PROPOSED MIXED USE DEVELOPMENT

Caulfield Village Precinct 2 North, Stages 7 & 8

ENVIRONMENTAL MANAGEMENT PLAN

FOR

RESHAPE DEVELOPMENT

6 September 2019

File 647H

CONTENTS

APPENDICES

Issue	Date	Prepared	Approved	Status
A	11 July 2019	MT/LD/JT	JT	Draft
B	2 August 2019	MT/LD/JT	JT	TP Issue
C	2 September 2019	MT/LD/JT	JT	TP Issue - Correction
D	6 September 2019	MT/LD/JT	JT	TP Issue

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1. Executive Summary

Ark Resources has been engaged by Reshape Development to prepare an Environmental Management Plan for the proposed development of Caulfield Village Precinct 2 North, Stages 7 & 8 in accordance with the requirements of the Incorporated Plan and Schedule 2 to the Priority Development Zone for the site.

The relevant provisions of the Incorporated Plan and the Priority Development Zone are set out below.

1.1. Priority Development Zone Requirements

Schedule 2 to the Development Plan Overlay requires an *Environmental Management Plan* to be prepared which must include:

- *An explanation of the ecologically sustainable development (ESD) principles adopted for the proposed development.*
- *A statement of the ESD targets proposed for the development of the site covered by this schedule and what key design initiatives will be incorporated to achieve these targets.*
- *An outline of the proposed management systems to ensure that the development can be set up and managed effectively to achieve and maintain the ESD performance targets identified for the site.*

1.2. Incorporated Plan Provisions

The design guidelines in the Incorporated Plan incorporate the following sustainable design provisions for residential precincts:

- *A sustainable design response will be required in all buildings, where orientation, sun-shading, ventilation, sustainable material specification and/or environmental systems are employed to meet sustainability objectives.*
- *New dwellings should demonstrate passive design strategies that take advantage of unassisted cross-flow ventilation and building orientation to manage thermal comfort.*
- *New buildings should include:*

  a) Minimum star rating requirements for all new commercial and retail buildings

  b) The use of low maintenance, self-finished, low embodied energy materials and finishes

  c) The provision of bicycle parking, in all new retail, commercial and residential development

This report confirms that a combination of sustainable building management practices, design initiatives, fixtures, systems, appliances, materials and finishes will be integrated into the building in order to attain a **4 star** *Green Star Design & As Built* performance standard. The standard achieved is defined as *Australian Best Practice* in terms of environmental design.

The development also meets the *Best Practice* standard for Urban Stormwater Quality.

Accordingly, the performance outcomes achieved by the proposed development considered to be appropriate for a mixed use development of this scale.

2. Introduction

Ark Resources has been engaged by Reshape Development to provide advice in relation to environmentally sustainable development outcomes from the proposed mixed-use development at Caulfield Village Precinct 2 North, Stages 7 & 8.

This report contains a summary of:

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

Performance outcomes in this report are based on:

- Landscape Architectural Report prepared by Tract, dated 12 July 2019
- Architectural plans prepared by ARM Architecture set out below:

Description	Drawing No.	Revision	Date
Apartment Type Plans & RCP - Type 1 & 2	A1800	17	31/07/2019
Apartment Type Plans & RCP - Type 3 & 4	A1801	17	31/07/2019
Apartment Type Plans & RCP - Type 5 & 6	A1802	17	31/07/2019
Apartment Type Plans & RCP - Type 7 & 8	A1803	17	31/07/2019
Apartment Type Plans & RCP - Type 9 & 10	A1804	17	31/07/2019
Apartment Type Plans & RCP - Type 11 & 12	A1805	17	31/07/2019
Apartment Type Plans & RCP - Type 13 & 14	A1806	17	31/07/2019
Apartment Type Plans & RCP - Type 15 & 16	A1807	17	31/07/2019
Apartment Type Plans & RCP - Type 19 & 18	A1808	17	31/07/2019
Apartment Type Plans & RCP - Type 19 & 20	A1809	17	31/07/2019
Apartment Type Plans & RCP - Type 21 & 22	A1810	17	31/07/2019
Apartment Type Plans & RCP - Type 23 & 24	A1811	17	31/07/2019
Apartment Type Plans & RCP - Type 25 & 26	A1812	17	31/07/2019
Apartment Type Plans & RCP - Type 27 & 28	A1813	17	31/07/2019
Apartment Type Plans & RCP - Type 29 & 30	A1814	17	31/07/2019
Apartment Type Plans & RCP - Type 31 & 32	A1815	17	31/07/2019
Apartment Type Plans & RCP - Type 33 & 34	A1816	17	31/07/2019
Apartment Type Plans Typical	A1850	17	31/07/2019
Area Schedules	TP-A0300	17	31/07/2019
Site Plan	TP-A1000	17	31/07/2019
Basement 02_Existing & Proposed	TP-A1050	17	31/07/2019
Basement 01_Existing & Proposed	TP-A1051	17	31/07/2019
B2_Basement Level	TP-A1100	17	31/07/2019
B1_Basement Level	TP-A1101	17	31/07/2019
Ground Level	TP-A1102	17	31/07/2019
Site Level 1 Plan	TP-A1103	17	31/07/2019
Site Level 2 Plan	TP-A1104	17	31/07/2019
Site Level 3 Plan	TP-A1105	17	31/07/2019
Site Level 4 Plan	TP-A1106	17	31/07/2019

Description	Drawing No.	Revision	Date
Site Level 5 Plan	TP-A1107	17	31/07/2019
Site Level 6 Plan	TP-A1108	17	31/07/2019
Site Level 7 Plan	TP-A1109	17	31/07/2019
Site Level 8 Plan	TP-A1110	17	31/07/2019
Site Level 9 Plan	TP-A1111	17	31/07/2019
Roof Plan	TP-A1112	17	31/07/2019
B2_Basement Level_Area Plan	TP-A1500	17	31/07/2019
B1_Basement Level_Area Plan	TP-A1501	17	31/07/2019
Ground Level_Area Plan	TP-A1502	17	31/07/2019
Site Level 1_Area Plan	TP-A1503	17	31/07/2019
Site Level 2_Area Plan	TP-A1504	17	31/07/2019
Site Level 3_Area Plan	TP-A1505	17	31/07/2019
Site Level 4_Area Plan	TP-A1506	17	31/07/2019
Site Level 5_Area Plan	TP-A1507	17	31/07/2019
Site Level 6_Area Plan	TP-A1508	17	31/07/2019
Site Level 7_Area Plan	TP-A1509	17	31/07/2019
Site Level 8_Area Plan	TP-A1510	17	31/07/2019
Site Level 9_Area Plan	TP-A1511	17	31/07/2019
Ground Level_Design Guidelines	TP-A1602	17	31/07/2019
Site Level 1_Design Guidelines	TP-A1603	17	31/07/2019
Site Level 2_Design Guidelines	TP-A1604	17	31/07/2019
Site Level 3_Design Guidelines	TP-A1605	17	31/07/2019
Site Level 4_Design Guidelines	TP-A1606	17	31/07/2019
Site Level 5_Design Guidelines	TP-A1607	17	31/07/2019
Site Level 6_Design Guidelines	TP-A1608	17	31/07/2019
Site Level 7_Design Guidelines	TP-A1609	17	31/07/2019
Site Level 8_Design Guidelines	TP-A1610	17	31/07/2019
Site Level 9_Design Guidelines	TP-A1611	17	31/07/2019
Site Elevations A-A & B-B	TP-A2000	17	31/07/2019
Site Elevations C-C & D-D	TP-A2001	17	31/07/2019
Elevations_Building E	TP-A2002	17	31/07/2019
Elevations_Building L	TP-A2003	17	31/07/2019
Elevations_Building G	TP-A2004	17	31/07/2019
Elevations_Building J	TP-A2005	17	31/07/2019
Elevations_Building K	TP-A2006	17	31/07/2019
Elevations_Building F	TP-A2007	17	31/07/2019
Elevations_Building M	TP-A2008	17	31/07/2019
Elevations_Building H	TP-A2009	17	31/07/2019
Site Sections	TP-A3100	17	31/07/2019
Site Sections	TP-A3101	17	31/07/2019

3. Site Description

The proposed development comprises:

- 437 residential apartments with 599 bedrooms
- Ground level retail spaces with an NLA of approx. 6,020m^2

The building comprises the following uses:

Level	Use
Basement levels	• Car parking, storage facilities, services, bicycle parking, dog wash, water tanks, and bin rooms
Ground level	• Residential entries, retail spaces, storage, bicycle parking, end of trip facilities
Level 1 -2	• Residential apartments
Level 3	• Communal facilities and garden, residential apartments
Level 4 – 8	• Residential apartments

The site is located within the City of Glen Eira and has an area of approximately 12,928m^2.

An image of the site and the surrounding locale is shown below.

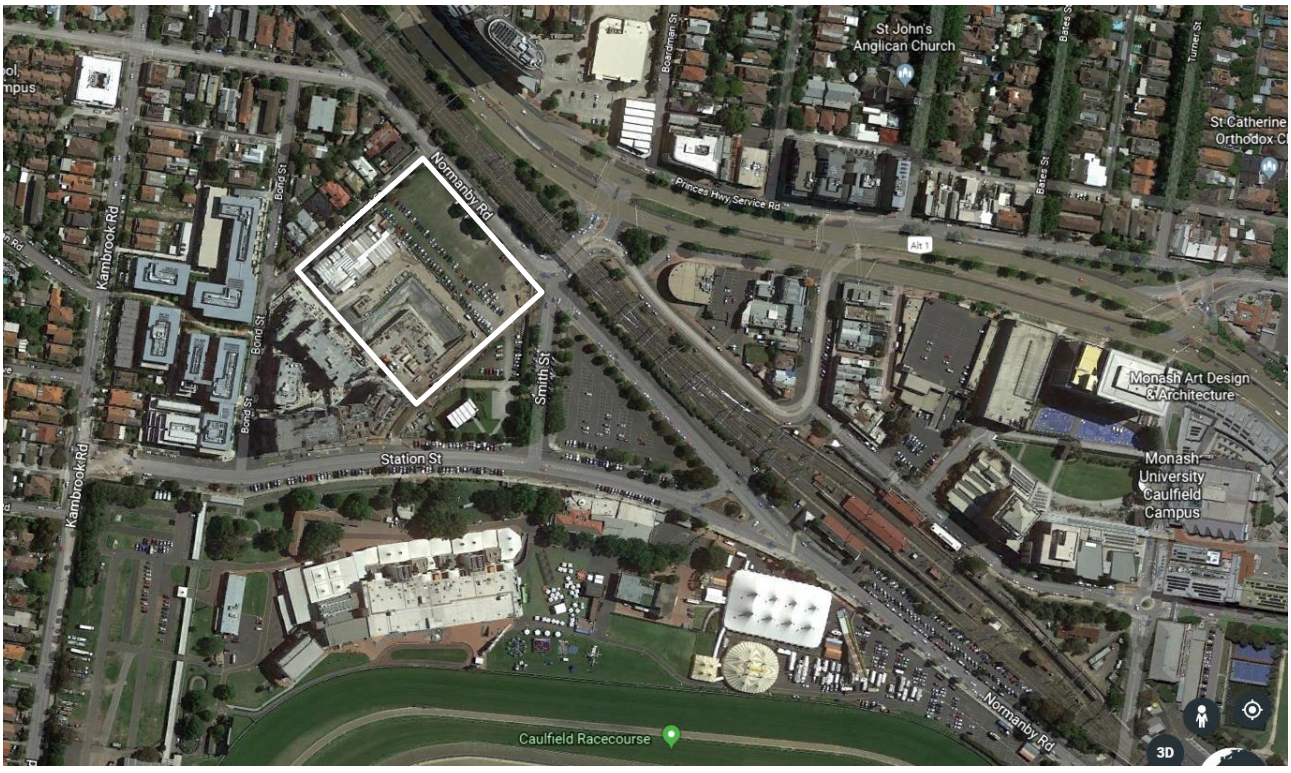


Image ©Google Earth™ (accessed July 2019)

4. Summary of Key ESD Initiatives

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

- Rainwater harvesting system for toilet flushing and irrigation;
- Achieve sustainable water cycle management through:
    - Efficient use of potable water supplies
    - Recycling and re-use of alternative water sources
    - Integration of stormwater treatment into the design of urban spaces and landscapes
- Rooftop photovoltaic systems with a peak capacity of 36kW distributed across all buildings.
- High-performance glazing and energy efficient building services, appliances and fixtures;
- Environmentally preferable internal finishes;
- Provide landscaping which enhances amenity and contributes to biodiversity; and
- Encourage walking and cycling to reduce the extent of private car use.

An assessment of sustainable design outcomes of the proposed development has been undertaken with *Green Star Design & As Built*, *MUSIC* and *FirstRate5* benchmarking tools based on the proposed architectural design and the building services and materials initiatives considered feasible at this stage of the design process.

The information presented in this report demonstrates that:

- The development will achieve a 4 star *Green Star Design & As Built* rating;
- The development will achieve a minimum average NatHERS energy rating of 6.5 stars;
- The development will meet the ESD objectives of the *Better Apartment Design Standards*;
- The development meets the *Best Practice* standard for stormwater quality

5. Water Sensitive Urban Design

The development has been designed to meet the following strategic water management objectives:

- Encourage minimal water consumption and conserve potable water supplies.
- Ensure high quality urban stormwater discharges which maintain ecosystem health by meeting the best practice performance objective set out in the *Urban Stormwater Best Practice Environmental Management Guidelines* (CSIRO 1999).

The following initiatives have been integrated into the development to meet the best practice objectives set out above:

- A rainwater harvesting system will be installed comprising:
    - Harvesting of stormwater from all roof areas;
    - A total storage volume of 140,000 litres in tanks located within the basement car park;
    - Re-use of water for toilet flushing of toilets to the retail and commercial components and all apartments in buildings E & F ;
    - Re-use of water for irrigation;
- Specification of water efficient fittings to all dwellings;
- Water efficient irrigation systems incorporating moisture sensors to prevent over watering.

Refer to Appendix 1 for MUSIC Report.

6. Landscaping Initiatives

Significant areas of soft landscaping and planting have been incorporated on the podium level including significant trees and shrubs which will provide shade and mitigate the 'urban heat island effect'. The proposed landscape includes predominantly deciduous trees to allow shade in summer and solar access to both private and shared spaces in winter. Understorey planting, including native species, has been selected to serve both functional (such as screening for privacy) and aesthetic objectives and includes a diverse range of plants. The planting design is arranged in tiers or layers, providing greater potential for habitat and many of the proposed trees and understorey plants are flowering species, attracting birds and insects.

7. Materials and Waste Management

7.1. Environmentally Preferable Materials

The following environmentally preferable materials will be specified with the objective of reducing off-site environmental impacts and improving indoor environmental quality for residents, staff and visitors:

- PVC products will meet Green Star Design & As Built best practice standards.
- All engineered wood products will be specified to have low formaldehyde emissions in accordance with the emission limits set out the Green Star Design & As Built Technical Manual.
- Low VOC paints will be specified for internal walls in accordance with the VOC limits set out in the Green Star Design & As Built Technical Manual, with 50% of internal paint to be ultra-low VOC.

7.2. Construction Waste Management

A target recycling rate of 90% of construction waste has been adopted for the construction phase of the development to minimise the volume of waste to landfill.

This will be achieved by the development of a comprehensive waste minimisation strategy including:

- Separation of all commercially viable recyclable waste streams
- Training in waste minimisation for all site staff and contractors to form part of site induction training.
- Record keeping of landfill waste and recyclable stream volumes to track performance against the 90% recyclable target.
- Quarterly reporting of volumes and percentages for each waste stream.

Note that details of operational waste management and recycling strategies are provided in the Waste & Recycling Management Plan.

8. Renewable Energy System

A solar photovoltaic system will be installed to offset greenhouse emissions arising from common area energy usage and will provide a total peak generation capacity of 36 kW.

The solar panels will be located on the roofs of Buildings E and L and power will be distributed so that all residents benefit equally from the energy savings and greenhouse gas emissions reductions.

Note that the system is predicted to result in equivalent avoided greenhouse emissions of approximately 58 tonnes CO2-e each year.

Refer to Appendix 2 for details of proposed system capacity and panel numbers.

9. Sustainable Transport Initiatives

9.1. Cyclist facilities

A total of 104 bicycle racks will be installed at ground level comprising:

- 88 racks for residents
- 19 racks for employees:

Racks are located at ground level, with resident access from the western entrance, and staff racks located in the back of house area, adjacent to change facilities.

In addition, 16 hoops will be provided for a total of 32 visitor bikes at ground level distributed across the site. The hoops will be located in close proximity to the residential building lobbies and retail entrance points.

10. Performance Outcomes

An analysis of performance outcomes from Caulfield Village Precinct 2 North, Stages 7 & 8 has been undertaken based on the architectural drawings and the combination of sustainable design initiatives described in this report. The results are summarised below.

10.1. Energy Ratings

FirstRate5 Version 5.2.10b (3.13) energy ratings have been undertaken for a representative sample of the apartments and are summarised in the table below.

Apartment		Star Rating	Energy Demand (MJ/m2)		
Apt Type	Apt Number		Total	Heating	Cooling
A1-A	L2.04	5.9	126.9	105.9	21.0
A1-A	L3.04	5.5	143.7	123.8	19.9
A2-B	J3.02	7.7	67.9	57.6	10.3
A2-B	J3.03	5.7	135.0	120.8	14.2
A2-B	J3.04	6.6	106.1	88.4	17.7
A2-B	J5.02	7.6	71.0	58.9	12.1
A2-B	J5.03	6.1	122.1	104.8	17.3
A2-B	J5.11	6.7	100.1	81.2	18.9
A2-B	J6.02	7.1	86.7	70.1	16.6
A2-B	J6.03	5.6	140.0	120.6	19.4
A2-B	J6.11	6.1	120.3	99.6	20.7
A2-D	K5.12	5.7	135.0	121.0	14.0
A2-D	K5.14	7.7	68.7	59.5	9.2
A2-D	K6.12	5.5	143.4	128.3	15.1
A2-E	L2.11	5.8	131.6	117.8	13.8
A2-E	L3.11	5.5	143.3	130.3	13.0
A2-F	E7.10	8.0	56.6	41.9	14.7

Apartment		Star Rating	Energy Demand (MJ/m2)		
Apt Type	Apt Number		Total	Heating	Cooling
A2-F	E8.10	6.9	95.2	78.2	17.0
A4-A	J5.15	7.1	88.4	75.5	12.9
A4-A	J6.15	6.5	107.5	89.8	17.7
B1-A	E3.03	5.8	134.1	122.4	11.7
B1-A	J5.04	5.9	129.3	117.7	11.6
B1-A	J6.04	5.5	143.0	129.8	13.2
B1-B	J5.05	6.7	101.0	90.4	10.6
B1-B	J6.05	5.7	135.9	122.4	13.5
B1-D	J5.07	7.1	88.7	78.2	10.5
B1-D	J6.07	6.0	123.8	111.1	12.7
B1-E	G5.03	5.5	142.6	131.9	10.7
B1-E	G5.08	6.8	99.5	90.4	9.1
B1-E	G5.09	5.9	125.8	112.2	13.6
B1-E	G6.03	5.5	143.3	131.0	12.3
B1-E	G6.05	5.7	134.9	122.7	12.2
B1-E	G6.09	5.5	143.4	129.0	14.4
B2-A	L7.03	5.5	143.2	126.6	16.6
B2-A	L8.04	5.5	142.7	126.4	16.3
B2-A	L8.07	5.5	142.8	128.0	14.8
B3-A	L7.09	6.9	95.2	81.9	13.3
B3-A	L8.09	5.9	127.2	112.8	14.4
B3-B	E3.15	7.4	78.4	68.1	10.3
B3-D	G5.12	7.1	86.4	74.3	12.1
B3-D	G6.12	6.0	123.3	108.1	15.2
B3-E	F5.01	7.4	77.5	68.4	9.1
B3-E	F6.01	6.6	104.6	92.6	12.0
B3-F	G1.01	6.9	95.0	81.4	13.6
B3-F	G6.01	5.9	128.4	112.3	16.1
B5-A	H1.01	6.8	99.0	83.2	15.8
B5-B	HG.01	6.4	108.2	97.0	11.2
B5-C	H1.07	7.0	89.8	75.7	14.1
B7-A	K5.04	6.8	97.5	86.7	10.8
B7-A	K6.04	5.9	125.2	111.5	13.7
C2-A	E7.08	7.8	64.8	57.5	7.3
C2-A	E8.08	6.8	99.1	88.9	10.2
C2-A	F2.01	6.8	97.6	87.0	10.6

Apartment		Star Rating	Energy Demand (MJ/m2)		
Apt Type	**Apt Number**		**Total**	**Heating**	**Cooling**
C2-A	MG.02	7.3	79.9	71.6	8.3
C2-B	L7.08	6.6	105.7	93.7	12.0
C2-B	L8.08	5.8	134.1	121.1	13.0
C2-C	H2.03	7.4	76.4	68.2	8.2
C2-C	H3.03	6.1	122.0	110.2	11.8
C2-D	E8.07	6.2	117.9	108.8	9.1
C3-A	E7.06	5.9	127.0	116.7	10.3
C3-A	E8.06	5.5	143.6	131.3	12.3
C3-C	M2.02	6.7	102.2	83.4	18.8
C4-A	H2.01	6.5	106.5	87.8	18.7
C4-A	H3.01	6.2	117.5	96.7	20.8
C4-B	H2.05	6.5	106.3	88.3	18.0
C4-B	H3.05	6.2	117.8	97.3	20.5
C5-A	F5.11	6.6	105.0	97.2	7.8
C5-A	F6.11	5.9	129.3	118.3	11.0
C5-B	F3.11	6.4	109.2	99.9	9.3
D2-B	G5.02	6.8	98.2	88.4	9.8
D2-B	G6.02	5.9	127.5	114.9	12.6
D3-A	L7.02	6.4	111.2	99.0	12.2
D3-A	L8.02	5.5	143.9	129.8	14.1
Estimated Development Average		**6.5**	**114.1**	**100.6**	**13.5**

The energy ratings set out above indicate that the development will exceed the standard required by the National Construction Code (Victoria) 2016.

The results of the modelling confirm that all apartments have a cooling load less than 21MJ/m2 (NatHERS Climate Zone 62 Moorabbin) and therefore meet the energy efficiency objectives set out in clause 58.03-1 of the Planning Scheme. All other apartments in the development are expected to have similar or lower cooling loads.

Please refer to Appendix 3 for details of building construction assumptions.

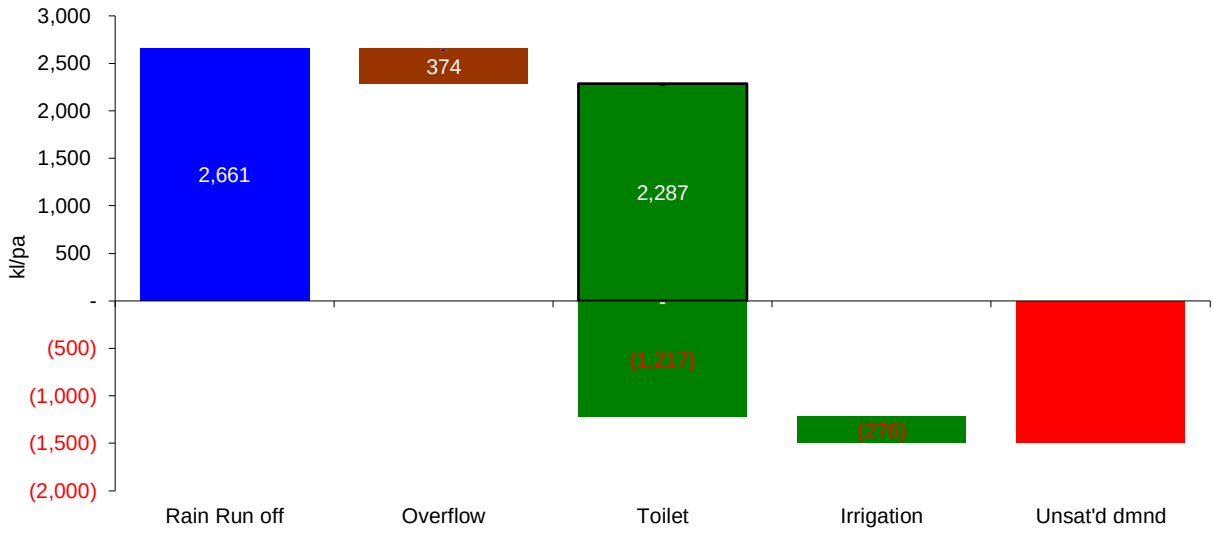
10.1. Rainwater Modelling

An analysis of rainwater supply and demand has been undertaken to assess the reliability of supply and the estimated annual mains water saving.

The results of the analysis predict that the rainwater harvesting system will reduce annual mains water consumption by 2,287 kL with a supply reliability of 56% for toilet flushing and irrigation.

The components of the rainwater harvesting system are illustrated in the chart below.

Graph 1 - The water System based on actual daily rainfall



Please refer to Appendix 4 for details of the rainwater supply and demand analysis.

10.2. Stormwater Quality

A MUSIC model has been prepared to assess stormwater quality outcomes from Caulfield Village Precinct 2 North, Stages 7 & 8 and the results are summarised in the table below.

	Best Practice Performance Objective	Precinct 2 North Results
Suspended Solids	80%	91.4%
Total Phosphorus	45%	76.8%
Total Nitrogen	45%	53.9%
Gross Pollutants	70%	100%

The results of the music model demonstrate that Caulfield Village Precinct 2 North, Stages 7 & 8 meets the best practice performance objective set out in the Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO 1999). Please refer to Appendix 1 for the MUSIC model schematic and results.

11. Green Star

The Green Star Design & As Built (Version 1.2) 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[1].

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

The initiatives which contribute to the 4 star Green Star rating are detailed in Section 10.1 below.

11.1. Green Star 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 Design & As Built v1.2 Technical Manual.

Further information in relation to key performance outcomes is provided in the Appendices to this report as referenced in the right hand column of the table.

Green Star Element	Design Attribute	Reference
Management	• **Design Intent Report prepared** • **Provide floor-by-floor metering; plus independent metering for all loads >5% of annual building energy use or 100kW; and metering for common water use consuming 10% of development's water use** • **Comprehensive project-specific environmental management plan implemented during construction**	**Conditional Requirements**
	• Green Star Accredited Professional involved from outset to completion • Detailed Operations and Maintenance Manual prepared • Detailed guide to building systems provided to council and residents • Measurement and reporting of building performance metrics by Owners Corporation • Operational Waste Management Plan prepared including targets and monitoring • Services and Maintainability Review undertaken during design stage • Head contractor to have current ISO 14001 certification	

[1] Note that a minimum of 45 points must be achieved for a 4 star Green Star rating to be achieved. The development will attain a 4 star Green Star standard however certification of the rating with the Green Building Council will not be undertaken.

Green Star Element	Design Attribute	Reference
Indoor Environmental Quality	• **Lighting systems comprise flicker free luminaires and a Colour Rendering Index (CRI) greater than 80** • **Strategies to reduce glare incorporated into the design**	**Conditional Requirements**
	• Ventilation systems to comply with ASHRAE 62.1, and pre-cleaned prior to handover • Natural ventilation to apartments • Exhaust systems to directly exhaust pollutants to exterior • Internal noise in nominated areas no more than 5dBA above 'Satisfactory' levels from Table 2 of AS/NZS 2107:2016 • Lighting systems designed to meet best practice illuminance levels • Specification of low VOC paints, adhesives, sealants and carpets • Specification of low formaldehyde engineered wood products • Lighting systems designed for task lighting	
Energy	• **Attain a development NatHERS area-weighted energy rating average of 6.5 stars and a minimum individual NatHERS energy rating of 5.5 stars for each apartment.**	**Conditional Requirement**
	• Development NatHERS energy rating average 6.5 stars • Rooftop photovoltaic systems with a peak capacity of 36kW to offset common area energy. • Energy efficient gas domestic hot water system • Energy efficient appliances within 1 star of best available at time of tender	Appendix 3
Transport	• 14 Electric Vehicle charging points serving 28 bays within the basement car park • Three shared cargo e-bikes for residents • A total of 139 bike racks for residents, staff and visitors and associated end-of trip facilities located at ground level • A WalkScore® of 82 out of 100 points – defined as 'Very Walkable'	
Innovation	Particularly subject to design development but may include: • 50% of internal paints to be ultra-low VOC type (<5g/litre) • Improved stormwater pollutant reduction measures to column B level • Provision of 3 shared cargo e-bikes , with ancillary facilities including bike repair station etc. and electronic booking system • Implementation of an affordable housing program	

Green Star Element	Design Attribute	Reference

Water	• Water efficient fixtures (WELS 5 star taps, 4 star toilets, 3 star showers)
	• Water efficient dishwashers
	• Water efficient sub-soil drip irrigation system with moisture sensors and timers
	• Rainwater harvesting from all roofs and L4 & L6 terrace areas:
	  ○ Filtration and treatment of all rainwater prior to draining into the tank
	  ○ Total rainwater tank storage volume of 140kL
	  ○ Re-use of captured water for toilet flushing
	  ○ Re-use of captured water for irrigation
	• Cooling towers not used
	• Fire test system water storage and re-use
		Appendix 1

Materials	• Life Cycle Assessment undertaken, with 70% improvement over reference building • 5 impact categories reported in Life Cycle Assessment • Specification of common use PVC products that meet Best Practice Guidelines for PVC in the Built Environment • Demolition and construction waste sent to landfill to be less than 10kg per square meter of GFA	
Land Use & Ecology	• **No endangered or vulnerable species on site at time of purchase** • **Site does not contain old growth forest or wetland of High National Importance**	**Conditional Requirements**
	• Native planting used on at least 2½% of the site • Extensive site contamination found and remediated in accordance with best practice	
Emissions	• **All outdoor lighting to comply with AS4282:1997 for light spill to inhabited boundaries.**	**Conditional Requirement**
	• No increase in stormwater discharge to result from re-development • MUSIC modelling has been undertaken to confirm the development attains the Best Practice standard for urban stormwater quality • External lighting design to have an upward light output ratio <5% • Strategies to minimise Legionella impacts from cooling systems implemented	

11.2. Green Star Preliminary Design Rating

Based on the design attributes and performance outcomes set out above, the following Green Star pathway has been prepared which confirms that the development has the preliminary design potential to achieve a 4 star Green Star standard.

Green Star - Design & As Built v1.2 Scorecard

Project:	Caulfield Village Precinct 2 North Stages 7 & 8
Current Rating:	4 Star - Best Practice

TP stage - Preliminary 30/07/2019

Points Available	Total Score Targeted
100	45.5

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	Points Available	4* pathway
Management				14	
Green Star Accredited Professional	To recognise appointment and active involvement of Green Star AP to ensure rating tool is applied effectively and as intended.	1.0	Accredited Professional	1	1
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	-	Complies
		2.1	Services and Maintainability Review	1	1
		2.3	Building Systems Tuning	1	1
Building Information	Information facilitating understanding of building systems, O&M requirements and targets to optimise performance.	4.1	Building Information	1	1
Commitment to Performance	To recognise practices that encourage building owners, building occupants and FM teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	1	1
Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	-	Complies
Responsible Building Practices	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies
		7.1	Formalised Environmental Management System	1	1
Operational Waste	Performance Pathway	8A	Performance Pathway - Specialist Plan	1	1
Total				14	7

Indoor Environment Quality				17	
Indoor Air Quality	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1	1
		9.2	Provision of Outdoor Air	2	2
		9.3	Exhaust or Elimination of Pollutants	1	1
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1	1
Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort	-	Complies
		11.1	General Illuminance and Glare Reduction	1	1
		11.3	Localised Lighting Control	1	1
Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	-	Complies
Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, Adhesives, Sealants and Carpets	1	1
		13.2	Engineered Wood Products	1	1
Total				**17**	**9**

Energy				22	
Greenhouse Gas Emissions	B. NatHERS Pathway	15B.0	Conditional Requirement: NatHERS Pathway	-	Complies
Max.5pts achievable via Credit 15A -		15B.1	NatHERS Pathway	16	3.5
Total				**18**	**3.5**

Transport				10	
Sustainable Transport	Prescriptive Pathway	17B.1	Access by Public Transport	3	3
		17B.3	Low Emission Vehicle Infrastructure	1	1
		17B.5	Walkable Neighbourhoods	1	1
Total				**7**	**5**

Water				12	
Potable Water	Prescriptive Pathway	18B.1	Sanitary Fixture Efficiency	1	1
		18B.3	Heat Rejection	2	2
		18B.4	Landscape Irrigation	1	1
		18B.5	Fire System Test Water	1	1
Total				**6**	**5**

Materials				14	
Life Cycle Impacts Points from operational energy reductions capped at 3 out of the 6 points available for 19A.1.	Performance Pathway - Life Cycle Assessment	19A.1	Comparative Life Cycle Assessment	6	3
		19A.2	Additional Life Cycle Impact Reporting	4	1
Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1	1
Construction and Demolition Waste	Fixed Benchmark	22A	Fixed Benchmark	1	1
Total				**14**	**6**

Emissions				5	
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Stormwater Peak Discharge	1	1
		26.2	Stormwater Pollution Targets	1	1
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies	-	Complies
		27.1	Light Pollution to Night Sky	1	1
Microbial Control	To recognise implementation of systems to minimise impacts associated with harmful microbes in building systems.	28.0	Legionella Impacts from Cooling Systems	1	1
Total				**5**	**4**

Innovation				10	
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world.	30B	Market Transformation	10	1
Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks		2
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge		1
Total				**10**	**4**

	4* pathway
TOTAL SCORE TARGETED	**45.5**
Green Star rating	**4 Star**

12. Management Systems

To ensure the ESD performance outcomes set out in this report are achieved, an implementation strategy has been developed and will be coordinated by the Project Manager in conjunction with the following project design team members:

- Architect
- Thermal Performance Assessor
- Building Services Consultant
- Fire Services Engineer
- Structural Engineer
- Waste Management Consultant

A copy of the implementation schedule is set out in Appendix 5.

The works will be undertaken in accordance with the ISO 9000 Quality Management system which provides an additional certification process to ensure that the ESD performance outcomes documented in this report are achieved.

13. 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 development in order to improve environmental outcomes during occupation.

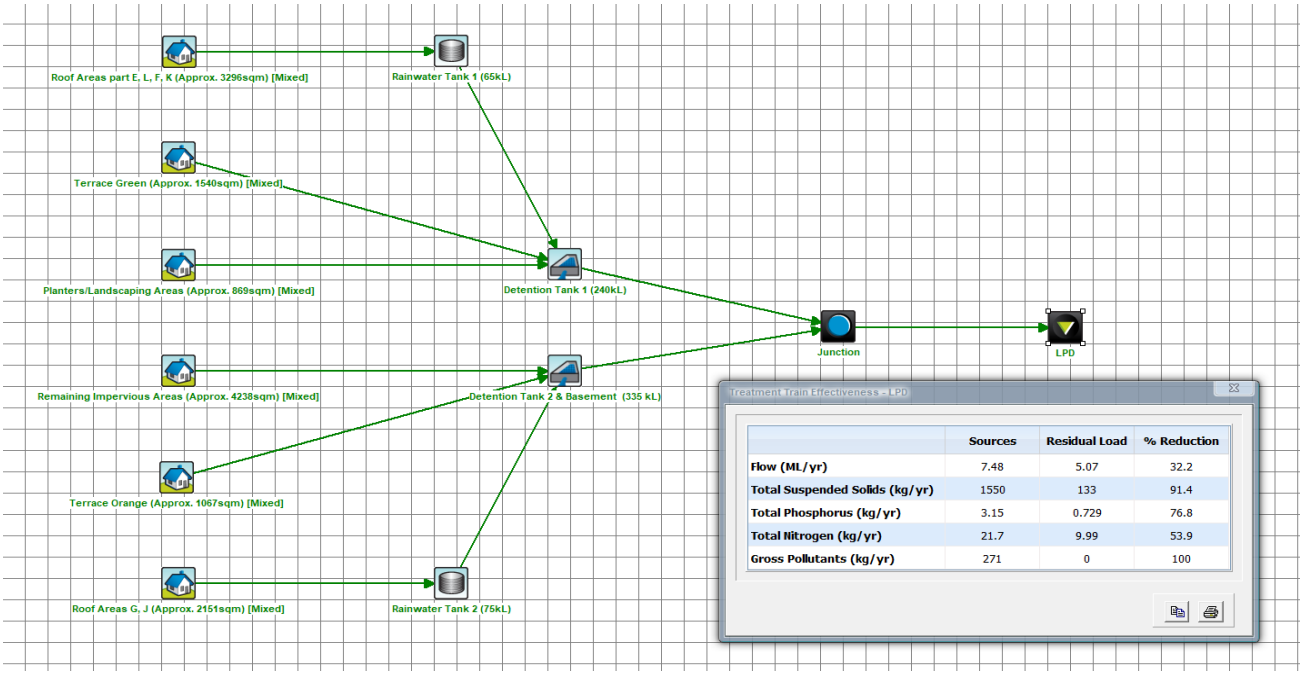
In terms of performance outcomes, the analysis presented in this report demonstrates that the proposed development will:

- Attain a 4 star Green Star standard based on the Design & As Built v1.2 rating tool
- Meet the ESD objectives of the *Better Apartment Design Standards*
- Attain the *Best Practice* standard for urban stormwater quality
- Attain a NatHERS development average energy rating of 6.5 stars

The initiatives presented in this Environmental Management Plan will ensure that the site will be developed in accordance with the Environmentally Sustainable Development provisions set out in the Incorporated Plan and Schedule 2 to the Priority Development Zone for the site.

Jan Talacko
Director

Appendix 1: MUSIC Results



Assumptions	
Area Name	**Area [m^2]**
Total Roof Areas to RWT 1	3,295
Part Bldg E & Bldg L Roof	1,499
Part Bldg F Roof	554
Building K Roof	1,242
Total Roof Areas to RWT 2	2,151
Building G Roof	958
Building J Roof	1,193
Semi permeable Landscape Areas	869
Level 3 Planters & Landscaping	869
Total Podium Terrace Areas	2,609
Podium Terrace Area to DT1	1,541
Podium Terrace Area to DT2	1,068
Other impervious areas	4,238
Total Site Area	**13,163**

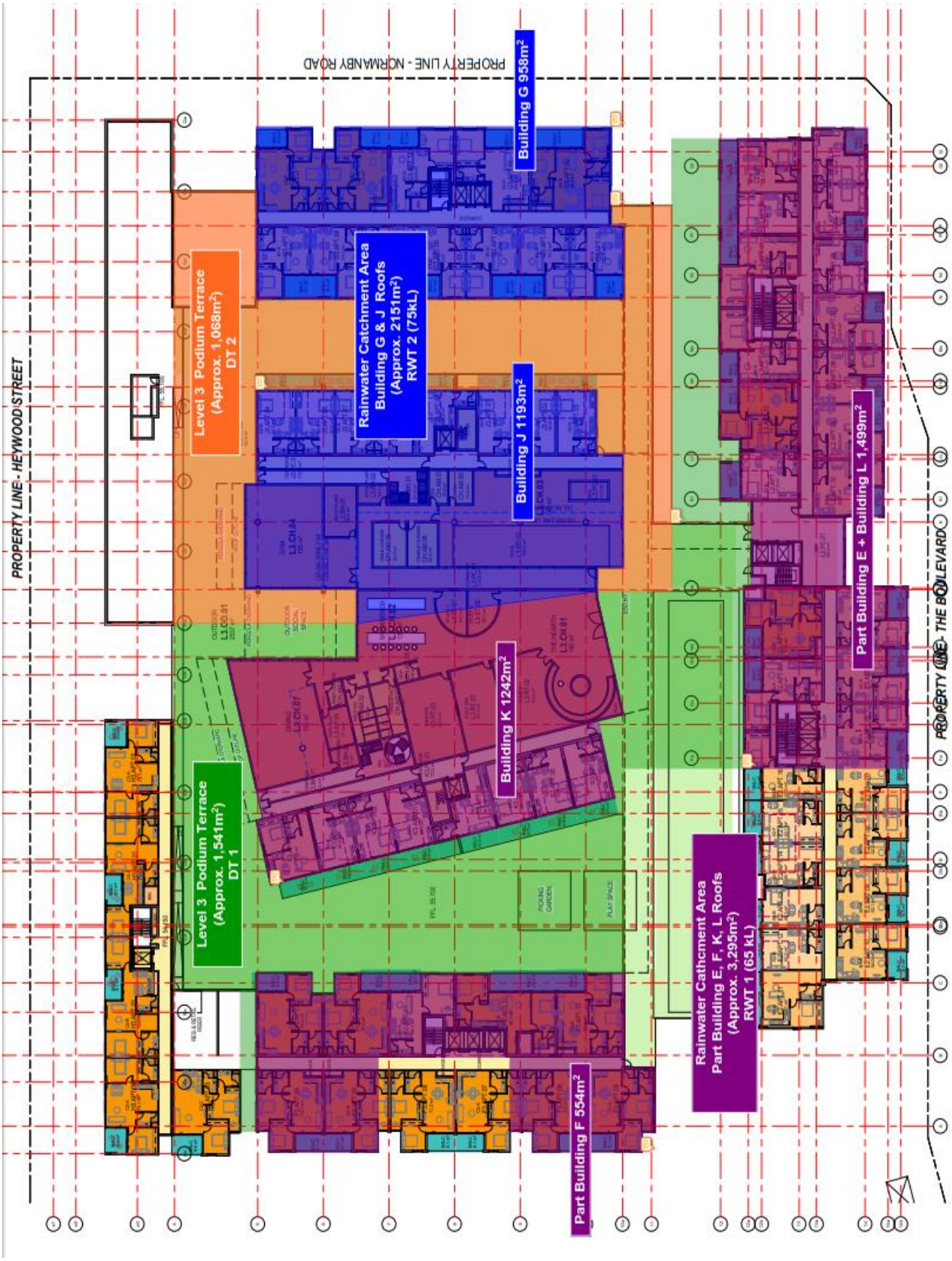
Acronyms
RWT: Rain Water Tank
RG: Rain Garden
TF: Toilet Flushing
GPT: Gross Pollutant Trap

	MUSIC Model 30/07/2019
Treatment Devices Features	
RWTs Total Capacity	140 kL
Total RWT 1 Capacity	65 kL
Total RWT 2 Capacity	75 kL
Annual water demand for TF RWT 1 (Ground Floor Commercial)	1803 kL/yr
Annual water demand for TF RWT 2 (Residential Bldgs E & F)	1700 kL/yr
Annual water demand for Irrigation	276 kL/yr
***Total Detention Tank Volume	575 kL
Results	
Reduction in Total Suspended Solids (TSS)	92.4%
Reduction in Total Phosphorus (TP)	78.0%
Reduction in Total Nitrogen (TN)	55.8%
Reduction in Total Gross Pollutants	100.0%
Compliance with Melbourne Water targets	✓

Melbourne Water Targets	Green Star Targets (Column B)
80.0%	80.0%
45.0%	60.0%
45.0%	45.0%
70.0%	90.0%
✓	✓

NOTES:
***Detention volume indicative only - to be further specified during Detailed Design.

RAINWATER CATCHMENT AREAS

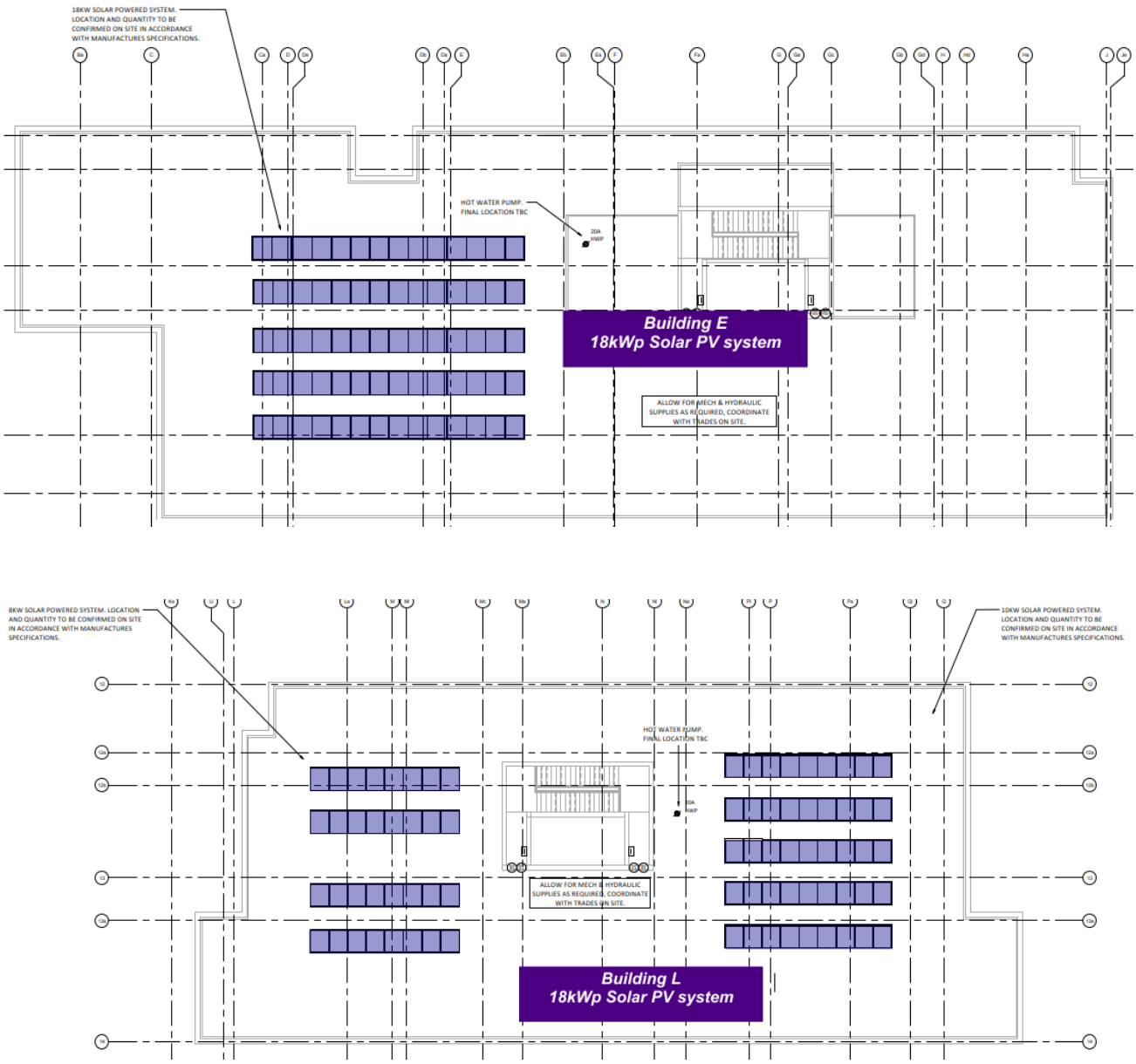


Appendix 2: Renewable Energy System

Solar PV modules with a total capacity of 36 kWp will be installed at roof level as per the preliminary layout indicated below.

Each PV module will be oriented northwest at 10-15° tilt and have at least 250Wp capacity.

Total yield of this array will be approximately 50.4 MWh per annum equating to an estimated annual carbon emissions offset of 58.4 tonnes $CO_{2\text{-}e}$ per annum.



Indicative Solar Photovoltaic array layout

Caulfield Village P2 North Stage 7&8

Input
Calculated
Step Control
Copied data

Photovoltaic System			
Electricity gas emissions factor, NG [2]	kg_CO2-e/kWh	1.16	Scope 2 and 3
PV Melbourne energy delivery	MWh/y per kWe	1.40	10° tilt, Northwards
PV capacity required	kWe	36.0	
Proposed PV module rating	Wp	250	
Efficiency improvement over traditional 250W module		0.0%	
Typical dimensions for 60-cell module	Width (m) x length (m)	1.0 x 1.7	
Number of panels required	rounded up	144	
Expected electricity produced	kWh/day	138.1	
Annual expected electricity produced	MWh/yr	50.4	

Annual expected solar energy contribution	GJ/y	792.2	
Natural gas use reduction from solar	GJ/y	1056.3	
Greenhouse gas emissions factor, NG [1]	kg_CO_2-e/GJ	55.3	Scope 1 and 3
Greenhouse gas emissions reduction	tonnes_CO_2-e/yr	58.41	

[1] National Greenhouse Accounts (NGA) Factors, August 2018, tables 2 and 38
[2] National Greenhouse Accounts (NGA) Factors, August 2018, table 41 "Latest", "Victoria"

Appendix 3: NatHERS Energy Ratings

BUILDING MATERIALS ASSUMPTIONS

Element	Description	Added R Value
Floor Type	Suspended concrete slab	
Floor Insulation	50mm Kingspan Kooltherm: Underside of level floors shared with car park, terraces below and outside	**R 2.5**
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 R1.5	**R 1.5**
	Precast concrete external walls: Insulation R 1.55	**R 1.55**
	Lightweight clad walls: Insulation R 2.5	**R 2.5**
Roof Insulation	Concrete roof: R 2.5 insulation	**R 2.5**
	Concrete roof: (E8.06, J6.04, K6.12, L3.11) R 3.5 insulation	**R 3.5**
	Concrete roof: (L8.04, L8.07) R 4.5 insulation	**R 4.5**
	All apartment concrete ceilings shared with terraces above: R 2.5 insulation	**R 2.5**
Window Frames	Aluminium frames to all windows and glazed doors	
Sky Lights	None	
External Blinds	Screens and shading as per elevations	

NOTES

1. The added insulation R value must be equal to or higher than that specified above to meet the energy rating results.
2. All insulation specified for construction must meet Fire Engineer requirements

GLAZING VALUES

Glazing Type		Whole of Window Value		Location
Capral – Hinged Door		**U**	**SHGC**	
Specified Glazing	CAP-048 200 Series Hinge Door DG 6mm Bronze/12mm Argon gap/6mm ET Clear	3.60	0.34	All Apartments unless otherwise specified
Energy Rating Software Equivalent	A&L-029-12 AL French door DG 4mm Gy/10mm Argon gap/4mm Sn	3.61	0.34	
Capral – Fixed		**U**	**SHGC**	
CAP-055-55 419 Flushline fixed DG 6mm Bronze/12mm Argon gap/6mm ET Clear		2.71	0.39	All Apartments unless otherwise specified
Capral – Sliding		**U**	**SHGC**	
Specified Glazing	CAP-057 900 Series Sliding Door DG 6mm Bronze/12mm Argon gap/6mm ET Clear	3.12	0.32	All Apartments unless otherwise specified
Energy Rating Software Equivalent	CAP-057-26 900 Sliding door DG 6mm Grey/12mm Argon gap/6mm Clear Low e Energy Tech	3.12	0.32	
Capral – Awning		**U**	**SHGC**	
Specified Glazing	CAP-051-03 35 Series Awning DG 6mm Bronze/Argon gap/6mm ET Clear	4.40	0.30	All Apartments unless otherwise specified
Energy Rating Software Equivalent	CAP-061-07 Capral Awning DG 6mm SE/12mm Air gap/6mm EA Clear	4.40	0.29	
Capral – Awning		**U**	**SHGC**	
CAP-051-03 35 Series Awning DG 6mm Clear/Air gap6mm /EA Clear		4.55	0.41	All snorkel bedrooms only

NOTES

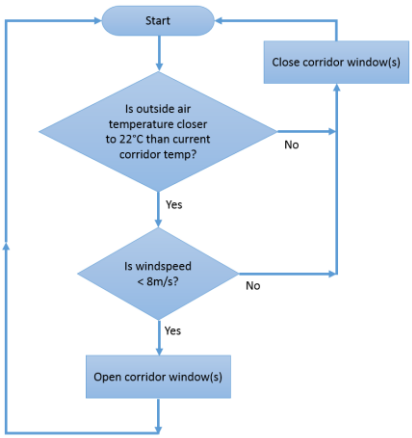
The energy rating software accredited by the Australian Building Codes Board contains a relatively limited library of window systems. When the glazing systems specified are not available in the software, the protocol requires that the glazing type which most closely matches the specified glazing is selected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

The table above sets out the glazing specified on the architectural drawings together with the glazing input 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.

AUTOMATED CORRIDOR VENTILATION

All apartment corridors incorporate a source of natural light and ventilation in accordance with the Victorian Better Apartment Design Standards 2017. Operable glazing in corridors will be automatically actuated so as to optimise thermal conditions and indoor air quality in accordance with the following control logic.



GENERAL RATING ASSUMPTIONS

Item	Details
Floor Coverings	• Tiles to bathrooms, • Carpet to bedrooms, • Timber boards to kitchen, living and all other areas
Window Coverings	Holland blinds to all windows. (Regulation Mode)[2]
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

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

2. 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 2016 Part J3.

[2] Holland blinds are assumed as required by VBA Practice Note 55 (Clause 5.2). This assumption is for regulatory purposes only.

Appendix 4: Rainwater Harvesting

Property: **Caulfield Village Precinct 2 Stage 2 Tanks 1 & 2**
Version:

box 1

Inputs:

Commercial	Floor Area - NLA (m2)	4668		
	PPL [M / F]	467	467	
	Flush/Person/Day [M - Urinal]	2		
	Flush/Person/Day [M / F - WC]	0.3	2.3	
	Litres/Flush [Urinal / WC]	1	3.3	
	Total Daily usage (litres)	4938.7		
Residential	PPL	233		
	Flush/Person/Day	5		
	Litres/Flush	4		
	Total Daily usage (litres)	4660		
Development	Total Daily usage (litres)	9599		
	Roof area (m2)	5,447		
	Collection Evaporation	5%		
	Tank Capacity (litres)	140,000		
	Irrigation Area (m2)	651		
	T'off if Total Rain (mm)	10		
	in the last	5	days	

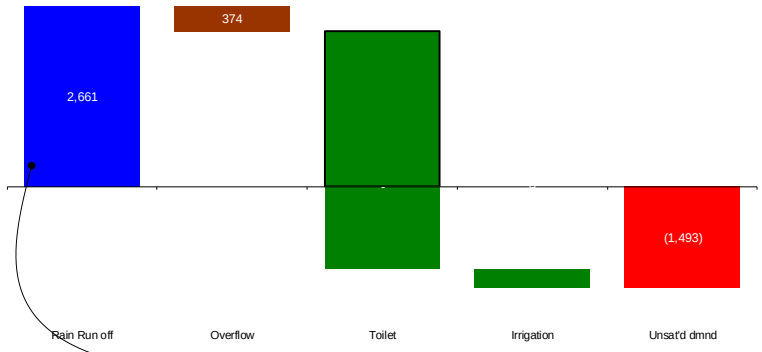
Recalc, update pivots, table and graphs

Irrigation Schedule

	l /m2	S	M	T	W	Th	Fr	S
Jan	10		y			y		
Feb	10		y			y		
Mar	10		y			y		
Apr	5		y					
May	5			y				
Jun	5			y				
Jul	5				y			
Aug	5				y			
Sep	5					y		
Oct	5					y		
Nov	10						y	
Dec	10		y				y	

box 2

System components (kls per year)



box 3

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

12 years of Averages
(k l)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rain Run off	**173**	**238**	**153**	**243**	**225**	**194**	**181**	**239**	**205**	**265**	**270**	**274**	**2,661**
Overflow	(15)	(68)	(32)	(47)	(15)	(18)	(8)	(9)	(10)	(35)	(59)	(58)	(374)
Rain Water saved	**158**	**170**	**121**	**197**	**210**	**176**	**173**	**230**	**195**	**230**	**211**	**216**	**2,287**
Toilet	(297)	(271)	(297)	(288)	(297)	(288)	(297)	(297)	(288)	(297)	(288)	(296)	(3,504)
(Shortfall)/Surplus before Irrigation	**(139)**	**(102)**	**(176)**	**(91)**	**(87)**	**(112)**	**(124)**	**(67)**	**(93)**	**(67)**	**(77)**	**(80)**	**(1,217)**
Irrigation	(48)	(41)	(50)	(11)	(11)	(12)	(11)	(11)	(9)	(11)	(20)	(43)	(276)
Unsatisfied Demand	**(187)**	**(142)**	**(226)**	**(102)**	**(98)**	**(124)**	**(136)**	**(78)**	**(103)**	**(78)**	**(96)**	**(123)**	**(1,493)**

Actual Years
(k l)

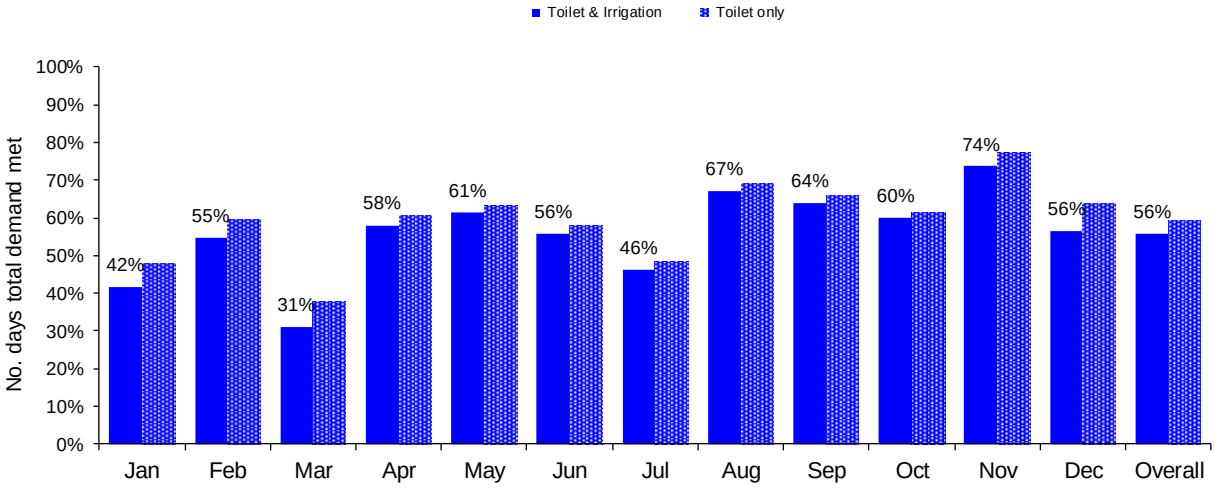
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Rain Run off	**1,862**	**3,027**	**3,159**	**3,257**	**3,132**	**2,052**	**2,551**	**3,220**	**3,053**	**2,269**	**2,189**	**2,168**	**31,938**
Overflow	(28)	(298)	(464)	(548)	(719)	-	(217)	(790)	(844)	(128)	(141)	(314)	(4,490)
Rain Water saved	**1,834**	**2,729**	**2,694**	**2,709**	**2,413**	**2,052**	**2,334**	**2,430**	**2,209**	**2,141**	**2,048**	**1,854**	**27,448**
Toilet	(3,504)	(3,504)	(3,504)	(3,504)	(3,504)	(3,504)	(3,504)	(3,504)	(3,504)	(3,504)	(3,504)	(3,513)	(42,052)
(Shortfall)/Surplus before Irrigation	**(1,670)**	**(775)**	**(809)**	**(794)**	**(1,090)**	**(1,451)**	**(1,169)**	**(1,074)**	**(1,294)**	**(1,363)**	**(1,455)**	**(1,659)**	**(14,604)**
Irrigation	(309)	(234)	(231)	(257)	(280)	(277)	(290)	(267)	(286)	(247)	(319)	(312)	(3,310)
Unsatisfied Demand	**(1,979)**	**(1,009)**	**(1,040)**	**(1,051)**	**(1,370)**	**(1,728)**	**(1,459)**	**(1,340)**	**(1,581)**	**(1,610)**	**(1,774)**	**(1,972)**	**(17,915)**

box 4

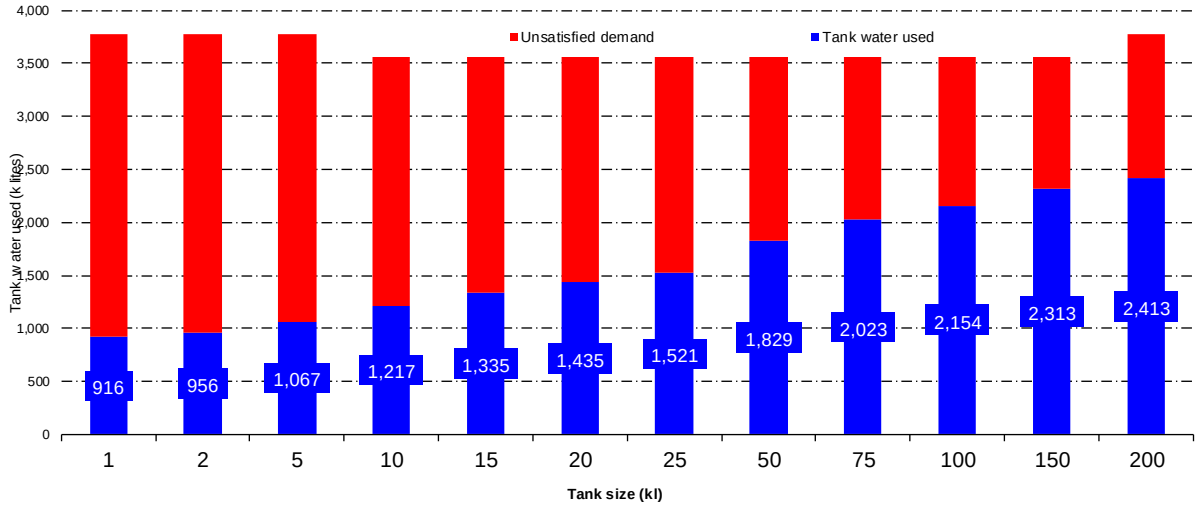
Reliability of supply (daily demand met)- Tank size what ifs

Tank	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
1k	12%	13%	11%	16%	22%	17%	19%	20%	22%	20%	18%	15%	17%
2k	12%	13%	11%	16%	22%	17%	19%	20%	22%	20%	19%	15%	17%
5k	13%	14%	11%	17%	22%	19%	20%	22%	23%	22%	19%	16%	18%
10k	17%	20%	15%	25%	30%	26%	27%	30%	32%	31%	28%	23%	25%
20k	22%	26%	18%	32%	34%	32%	32%	39%	38%	40%	35%	29%	31%
50k	32%	39%	24%	44%	44%	43%	40%	55%	48%	52%	50%	40%	43%
100k	38%	52%	28%	54%	55%	52%	45%	65%	61%	58%	66%	52%	52%
200k	47%	58%	34%	62%	67%	60%	48%	68%	68%	62%	79%	64%	60%

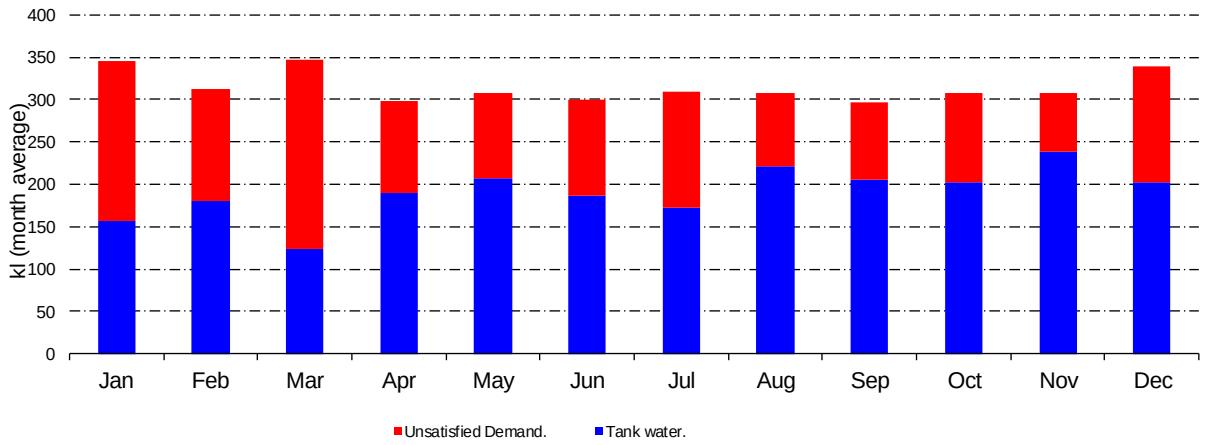
Graph 2 - Reliability of supply from tank (average across 12 years)



Graph 3 -Tank water used (per year) V Tank size
Kls per year



Graph 4 - Tank water used v unsatisfied demand
by month (kls per month)



Appendix 5: Implementation Schedule

ESD Initiative Implementation Schedule				
#	**Initiative**	**Requirement**	**Responsibility**	**Stage**
1	Coordination of Initiatives	Full implementation.	Project Manager	All
2	Apartment Energy Ratings	Full First Rate Assessments for all dwellings.	Thermal Performance Assessor	Design Development
3	Heating & Cooling	Specification of units in accordance with nominated MEPS star ratings.	Building Services Engineer	Design Development
4	Energy Efficient Appliances	Specification of dishwashers in accordance with nominated WELS and energy star ratings.	Architect	Design Development
5	Lighting	Specification of nominated energy efficient lighting types and automated controls.	Building Services Engineer	Design Development
6	Rainwater Harvesting	Design and specify rainwater harvesting system including toilet flushing & automated irrigation system.	Building Services Engineer	Design Development
7	Water Efficiency	Specify fixtures in accordance with nominated WELS star ratings.	Architect	Design Development
8	Bicycle Facilities	Specify bike racks & hoops.	Architect	Design Development
9	Operational Waste Management	Provide layout waste storage areas. Specify bins and associated waste management equipment.	Waste Management Consultant	Design Development
10	Construction Waste Minimisation	Prepare construction waste minimisation plan.	Builder	Construction
11	Environmentally Preferable Materials	Specify materials in accordance with nominated schedule.	Architect	Design Development
12	Metering	Specify meters in accordance with nominated schedule.	Building Services Engineer	Design Development
13	Commissioning & Maintenance	Commission & tune all equipment in accordance with performance standards & targets.	Builder	Construction/ occupancy