satisfy (DtS) method for Energy?	Yes
Do all exposed floors and ceilings (forming part of the envelope) demonstrate a minimum 10% improvement in required NCC2019 insulation levels (total R-value upwards and downwards)?	Yes
Does all wall and glazing demonstrate meeting the required NCC2019 facade calculator (or better than the total allowance)?	Yes
Are heating and cooling systems within one Star of the most efficient equivalent capacity unit available, or Coefficient of Performance (CoP) & Energy Efficiency Ratios (EER) not less than 85% of the CoP & EER of the most efficient equivalent capacity unit available?	Yes
Are water heating systems within one star of the best available, or 85% or better than the most efficient equivalent capacity unit?	Yes

Dwellings Energy Approachs

What approach do you want to use for Energy?	Use the built in calculation tools
Are you installing a solar photovoltaic (PV) system?	Yes
Are you installing any other renewable energy system(s)?	No
Gas supplied into building	Natural Gas
Are you installing a cogeneration or trigeneration system?	No

Dwelling Energy Profiles

	Dwelling 1	Dwelling 2	Dwelling 3
Below the floor is	Another Occupancy	Another Occupancy	Another Occupancy
Above the ceiling is	Another Occupancy	Another Occupancy	Another Occupancy
Exposed sides	2	1	2
NatHERS Annual Energy Loads - Heat MJ/sqm	71.7	86.8	113.7
NatHERS Annual Energy Loads - Cool MJ/sqm	5.3	2.6	8.2
NatHERS star rating	7.6	7.3	6.4

	Dwelling 1	Dwelling 2	Dwelling 3
Type of Heating System	D Reverse cycle space	D Reverse cycle space	D Reverse cycle space
Heating System Efficiency	5 Star	5 Star	5 Star
Type of Cooling System	Refrigerative space	Refrigerative space	Refrigerative space
Cooling System Efficiency	5 Stars	5 Stars	5 Stars
Type of Hot Water System	F Gas Storage 5 star	F Gas Storage 5 star	F Gas Storage 5 star
Central Hot Water System	No	No	No
Clothes Line	D Private outdoor clothesline	D Private outdoor clothesline	D Private outdoor clothesline
Clothes Dryer	A No clothes dryer	A No clothes dryer	A No clothes dryer

	Dwelling 4	Dwelling 5	Dwelling 6
Below the floor is	Another Occupancy	Another Occupancy	Another Occupancy
Above the ceiling is	Another Occupancy	Another Occupancy	Another Occupancy
Exposed sides	2	1	2
NatHERS Annual Energy Loads - Heat MJ/sqm	65.6	52.2	48.4
NatHERS Annual Energy Loads - Cool MJ/sqm	5.4	3.2	8.7
NatHERS star rating	7.8	8.3	8.2
Type of Heating System	D Reverse cycle space	D Reverse cycle space	D Reverse cycle space
Heating System Efficiency	5 Star	5 Star	5 Star
Type of Cooling System	Refrigerative space	Refrigerative space	Refrigerative space
Cooling System Efficiency	5 Stars	5 Stars	5 Stars
Type of Hot Water System	F Gas Storage 5 star	F Gas Storage 5 star	F Gas Storage 5 star
Central Hot Water System	No	No	No
Clothes Line	D Private outdoor clothesline	D Private outdoor clothesline	D Private outdoor clothesline
Clothes Dryer	A No clothes dryer	A No clothes dryer	A No clothes dryer

	Dwelling 7	Dwelling 8	Dwelling 9
Below the floor is	Another Occupancy	Another Occupancy	Another Occupancy
Above the ceiling is	Outside	Outside	Outside
Exposed sides	2	1	2
NatHERS Annual Energy Loads - Heat MJ/sqm	88.3	85.3	76.8
NatHERS Annual Energy Loads - Cool MJ/sqm	10.0	6.5	14.5
NatHERS star rating	7.0	7.2	7.2
Type of Heating System	D Reverse cycle space	D Reverse cycle space	D Reverse cycle space

	Dwelling 7	Dwelling 8	Dwelling 9
Heating System Efficiency	5 Star	5 Star	5 Star
Type of Cooling System	Refrigerative space	Refrigerative space	Refrigerative space
Cooling System Efficiency	5 Stars	5 Stars	5 Stars
Type of Hot Water System	F Gas Storage 5 star	F Gas Storage 5 star	F Gas Storage 5 star
Central Hot Water System	No	No	No
Clothes Line	D Private outdoor clothesline	D Private outdoor clothesline	D Private outdoor clothesline
Clothes Dryer	A No clothes dryer	A No clothes dryer	A No clothes dryer

	Dwelling 10	Dwelling 11	Dwelling 12
Below the floor is	Ground or Carpark	Ground or Carpark	Ground or Carpark
Above the ceiling is	Outside	Outside	Outside
Exposed sides	2	1	1
NatHERS Annual Energy Loads - Heat MJ/sqm	92.2	52.1	51.9
NatHERS Annual Energy Loads - Cool MJ/sqm	28.7	25.4	24.9
NatHERS star rating	6.4	7.6	7.6
Type of Heating System	D Reverse cycle space	D Reverse cycle space	D Reverse cycle space
Heating System Efficiency	5 Star	5 Star	5 Star
Type of Cooling System	Refrigerative space	Refrigerative space	Refrigerative space
Cooling System Efficiency	5 Stars	5 Stars	5 Stars
Type of Hot Water System	I Gas Instantaneous 5 star	I Gas Instantaneous 5 star	I Gas Instantaneous 5 star
Central Hot Water System	No	No	No
Clothes Line	D Private outdoor clothesline	D Private outdoor clothesline	D Private outdoor clothesline
Clothes Dryer	A No clothes dryer	A No clothes dryer	A No clothes dryer

	Dwelling 13	Dwelling 14
Below the floor is	Ground or Carpark	Ground or Carpark
Above the ceiling is	Outside	Outside
Exposed sides	1	2
NatHERS Annual Energy Loads - Heat MJ/sqm	51.8	65.0
NatHERS Annual Energy Loads - Cool MJ/sqm	24.7	33.4
NatHERS star rating	7.7	7.0
Type of Heating System	D Reverse cycle space	D Reverse cycle space
Heating System Efficiency	5 Star	5 Star
Type of Cooling System	Refrigerative space	Refrigerative space

	Dwelling 13	Dwelling 14
Cooling System Efficiency	5 Stars	5 Stars
Type of Hot Water System	I Gas Instantaneous 5 Star	A Gas Instantaneous 5 Star
Central Hot Water System	No	No
Clothes Line	D Private outdoor clothesline	D Private outdoor clothesline
Clothes Dryer	A No clothes dryer	A No clothes dryer

Energy 1.1 Thermal Performance Rating - Non-Residential 37%

Score Contribution	This credit contributes 3.6% towards this section's score.
Aim	Reduce reliance on mechanical systems to achieve thermal comfort in summer and winter - improving comfort, reducing greenhouse gas emissions, energy consumption, and maintenance costs.
Criteria	What is the % reduction in heating and cooling energy consumption against the reference case (NCC 2019 Section J)?

Energy 1.2 Thermal Performance Rating - Residential 50%

Score Contribution	This credit contributes 25.2% towards this section's score.
Aim	Reduce reliance on mechanical systems to achieve thermal comfort in summer and winter - improving comfort, reducing greenhouse gas emissions, energy consumption, and maintenance costs.
Criteria	What is the average NatHERS rating?

Calculations

Average NATHERS Rating (Weighted) * Stars

Townhouse	Apartment
7.3	7.4

Energy 2.1 Greenhouse Gas Emissions 100%

Score Contribution	This credit contributes 9.3% towards this section's score.
Aim	Reduce the building's greenhouse gas emissions.
Criteria	What is the % reduction in annual greenhouse gas emissions against the benchmark?

Calculations

Reference Building with Reference Services (BCA only) * kg CO_2

Townhouse	Apartment
36795.1	48525.4

Proposed Building with Proposed Services (Actual Building) * kg CO2

Townhouse	Apartment
10083.1	12900.2

% Reduction in GHG Emissions * Percentage %

Townhouse	Apartment
72 %	73 %

Energy 2.2 Peak Demand 10%

Score Contribution	This credit contributes 4.7% towards this section's score.
Aim	Reduce demand on electrical infrastructure during peak cooling periods
Criteria	What is the % reduction in the instantaneous (peak-hour) demand against the benchmark?

Calculations

Peak Thermal Cooling Load - Baseline * kW

Townhouse	Apartment
91.0	101.8

Peak Thermal Cooling Load - Proposed * kW

Townhouse	Apartment
81.4	93.9

Peak Thermal Cooling Load - % Reduction * Percentage %

Townhouse	Apartment
10 %	7 %

Energy 2.3 Electricity Consumption 100%

Score Contribution	This credit contributes 9.3% towards this section's score.
Aim	Reduce consumption of electricity
Criteria	What is the % reduction in annual electricity consumption against the benchmark?

Calculations

Reference * kWh

Townhouse	Apartment
31745.5	41313.3

Proposed * kWh

Townhouse	Apartment
6687.9	7296.0

Improvement * Percentage %

Townhouse	Apartment
78 %	82 %

Energy 2.4 Gas Consumption 100%

Score Contribution	This credit contributes 9.3% towards this section's score.
Aim	Reduce consumption of gas
Criteria	What is the % reduction in annual gas consumption against the benchmark?

Calculations

Reference * MJ

Townhouse	Apartment
85889.9	124237.3

Proposed * MJ

Townhouse	Apartment
63452.2	106192.2

Improvement * Percentage %

Townhouse	Apartment
26 %	14 %

Energy 2.5 Wood Consumption N/A

This credit was scoped out: No wood heating system present

Aim	Reduce consumption of wood
Criteria	Is the annual wood consumption >10% below the benchmark?

Energy 3.1 Carpark Ventilation 100%

Score Contribution	This credit contributes 9.3% towards this section's score.

Questions

If you have an enclosed carpark, is it: (a) fully naturally ventilated (no mechanical ventilation system) or (b) 40 car spaces or less with Carbon Monoxide monitoring to control the operation and speed of the ventilation fans? *

Project wide
Yes

Energy 3.2 Hot Water 100%

Score Contribution	This credit contributes 4.7% towards this section's score.
Criteria	What is the % reduction in annual hot water system energy use (gas and electricity) against the benchmark?

Calculations

Reference * kWh

Townhouse	Apartment
23858.3	34510.4

Proposed * kWh

Townhouse	Apartment
17937.8	29497.8

Improvement * Percentage %

Townhouse	Apartment
24 %	14 %

Energy 3.3 External Lighting 100%

Score Contribution	This credit contributes 1.9% towards this section's score.

Questions

Is the external lighting controlled by a motion detector? *

Townhouse
Yes

Energy 3.4 Clothes Drying 100%

Score Contribution	This credit contributes 4.2% towards this section's score.
Criteria	Does the combination of clothes lines and efficient dryers reduce energy (gas+electricity) consumption by more than 10%?

Calculations

Reference * kWh

Townhouse	Apartment
3086.7	4598.5

Proposed * kWh

Townhouse	Apartment
617.3	919.7

Improvement * Percentage %

Townhouse	Apartment
80 %	80 %

Energy 3.5 Internal Lighting - Residential Single Dwelling 100%

Score Contribution	This credit contributes 1.9% towards this section's score.
Aim	Reduce energy consumption associated with internal lighting

Questions

Does the development achieve a maximum illumination power density of 4W/sqm or less? *

Townhouse
Yes

Energy 3.6 Internal Lighting - Residential Multiple Dwellings 100%

Score Contribution	This credit contributes 4.7% towards this section's score.
Aim	Reduce energy consumption associated with internal lighting

Questions

Is the maximum illumination power density (W/m2) in at least 90% of the relevant building class at least 20% lower than required by Table J6.2a of the NCC 2019 Vol 1 (Class 2-9) and Clause 3.12.5.5 NCC 2019 Vol 2 (Class 1 & 10)? *

Apartment
Yes

Energy 3.7 Internal Lighting - Non-Residential 100%

Score Contribution	This credit contributes 0.9% towards this section's score.
Aim	Reduce energy consumption associated with internal lighting

Questions

Does the maximum illumination power density (W/m2) in at least 90% of the area of the relevant building class meet the requirements in Table J6.2a of the NCC 2019 Vol 1? *

Office Building
Yes

Energy 4.1 Combined Heat and Power (cogeneration / trigeneration) N/A

This credit was scoped out: No cogeneration or trigeneration system in use.

This credit was disabled: No cogeneration or trigeneration system in use.

Aim	Reduce energy consumption
Criteria	Does the CHP system reduce the class of buildings GHG emissions by more than 25%?

Stormwater 100% - contributing 14% to overall score

Credit	Disabled	Scoped out	Score
Stormwater 1.1 Stormwater Treatment			100 %

Which stormwater modelling are you using?	Melbourne Water STORM tool

Stormwater 1.1 Stormwater Treatment 100%

Score Contribution	This credit contributes 100.0% towards this section's score.
Aim	To achieve best practice stormwater quality objectives through reduction of pollutant load (suspended solids, nitrogen & phosphorus)
Criteria	Has best practice stormwater management been demonstrated?

Questions

STORM score achieved *

Project wide

100

Calculations

Min STORM Score *

Project wide

100

IEQ

98% - contributing 16% to overall score

Credit	Disabled	Scoped out	Score
IEQ 1.1 Daylight Access - Living Areas			100 %
IEQ 1.2 Daylight Access - Bedrooms			100 %
IEQ 1.3 Winter Sunlight			100 %
IEQ 1.4 Daylight Access - Non-Residential			33 %
IEQ 1.5 Daylight Access - Minimal Internal Bedrooms			100 %
IEQ 2.1 Effective Natural Ventilation			100 %
IEQ 2.2 Cross Flow Ventilation			100 %
IEQ 3.1 Thermal comfort - Double Glazing			100 %
IEQ 3.2 Thermal Comfort - External Shading			100 %
IEQ 3.3 Thermal Comfort - Orientation			100 %

Use the BESS Deemed to Satisfy (DtS) method for IEQ?	Yes
Are all living areas and bedrooms less than 8m deep (5m if south facing)?	Yes
Do all living areas and bedrooms have a floor-to-ceiling height of at least 2.7m?	Yes
Does all glazing to living areas achieve at least 60% Visible Light Transmittance (VLT)?	Yes
Do all living areas have an external facing window (not into a courtyard, light well or other major obstruction)?	Yes
Does the building(s) comply with the requirements of the building separation tables?	Yes
What approach do you want to use for IEQ?	Use the built in calculation tools

IEQ 1.1 Daylight Access - Living Areas

100%

Score Contribution	This credit contributes 19.3% towards this section's score.
Aim	To provide a high level of amenity and energy efficiency through design for natural light.

Criteria	What % of living areas achieve a daylight factor greater than 1%

IEQ 1.2 Daylight Access - Bedrooms 100%

Score Contribution	This credit contributes 19.3% towards this section's score.
Aim	To provide a high level of amenity and energy efficiency through design for natural light.
Criteria	What % of bedrooms achieve a daylight factor greater than 0.5%

IEQ 1.3 Winter Sunlight 100%

Score Contribution	This credit contributes 6.4% towards this section's score.
Aim	To provide a high level of amenity and reduce need for artificial heating in winter.

Questions

Do 70% of dwellings receive at least 3 hours of direct sunlight in all Living areas between 9am and 3pm in mid-winter? *

Apartment

Yes

IEQ 1.4 Daylight Access - Non-Residential 33%

Score Contribution	This credit contributes 3.7% towards this section's score.
Aim	To provide a high level of amenity and energy efficiency through design for natural light.
Criteria	What % of the nominated floor area has at least 2% daylight factor?

Questions

% Achieved ? *

Office Building

30 %

IEQ 1.5 Daylight Access - Minimal Internal Bedrooms 100%

Score Contribution	This credit contributes 6.4% towards this section's score.

Aim	To provide a high level of amenity and energy efficiency through design for natural light and ventilation.

Questions

Do at least 90% of dwellings have an external window in all bedrooms? *

Apartment

Yes

IEQ 2.1 Effective Natural Ventilation 100%

Score Contribution	This credit contributes 19.3% towards this section's score.
Aim	To provide fresh air and passive cooling opportunities.
Criteria	What % of dwellings are effectively naturally ventilated?

Questions

% Achieved ? *

Apartment

100 %

IEQ 2.2 Cross Flow Ventilation 100%

Score Contribution	This credit contributes 5.1% towards this section's score.
Aim	To provide fresh air and passive cooling opportunities.

Questions

Are all habitable rooms designed to achieve natural cross flow ventilation? *

Townhouse

Yes

IEQ 3.1 Thermal comfort - Double Glazing 100%

Score Contribution	This credit contributes 10.3% towards this section's score.
Aim	To provide comfortable indoor spaces and reduce energy needed for heating and cooling

Questions

Is double glazing (or better) used to all habitable areas? *

Townhouse
Yes

IEQ 3.2 Thermal Comfort - External Shading 100%

Score Contribution	This credit contributes 5.1% towards this section's score.
Aim	To provide comfortable indoor spaces and reduce energy needed for heating and cooling

Questions

Is appropriate external shading provided to east, west and north facing glazing? *

Townhouse
Yes

IEQ 3.3 Thermal Comfort - Orientation 100%

Score Contribution	This credit contributes 5.1% towards this section's score.
Aim	To provide comfortable indoor spaces and reduce energy needed for heating and cooling

Questions

Are at least 50% of living areas orientated to the north? *

Townhouse
Yes

Transport 52% - contributing 5% to overall score

Credit	Disabled	Scoped out	Score
Transport 1.1 Bicycle Parking - Residential			100 %
Transport 1.2 Bicycle Parking - Residential Visitor			100 %
Transport 1.3 Bicycle Parking - Convenience Residential			100 %
Transport 1.4 Bicycle Parking - Non-Residential			100 %
Transport 1.5 Bicycle Parking - Non-Residential Visitor			100 %

Transport 1.1 Bicycle Parking - Residential 100%

Score Contribution	This credit contributes 21.2% towards this section's score.
Aim	To encourage and recognise initiatives that facilitate cycling
Criteria	Is there at least one secure bicycle space per dwelling?

Questions

Bicycle Spaces Provided ? *

Townhouse	Apartment
5	9

Calculations

Min Bicycle Spaces Required *

Townhouse	Apartment
5	9

Transport 1.2 Bicycle Parking - Residential Visitor 100%

Score Contribution	This credit contributes 21.2% towards this section's score.
Aim	To encourage and recognise initiatives that facilitate cycling
Criteria	Is there at least one visitor bicycle space per 5 dwellings?

Questions

Visitor Bicycle Spaces Provided ? *

Townhouse	Apartment
1	2

Calculations

Min Visitor Bicycle Spaces Required *

Townhouse	Apartment
1	2

Transport 1.3 Bicycle Parking - Convenience Residential 100%

Score Contribution	This credit contributes 5.9% towards this section's score.
Aim	To facilitate cycling by providing easily accessible parking infrastructure

Questions

Are bike parking facilities for residents located at ground level? *

Apartment

Yes

Transport 1.4 Bicycle Parking - Non-Residential 100%

Score Contribution	This credit contributes 2.3% towards this section's score.
Aim	To encourage and recognise initiatives that facilitate cycling
Criteria	Have the planning scheme requirements for employee bicycle parking been exceeded by at least 50% (or a minimum of 2 where there is no planning scheme requirement)?

Questions

Have the planning scheme requirements for employee bicycle parking been exceeded by at least 50% (or a minimum of 2 where there is no planning scheme requirement)? *

Office Building

Yes

Transport 1.5 Bicycle Parking - Non-Residential Visitor 100%

Score Contribution	This credit contributes 1.1% towards this section's score.
Aim	To encourage and recognise initiatives that facilitate cycling
Criteria	Have the planning scheme requirements for visitor bicycle parking been exceeded by at least 50% (or a minimum of 1 where there is no planning scheme requirement)?

Questions

Have the planning scheme requirements for visitor bicycle parking been exceeded by at least 50% (or a minimum of 1 where there is no planning scheme requirement)? *

Office Building

Yes

Waste 100% - contributing 6% to overall score

Credit Disabled Scoped out Score

Waste 1.1 - Construction Waste - Building Re-Use	100 %
Waste 2.1 - Operational Waste - Food & Garden Waste	100 %
Waste 2.2 - Operational Waste - Convenience of Recycling	100 %

Waste 1.1 - Construction Waste - Building Re-Use 100%

Score Contribution	This credit contributes 33.3% towards this section's score.
Aim	To recognise developments that re-use materials on-site

Questions

If the development is on a site that has been previously developed, has at least 30% of the existing building been re-used? *

Project wide

Yes

Waste 2.1 - Operational Waste - Food & Garden Waste 100%

Score Contribution	This credit contributes 33.3% towards this section's score.
Aim	To minimise organic waste going to landfill

Questions

Are facilities provided for on-site management of food and garden waste? *

Project wide

Yes

Waste 2.2 - Operational Waste - Convenience of Recycling 100%

Score Contribution	This credit contributes 33.3% towards this section's score.
Aim	To minimise recyclable material going to landfill

Questions

Are the recycling facilities at least as convenient for occupants as facilities for general waste? *

Project wide

Yes

Urban Ecology

34% - contributing 2% to overall score

Credit	Disabled	Scoped out	Score
Urban Ecology 2.1 Vegetation			50 %
Urban Ecology 2.4 Private Open Space - Balcony / Courtyard Ecology			100 %

Urban Ecology 2.1 Vegetation

50%

Score Contribution	This credit contributes 47.0% towards this section's score.
Aim	To encourage and recognise the use of vegetation and landscaping within and around developments
Criteria	How much of the site is covered with vegetation, expressed as a percentage of the total site area?

Questions

Percentage Achieved ? * Percentage %

Project wide
10 %

Urban Ecology 2.4 Private Open Space - Balcony / Courtyard Ecology

100%

Score Contribution	This credit contributes 10.6% towards this section's score.
Aim	Encourage plants to be grown on balconies and courtyards

Questions

Is there a tap and floor waste on every balcony / in every courtyard? *

Townhouse	Apartment
Yes	Yes

Innovation

0% - contributing 0% to overall score

Items to be marked on floorplans

0 / 26 floorplans & elevation notes complete.

Management 3.1: Individual utility meters annotated	Incomplete
Management 3.2: Individual utility meters annotated	Incomplete
Management 3.3: Common area submeters annotated	Incomplete
Water 3.1: Water efficient garden annotated	Incomplete
Energy 3.1: Carpark with natural ventilation or CO monitoring system	Incomplete
Energy 3.3: External lighting sensors annotated	Incomplete
Energy 3.4: Clothes line annotated (if proposed)	Incomplete
Stormwater 1.1: Location of any stormwater management systems used in STORM or MUSIC modelling (e.g. Rainwater tanks, raingarden, buffer strips)	Incomplete
IEQ 1.1: If using BESS daylight calculator, references to floorplans and elevations showing window sizes and sky angles.	Incomplete
IEQ 1.2: If using BESS daylight calculator, references to floorplans and elevations showing window sizes and sky angles.	Incomplete
IEQ 1.3: If using BESS daylight calculator, references to floorplans and elevations showing window sizes and sky angles.	Incomplete
IEQ 1.5: Floor plans with compliant bedrooms marked	Incomplete
IEQ 2.1: Dwellings meeting the requirements for being 'naturally ventilated'	Incomplete
IEQ 2.2: Dwellings meeting the requirements for having 'natural cross flow ventilation'	Incomplete
IEQ 3.1: Glazing specification to be annotated	Incomplete
IEQ 3.2: Adjustable shading systems	Incomplete
IEQ 3.3: North-facing living areas	Incomplete
Transport 1.1: All nominated residential bicycle parking spaces	Incomplete
Transport 1.2: All nominated residential visitor bicycle parking spaces	Incomplete
Transport 1.3: Residential bicycle parking spaces at ground level	Incomplete
Transport 1.4: All nominated non-residential bicycle parking spaces	Incomplete
Transport 1.5: All nominated non-residential visitor bicycle parking spaces	Incomplete
Waste 2.1: Location of food and garden waste facilities	Incomplete
Waste 2.2: Location of recycling facilities	Incomplete
Urban Ecology 2.1: Vegetated areas	Incomplete
Urban Ecology 2.4: Taps and floor waste on balconies / courtyards	Incomplete

Documents and evidence

0 / 19 supporting evidence documentation complete.

Management 2.2: Preliminary NatHERS assessments	Incomplete

Management 2.3: Preliminary modelling report	Incomplete
Energy 1.1: Energy Report showing calculations of reference case and proposed buildings	Incomplete
Energy 3.1: Provide a written explanation of either the fully natural carpark ventilation or carbon monxide monitoring, describing how these systems will work, what systems are required for them to be fully integrated and who will be responsible for their implementation throughout the design, procurement and operational phases of the building life.	Incomplete
Energy 3.5: Provide a written description of the average lighting power density to be installed in the development and specify the lighting type(s) to be used.	Incomplete
Energy 3.6: Provide a written description of the average lighting power density to be installed in the development and specify the lighting type(s) to be used.	Incomplete
Energy 3.7: Provide a written description of the average lighting power density to be installed in the development and specify the lighting type(s) to be used.	Incomplete
Stormwater 1.1: STORM report or MUSIC model	Incomplete
IEQ 1.1: If using an alternative daylight modelling program, a short report detailing assumptions used and results achieved.	Incomplete
IEQ 1.2: If using an alternative daylight modelling program, a short report detailing assumptions used and results achieved.	Incomplete
IEQ 1.3: If using an alternative daylight modelling program, a short report detailing assumptions used and results achieved.	Incomplete
IEQ 1.4: A short report detailing assumptions used and results achieved.	Incomplete
IEQ 1.5: A list of compliant bedrooms	Incomplete
IEQ 2.1: A list of naturally ventilated dwellings	Incomplete
IEQ 2.2: A list of dwellings with natural cross flow ventilation	Incomplete
IEQ 3.1: Reference to floor plans or energy modelling showing the glazing specification (U-value and Solar Heat Gain Coefficient, SHGC)	Incomplete
IEQ 3.2: Reference to floor plans and elevations showing shading devices	Incomplete
IEQ 3.3: Reference to the floor plans showing living areas orientated to the north.	Incomplete
Waste 1.1: Report detailing how the existing building is being reused on-site	Incomplete

7.3 APPENDIX C: RAINGARDEN SPECIFICATIONS

Melbourne Water

FILTER MEDIA COMPONENT NOTES:

F1. ALL FILTER MEDIA USED FOR THE WORKS IS TO BE APPROPRIATELY TESTED IN ACCORDANCE WITH THE FOLLOWING NOTES AND A COPY OF RESULTS SENT TO THE PROJECT SUPERINTENDENT PRIOR TO THE MATERIAL BEING PLACED ON SITE.

F2. FILTER MEDIA SHALL HAVE A SATURATED HYDRAULIC CONDUCTIVITY IN THE RANGE OF 250-350 mm/h UNLESS OTHERWISE APPROVED BY THE SUPERINTENDENT. SATURATED HYDRAULIC CONDUCTIVITY OF POTENTIAL FILTER MEDIA SHOULD BE MEASURED USING THE ASTM F1815-06 METHOD.

F3 FILTER EDIA, WHICH COMPLY WITH THE PARTICLE SIZE GRADING OUTLINED BELOW, WILL GENERALLY MEET SATURATED HYDRAULIC CONDUCTIVITY SPECIFICATIONS.

DESCRIPTION	PROPORTION	GRADING
CLAY & SILT	< 3 %	< 0.05 mm
VERY FINE SAND	5 - 10 %	0.05 - 0.15 mm
FINE SAND	10 - 25 %	0.15 - 0.25 mm
MEDIUM TO COARSE SAND	60 - 70 %	0.25 - 1.0 mm
COARSE SAND	7 - 10 %	1.0 - 2.0 mm
FINE GRAVEL	< 3 %	2.0 - 3.4 mm

F4 THE FILTER MEDIA SHOULD BE WELL-GRADED i.e., IT SHOULD HAVE ALL PARTICLE SIZE RANGES PRESENT FROM THE 0.075 mm TO THE 4.75 mm SIEVE (AS DEFINED BY AS1289.3.6.1 - 1995). THERE SHOULD BE NO GAP IN THE PARTICLE SIZE GRADING, AND THE COMPOSITION SHOULD NOT BE DOMINATED BY A SMALL PARTICLE SIZE RANGE.

F5. FILTER MEDIA THAT DO NOT MEET THE FOLLOWING ADAPTED AS4419 - 2003 - SOILS FOR LANDSCAPING AND GARDEN USE SPECIFICATION SHOULD BE REJECTED:

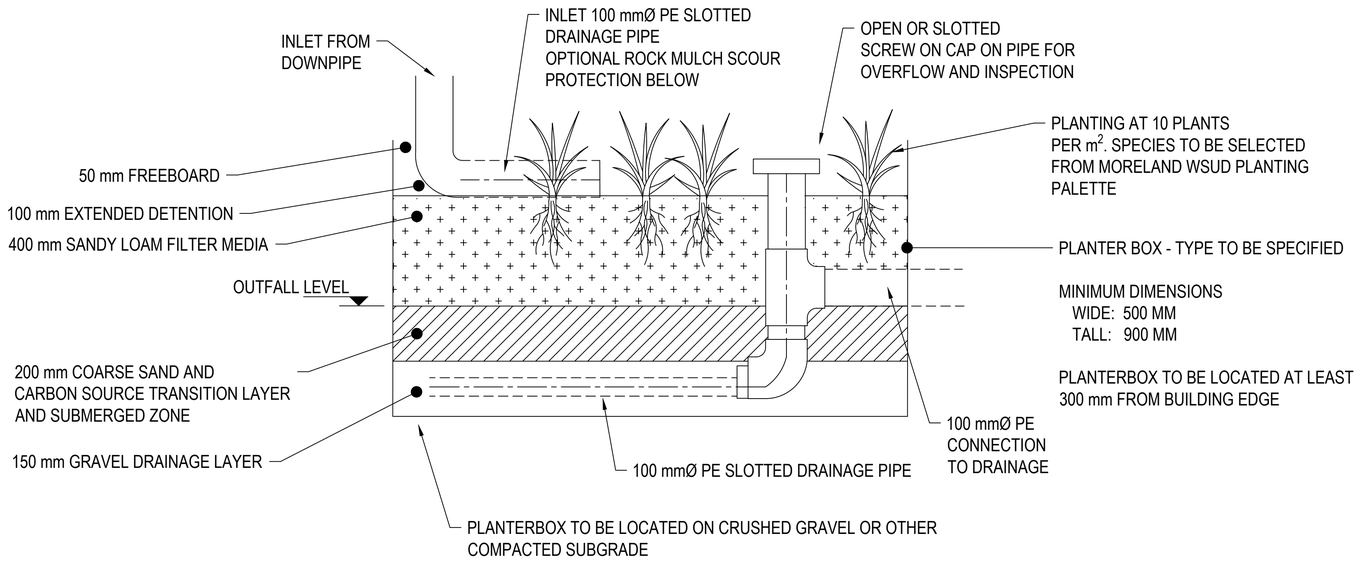
a. ORGANIC MATTER CONTENT - LESS THAN 5% (w/w). AN ORGANIC CONTENT HIGHER THAN 5% IS LIKELY TO RESULT IN LEACHING OF NUTRIENTS.
b. pH- AS SPECIFIED FOR "NATURAL SOILS AND BLENDS" 5.5 -7.5 (pH 1:5 IN WATER).
c. ELECTRICAL CONDUCTIVITY (EC) - AS SPECIFIED FOR NATURAL SOILS AND SOIL BLENDS < 1.2 dS/m.
d. PHOSPHORUS - < 100 mg/kg. SOILS WITH PHOSPHORUS CONCENTRATIONS > 100 mg/kg SHOULD BE TESTED FOR POTENTIAL LEACHING.

F6. POTENTIAL FILTER MEDIA SHOULD GENERALLY BE ASSESSED BY A HORTICULTURALIST TO ENSURE THAT THEY ARE CAPABLE OF SUPPORTING A HEALTHY VEGETATION COMMUNITY. THIS ASSESSMENT SHOULD TAKE INTO CONSIDERATION DELIVERY OF NUTRIENTS TO THE SYSTEM BY STORMWATER.

F10. THE TRANSITION LAYER SHALL CONSIST OF WASHED SAND WITH 90% PARTICLES RETAINED ABOVE 0.25mm THE HYDRAULIC CONDUCTIVITY OF THE TRANSITION LAYER IS TO BE NO LESS THAN 450mm/hr.

F12. THE DRAINAGE LAYER SHALL BE COMPOSED OF CLEAN STONE WITH ALL PARTICLES BETWEEN 4.0mm AND 7.0mm IN SIZE.

F13. SCORIA OR QUARTZ ARE NOT SUITABLE MATERIAL FOR USE AS A DRAINAGE LAYER.



PLANTER BOX RAINGARDEN CROSS SECTION

SCALE 1:10

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE
0 100 200 300 400 500mm
0 200 400 600 800 1000mm

DRAFT

rev	description	app'd	date
0			

STANDARD WSUD DRAWINGS

PLANTER BOX RAINGARDENS

scale AS SHOWN for A4 job no.
date FEB 2015 rev no. 0

approved (PD) .....

INSTRUCTION SHEET

Building a planter box raingarden (lined)

What is a planter box raingarden?

Building a raingarden is a simple way to help the environment and the health of our local waterways while providing a self-watering garden for your backyard.

A raingarden is a specially prepared garden designed to receive and filter rain run-off from roofs or hard surfaces such as driveways or paving. You can even create a raingarden in a planter box, positioning it to collect water from a diverted downpipe or rainwater tank overflow.

Featuring layers of soil for filtration, gravel for drainage, and plants that can tolerate periods without rain, a raingarden helps to protect our streams and rivers from stormwater pollutants.

With a slotted pipe beneath the soil to take away the filtered rainwater and an overflow pipe on the surface to prevent flooding, raingardens are designed to collect water from a diverted downpipe, rainwater tank overflow or pavement runoff.

Please note: A certified plumber must be used for stormwater connections and modifications.

Did you know that a raingarden is only wet during and immediately after rain, leaving it dry most of the time? This is due to the drainage and filtration properties of the soil combination used in the raingarden.

Building your raingarden

Step 1 – getting started

Location

Build your planter box as close as possible to the water source whether it be a downpipe or rainwater tank overflow. This will help minimise the additional plumbing needed to bring water to the raingarden. Your raingarden needs to sit at least 300mm away from your house.

Having decided on a location, it is important to determine the proximity of the existing stormwater pipe to make sure your raingarden is connected properly. Your local plumber can help with this and also how and when to divert your downpipe so that the area doesn't flood during construction.

Stormwater reconnection

All connections or modifications to existing stormwater pipes need to be done by a licensed plumber. The plumber should ensure that pipes are reconnected into the property's stormwater and not another services such as the sewer.

Underground services

Be aware of any underground services (gas, electricity, water) that run near your house as this may determine where you can build your raingarden. Raingardens should not be built over or in close proximity to a septic system.

Materials

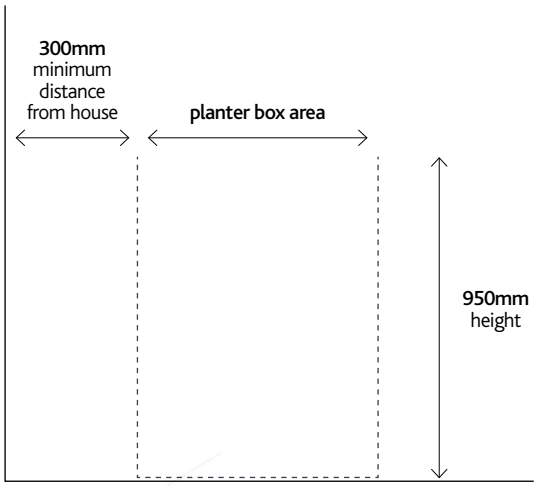
See *Materials List* for information about what you need to build a raingarden.

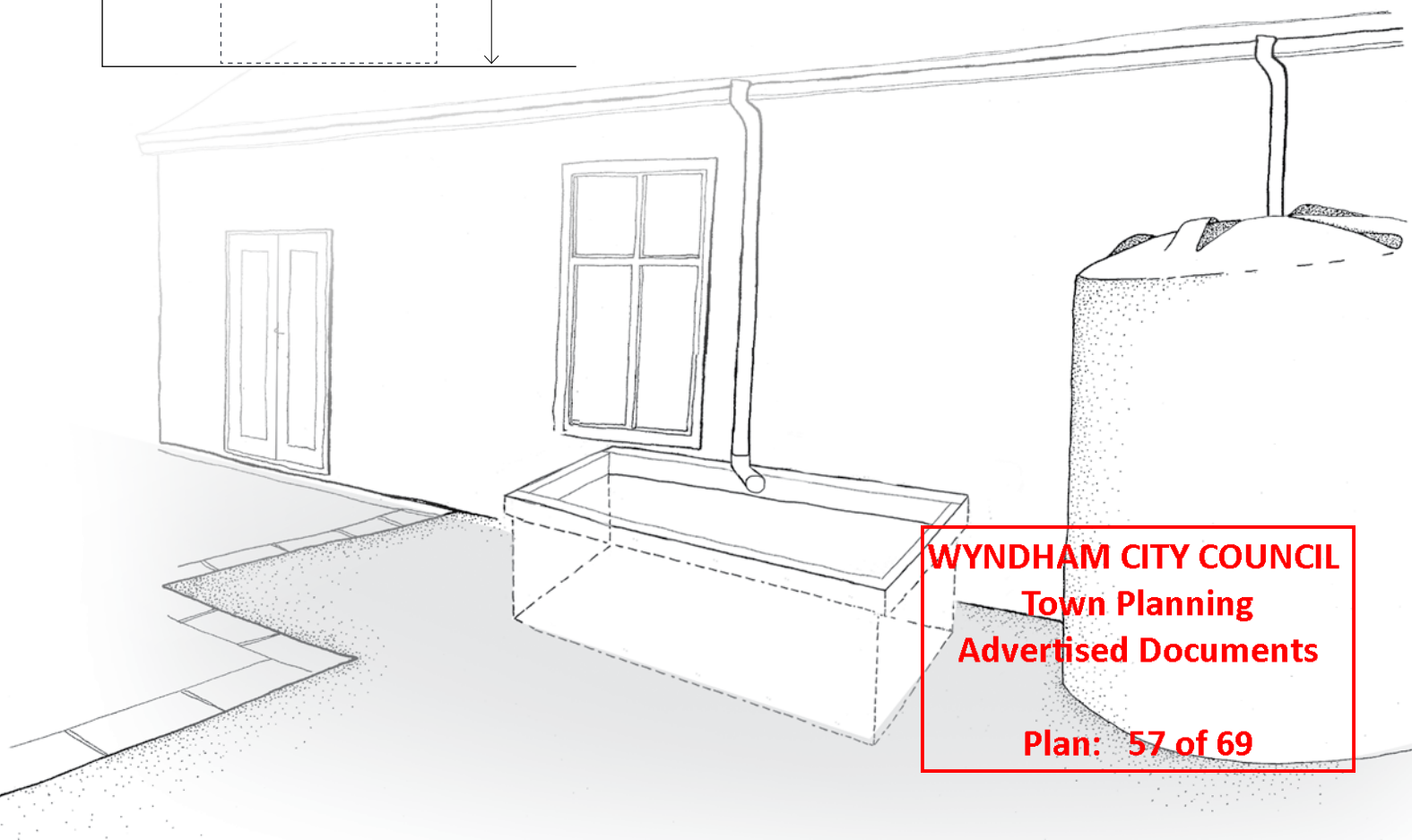
Size

You need to make sure that your raingarden is large enough to manage the amount of stormwater it will receive. If your raingarden is going to capture run-off from the roof via a downpipe, measure the area of roof that drains to that downpipe. Generally, the size of the raingarden should be approximately 2% of the run-off area. Table 1 will help you work out the correct size.

Table 1 – Raingarden sizing chart

AREA OF RUN-OFF (m²)	RAINGARDEN SIZE (m²)
50	1
100	2
150	3
200	4
250	5
300	6
350	7
400	8
450	9





Step 2 - planter box and pipe infrastructure

Preparing your planter box

You can create a planter box out of any material as long as it is strong enough to hold soil. This could be a corrugated iron 'tank', an old wine barrel, or you could build your own planter box using plantation hardwood or similar.

Line your planter box (sides and base) with a PVC liner. Overlap the sheets by 200mm and seal the joins with PVC tape.

Place the 7mm screenings (gravel) to a depth of 50mm. This will form a base for the slotted drainage pipe. Make sure the screenings are washed and cleaned of excess dirt as this can create blockages in the raingardens drainage.

Use the screenings to create a gentle slope towards the stormwater outlet (where the water will exit your planter box).

Pipe infrastructure

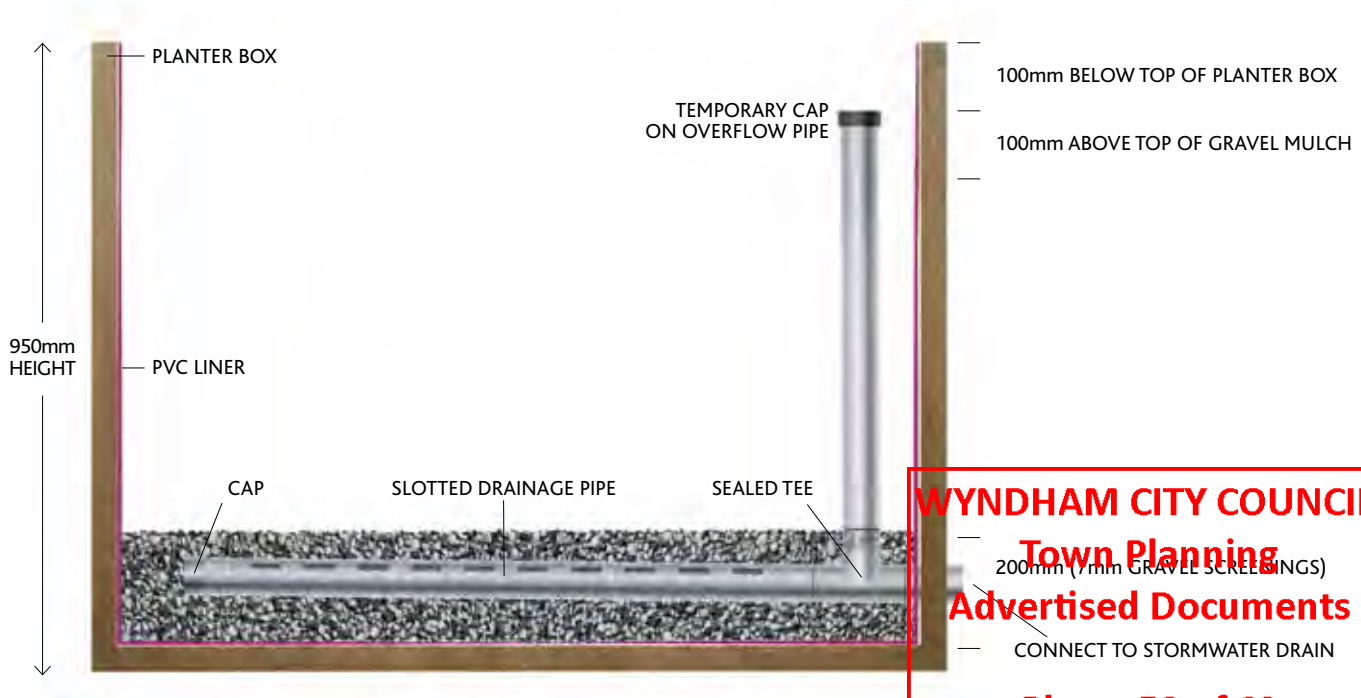
Lay a 90mm diametre slotted drainage pipe horizontally along the centre of the planter box base and cap one end of the slotted drainage pipe. Call your plumber to connect the drainage pipe back into the property's existing stormwater.

Handy Hint – If your raingarden is greater than 4m wide, you will need to install two slotted drainage pipes and two overflow pipes. These need to be evenly spaced across the planter box base to provide adequate drainage.

Connect the vertical 90mm diameter overflow pipe into the slotted drainage pipe using a 90 degree elbow pipe.

When the raingarden is finished the top of the overflow pipe should sit 100mm above the gravel mulch and 100mm below the top edge of the planter box.

Install a temporary cap on top of the overflow pipe to prevent materials dropping into it during construction. Some plastic taped across the top of the pipe will work fine.



Building your raingarden

Step 3 - soil layers

Screenings layer

Add 7mm screenings (gravel) to a depth of 150mm over the slotted drainage pipe in the base of your raingarden. This brings to total depth of screenings (gravel) to 200mm. Be careful when not to dislodge or damage the slotted drainage pipe when adding the additional screenings.

Sand layer

Place white washed sand to a depth of 100mm over the screenings (gravel) layer.

Sand/soil mix layer

Mix 4 parts white washed sand with 1 part topsoil. Add this mix to the raingarden to a depth of 400mm.

Handy Hint - Ensure you firmly pat down each layer of soil when building your raingarden to help reduce the layers from sinking.

Step 4 -pipe adjustments, plants and mulch

Pipe adjustments

Redirect your downpipe into the raingarden using pipe bends where required. If possible, use two 45 degree bends connected together as this will provide a much gentler and more even flow of water, reducing the risk of erosion and prevent blockages within the downpipe. A 90 degree elbow pipe will do as an alternative.

Plants

In general, plants that grow well in a raingarden:

- like dry conditions but can tolerate temporary wet periods
- are perennial rather than annual
- have an extensive fibrous root system.

A wide range of plants are suitable for raingardens and your local nursery will be able to guide you on what is right for your area.

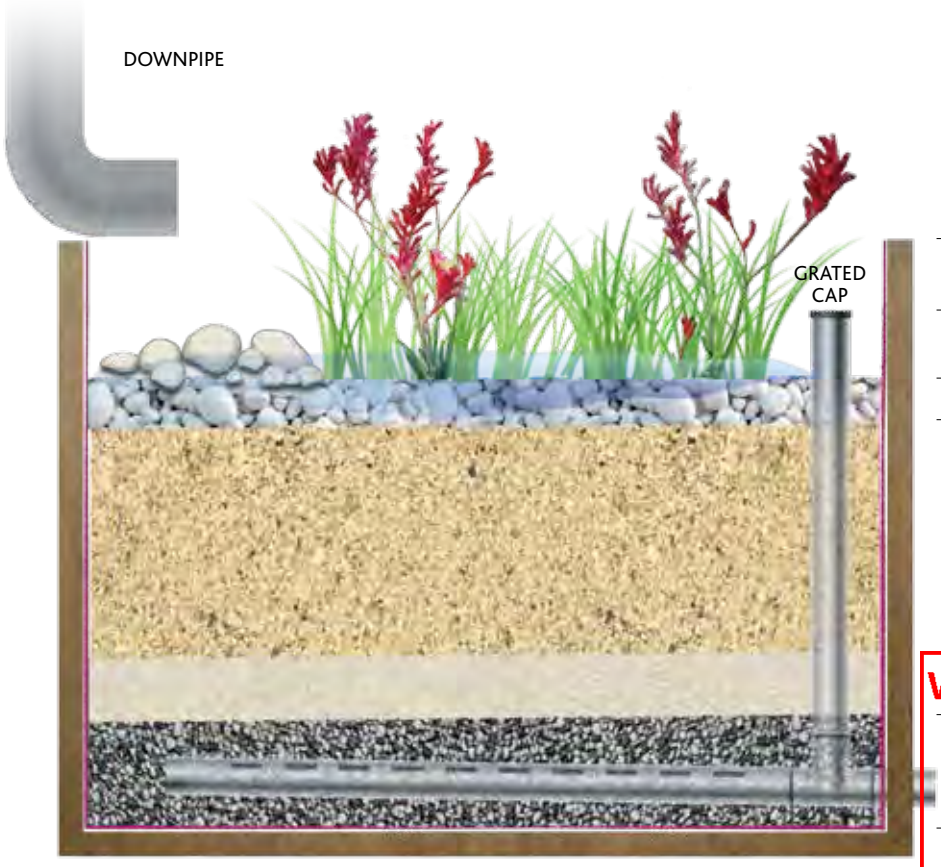
There are also particular plants that are really good at removing pollutants from stormwater. These include:

- *Carex appressa*
- *Lomandra longifolia*
- *Juncus flavidus*
- *Melaleuca ericifolia*
- *Goodenia ovate.*

50% of your raingarden should be planted with these species, the other 50% can be made up of plants that like a dry environment with intermittent wet periods. It is important that the plants you select are suitable for the amount of sun and shade on your raingarden. See the *Plant List* for a suggested list of suitable raingarden plants.

Regardless of the type of plants you select, it is important to plant densely to cover the raingarden. Set your plants out at roughly 6 plants per m². So for a 2m² raingarden, you will need to buy 12 plants. Now start planting.

(continued on next page)



Looking after your raingarden

Mulch

To allow the spread of water gently over the raingarden, place some large flat rocks where water flows from the downpipe. Place smaller rocks in between the large rocks to fill the gaps and help prevent erosion. Alternatively a flow spreading device can be fitted to the downpipe.

Spread gravel mulch to a depth of 50mm around the plants.

Remove the temporary end cap from overflow pipe and replace with a 90mm PVC finishing collar and domed pipe grate.

Water the plants in – complying with your local water restrictions.

Once established, raingardens are low maintenance especially when planted with native plant species. They don't need to be watered, mowed or fertilised. However, a few simple tips can help your raingarden mature and function well.

- Gravel mulch will help retain moisture in your raingarden and prevent weeds from growing.
- Ensure that the overflow is never blocked.
- Remove any sediment or build up from the downpipe.
- Some weeding may need to take place until plants have matured.
- Evenly distribute water flow into your garden to limit erosion from heavy rainfall. Strategically placed rocks may help with this.
- Inspect your garden regularly – replace plants and repair erosion when necessary.

Note – If necessary, water your raingarden until your plants have established in compliance with your local water restrictions.

Need help?
If you have questions about building a raingarden, your landscape gardener or local plumber may be able to help. For more information visit melbournewater.com.au/raingardens

Materials List – what you need to build your raingarden

Table 2 details the materials required to create a 2m² raingarden. While item prices may vary depending on the materials you select, building a 2m² raingarden is likely to cost between $400 and $500 (plus the cost of a planter box and plumber).

QUANTITY	MATERIAL
2 l/m	90mm diameter slotted drainage pipe (Ag Pipe)
2 l/m	90mm diameter uPVC pipe*
0.4m³	7mm screenings
0.85m³	Sand (white washed)
0.15m³	Topsoil
12	Plants (150mm pots)
0.1m³	Gravel mulch
1	90mm diameter uPVC 90 degree bend or 2x 45 degree bends
1	PVC grate 90mm finishing collar
1	PVC 90mm diameter domed pipe grate
1	PVC 90mm tee
1	PVC 90mm cap
10m²	PVC liner
	PVC tape

**Costs per square meter will depend on the length of connections back to the existing stormwater drain.*

l/m = lineal metres m² = square metres m³ = cubic metres mm = millimetres

Plant List – the best plants for your raingarden

The following plants grow well in raingardens.

BOTANICAL NAME	COMMON NAME	CONDITIONS	SIZE (H x W) (cm)
Anigozanthos sp.	Kangaroo paw	Full sun	30-90 x 100-120
Blechnum nudum	Fishbone Water-fern	Full sun to partial shade	50-100 x 40-80
Calocephalus lacteus	Milky Beauty-heads	Full sun to partial shade	15-30 x 10-30
Carex Appressa	Tall Sedge	Full sun to partial shade	80-100 x 120
Carpobrotus modestus	Pigface	Full sun	20cm high and spreading
Chrysocephalum apiculatum	Common Everlasting	Full sun	30-90 x 10-30
Derwentia perfoliata	Digger's Speedwell	Full sun to partial shade	20-40 x 30-60
Dianella species		Full sun to partial shade	60-120 x 40-150
Ficinia nodosa	Knobby Club-rush	Full sun	50-150 x 60-200
Juncas amabilis	Hollow Rush	Full sun to partial shade	20-120 x 20-50
Juncas flavidus	Yellow Rush	Full sun to partial shade	40-120 x 20-100
Leucaphyta brownii	Cushion Bush	Full sun, salt tolerant	100 x 200
Lomandra species		Full sun to partial shade	60-120 x 50-100
Melaleuca ericifolia	Swamp paperback	Full sun to partial shade	4m high x 3m wide
Myoporum parvifolium	Creeping Boobialla	Full sun	20-30 x 300
Patersonia occidentalis	Native iris	Sun to partial shade	20-40 x 30-60
Pratia perdunculata	Matter Pratia	Partial shade	50-150 x 1.8-5
Wahlenbergia communis	Tufted Bluebell	Full sun	15-50 x 15

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WSUD maintenance guidelines

Inspection and maintenance activities

healthy waterways

Melbourne Water

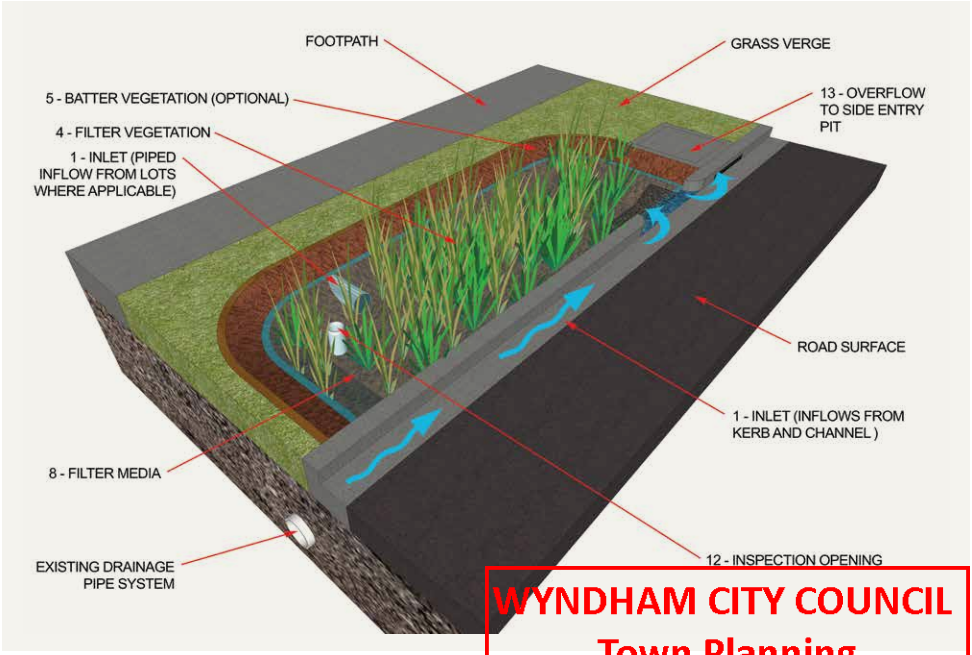
Introduction

Water Sensitive Urban Design (WSUD) assets require regular scheduled maintenance to ensure they remain healthy and perform as intended. This flip book provides an outline of the key inspection and maintenance activities for:

Please refer to the full WSUD Maintenance Guidelines for more detail.

Raingardens

Raingardens, also known as bioretention systems, biofilters, bio-infiltration systems and bioremediation systems, are vegetated infiltration systems that improve stormwater quality.



INSPECTION AND MAINTENANCE ACTIVITIES FOR RAINGARDENS

Component	Key activities	Typical frequency
Filter Media	– Remove leaf litter and gross pollutants	3 months
	– Check for biofilms (algal biofilms may develop on the surface of the filter media leading to clogging issues)	& following storm events
	– Monitor ponding of water following rainfall events	
	– Check for permanently boggy/pooled areas	
	– Remove sediment (or scarify filter media surface if required)	Annually
Erosion	– Check for erosion/scouring	3 months
	– Check for evidence of preferential flow paths	
	– Replace filter media in eroded areas	
	– Add rock protection around inlets (if required)	
Mulch	– Check depth and even distribution of mulch	3 months
	– Check mulch is not touching plant stems	
	– Check for sediment/silt accumulation in mulch layer	
	– Replace mulch (if required)	
	– Retain mulch using jute mats or nets (if required)	
Vegetation	– Inspect plant health and cover	3 months
	– Replace dead plants (maintain a consistent vegetation density of 6–10 plants per square metre across the raingarden filter media)	
	– Remove weeds (avoid use of herbicides)	
	– Prune plants (where applicable)	
	– Water plants (if required during establishment phase)	
Civil components	– Check infrastructure for damage and repair as required	3 months
	– Ensure inlet and outlet points are clear of sediment, litter and debris	& following storm events
	– Inspection opening for underdrain (slotted drainage pipe):	Annually
	– Check water level	
	– Check for sediment accumulation	
	– Flush the underdrain system (if required)	

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