B.C.S. Consulting **Engineers** Pty. Ltd.
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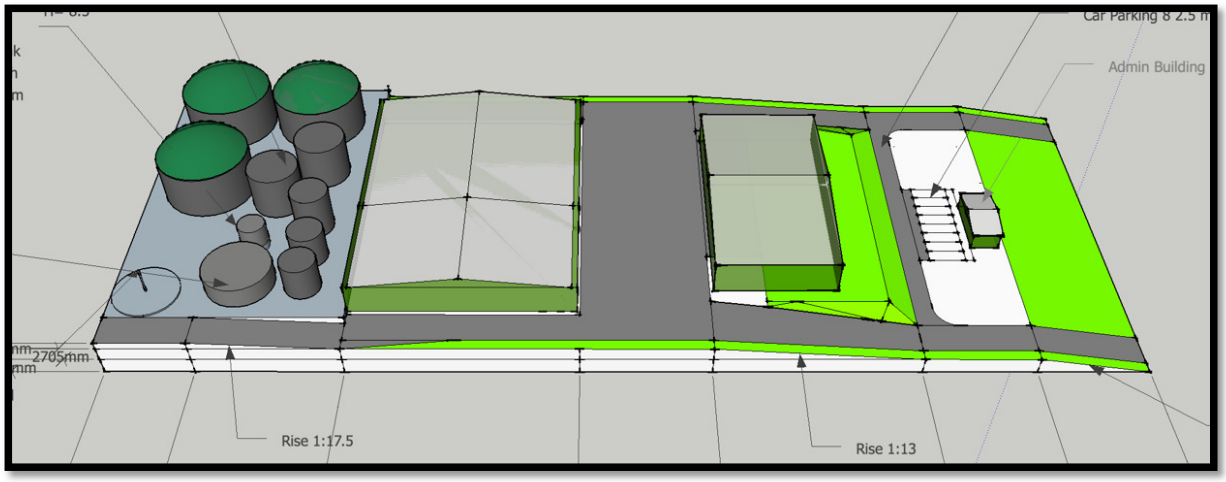
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BIOENERGY PLANT

RICHARDS ROAD, CASTLEMAINE

STORMWATER MANAGEMENT REPORT



NOVEMBER 23, 2021

MT ALEXANDER BIOENERGY PTY LTD

Richards Road, Castlemaine

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1. PROPOSED DEVELOPMENT

BCS Consulting Engineers have been engaged by Mt Alexander Bioenergy Pty Ltd to provide a Stormwater Management Report for a proposed Bioenergy plant located on Richards Road, Castlemaine. In doing so this report will outline the steps required to achieve objectives of safe urban development and the responsibility to protect existing waterways and infrastructure. Specifically, the report will outline how the development will minimise the impact of an increase in impervious area on water quality and runoff.

The site of the proposed Bioenergy Plant is mostly undeveloped grassland area with a sealed private road going partially through the front of the site. The location is to the north of the existing 'Don KR' factory on Richards Road. The proposal will contain approximately 8,098m^2 of new impervious area that must be serviced by stormwater treatment facilities prior to discharging to the swale within the road reserve.

A tank storage area located at the rear of the main structures will not be connected to the same stormwater system as the rest of the development as there are requirements to collect and store stormwater here separately.

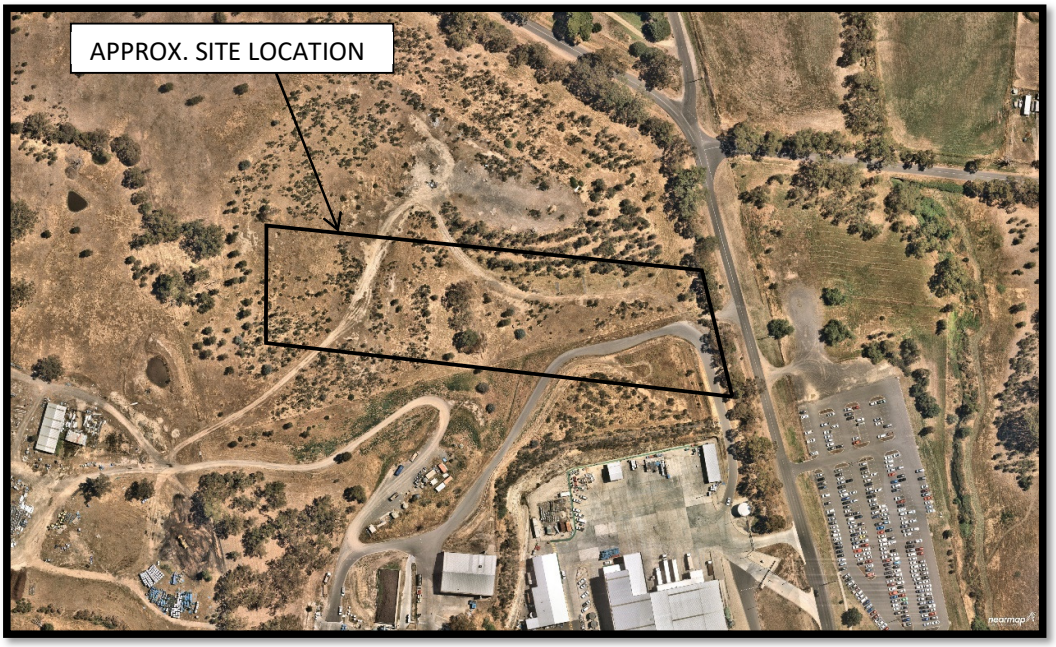


Figure 1: Subject site.

2. PROPOSED STORMWATER TREATMENT

The development is proposing to construct a bioretention basin to combat the increased stormwater runoff and pollutants brought about by an increase in impervious area. Bioretention basins have a dual function by both retarding stormwater runoff and filtering low flow water through sandy filtration layers making them effective and efficient in these types of developments. The basin will consist of a large storage pond with an outlet orifice pit limiting the basin outflow. A layer of filtration material with rows of perforated piping will drain and filter stormwater to the outlet pit in low flow stormwater events.

The site naturally slopes to the east allowing for the appropriate point of discharge to be the existing swale running along Richard Road. It is proposed that the basin will be installed in the south-east corner of the site.

Two impervious areas (shown green in figure 2) will not be drained to Richards Road and therefore will not be serviced by the proposed bioretention basin. Stormwater from these areas will be contained and disposed of separately.

All areas shown orange in figure 2 will be drained to the bioretention basin and then out to Richards Road.

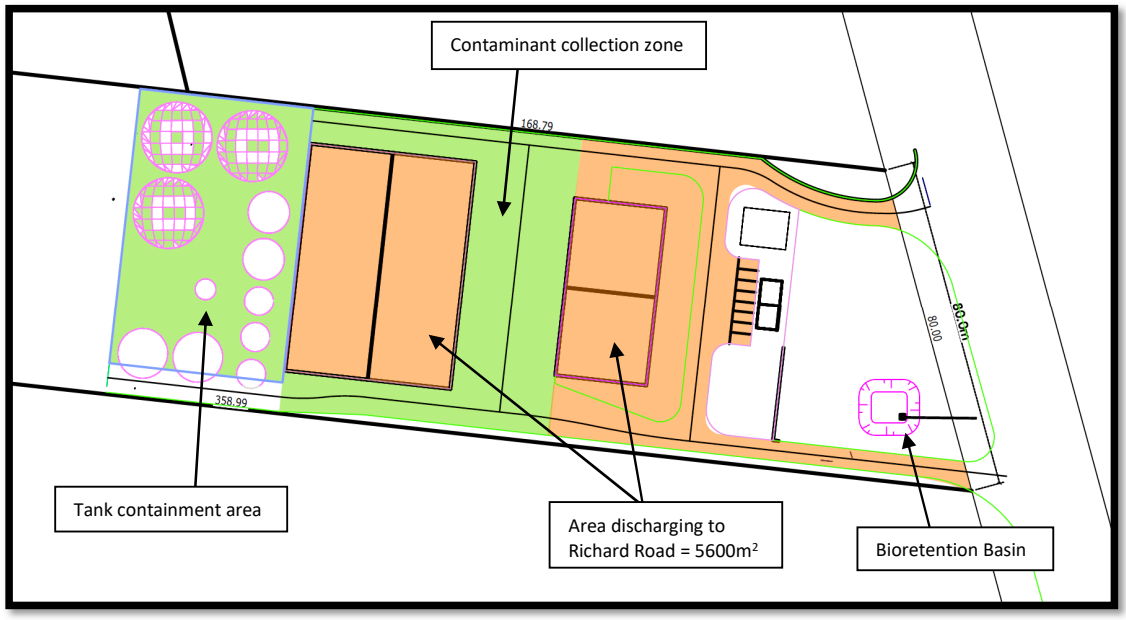


Figure 2: Approximate site layout.

2.1 Stormwater Detention

The method for calculating the development's stormwater detention requirements have been adopted from the Infrastructure Design Manual version 5.30. This method is effective at giving an overview of suitable drainage design however a more detailed design will be undertaken using computer modelling and the Australian Rainfall and Runoff method.

A summary of the results is displayed in the table below and computations shown in Appendix A.

Parameter	Result
Design storm	10% AEP (roughly 1 in 10 years)
Proposed impervious area	5,600m^2
Coefficient runoff pre-development, C_{pre}	0.3
Coefficient runoff post-development, C_{post}	0.95
Time of concentration, t	9 minutes
Rainfall intensity, I	86.6mm/h
Peak pre-development flow	40l/s
Detention storage required	64m^3

The basin will contain 64 cubic metres of storage and an orifice that will allow a maximum outflow rate of 40l/s. Greater than 10% AEP stormwater flows will travel over a spillway and flow naturally into the road reserve swale.

2.2 Stormwater Quality

The impact of the proposed bioretention basin on stormwater pollutants was modelled using the software package Music created by eWater. The development must meet Melbourne Water reduction objectives which are outlined in the table below.

To achieve the objectives set out by Melbourne Water a biofiltration area of 30 square metres will be needed with a filtration media depth of 0.3 metres. The extended detention depth will be 0.2 metres. The Music design and audit are shown in Appendix B with the pollutant reduction results tabled below.

Pollutant	Estimated reduction	MW reduction objective
Suspended Solids	91.7%	80%
Phosphorus	78.7%	45%
Nitrogen	47.9%	45%
Litter	100%	70%

The figure below outlines a standard biofiltration basin setup which will be adopted for this development.

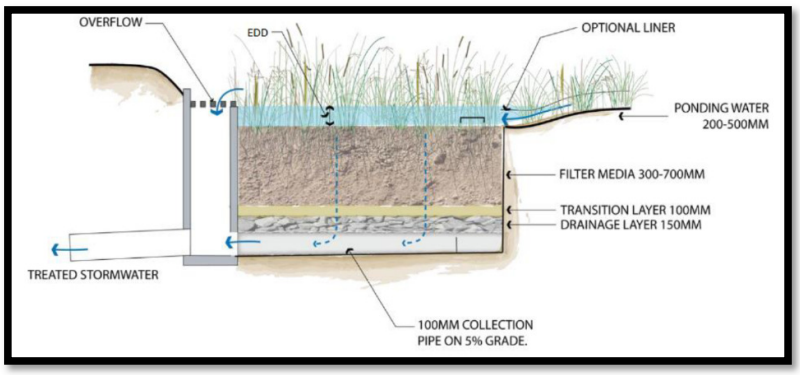


Figure 3: Biofiltration diagram from Melbourne Water 'Raingarden design for Melbourne's West'

3. CONCLUSION

This report demonstrates that the proposed development of a Bioenergy Plant at Richards Road will meet the designated stormwater safety objectives set by Melbourne Water and Mount Alexander Shire Council.

The development will connect the increased impervious area with a Bioretention Basin which will act to retard stormwater runoff and filter pollutants from the water. The basin will fit conveniently at the east boundary of the site and will discharge water runoff into the Richards Road swale.

Further detailed design to specify the hydraulics of the stormwater system will be undertaken during the design stage of the project.

4. APPENDICES

APPENDIX A – STORMWATER DETENTION COMPUTATIONS

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JOB No: 13252 PAGE: 1

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Phone: (03) 5428 3266
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CLIENT: GWF

PROJECT: Bioenergy Plant Date: 22/11/21

Stormwater Management Plan

Detention Requirement

Calculation method and policy have been taken from IDM 5.30

Design storm = 10% 1 EP → Based on industrial use.

Proposed Impervious area = 5600m² = 0.56 ha

Coefficient of Runoff Pre-development, C = 0.3

Coefficient of Runoff Post-development C = 0.95 paved area.

Time of concentration assessed on the site as the catchment.

$t_o = t_{pipe} + t_{surface} = (250s/1m/s) + 5min$

$t = 9$ minutes

Rainfall Intensity, I = 86.6 mm/h

Peak Pre-development flow, $Q = \frac{CIA}{360}$

$= \frac{0.3 \times 86.6 \times 0.56}{360}$

$= 0.0404$ m³/s

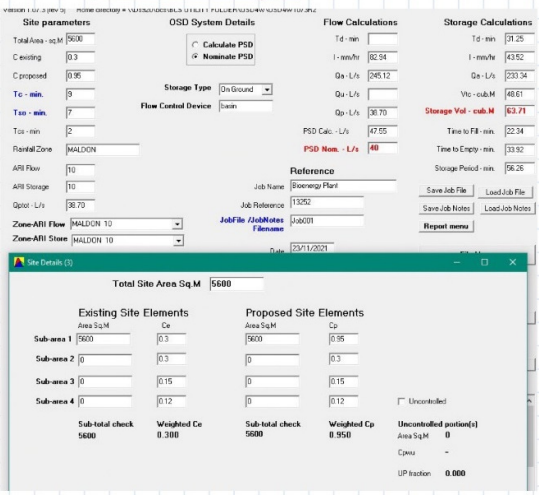
$= 40$ L/s

Table | Chart — Unit: mm/h

	Annual Exceedance Probability (AEP)						
Duration	63.2%	50%#	20%*	10%	5%	2%	1%
1 min	80.4	94.8	143	178	216	269	312
2 min	64.7	76.2	116	145	177	224	264
3 min	59.2	69.6	105	132	160	202	237
4 min	55.1	64.8	97.7	122	148	186	217
5 min	51.5	60.7	91.4	114	138	173	201
10 min	39.1	46.1	69.4	86.6	104	130	151
15 min	31.6	37.3	56.3	70.3	84.9	105	122
20 min	26.7	31.5	47.6	59.5	71.9	89.5	104
25 min	23.2	27.4	41.4	51.8	62.7	78.1	90.9
30 min	20.6	24.3	36.8	46.0	55.7	69.6	81.0
45 min	15.7	18.5	27.9	35.0	42.4	53.1	62.0
1 hour	13.0	15.2	22.9	28.6	34.7	43.4	50.8

Adopt 40 L/s as pre-development design discharge of impervious area.

OSD4W Analysis



Storage Volume = 64 m³

```
        ***  SUMMARY OSD DESIGN REPORT  ***
             ==========================

Printed from  *OSD4W*  version 1.07.3     S/N #  W8-03182
Licensed to : BCS Consulting Engineers P/L
Prepared by : JC
======================================================================

1. CLIENT DETAILS
   Client Name              :  George Weston Foods
   ClientDet1.....          :  ClientDet1.....
   ClientDet2.....          :  ClientDet2.....
   ClientDet3.....          :  ClientDet3.....

2. JOB NAME AND REFERENCE
   Job number               :  13252
   Project site             :  Bioenergy Plant
   ClientDet1.....          :  Richard Road
   ClientDet2.....          :  Castlemaine
   ClientDet2.....          :  Castlemaine


3. AREAS (sq.m.)  &  RUN-OFF COEFFICIENTS
    Total Site area  :     5600

4. EXISTING SITE DETAILS
   Aes1  :  5600          Ces1    :  0.30
   Aes2  :  0             Ces2    :  0.30
   Aes3  :  0             Ces3    :  0.15
   Aes4  :  0             Ces4    :  0.12
   Weighted C - site      Cew     :  0.30

5. PROPOSED SITE DETAILS
   Aps1  :  5600          Cps1    :  0.95
   Aps2  :  0             Cps2    :  0.30
   Aps3  :  0             Cps3    :  0.15
   Aps4  :  0             Cps4    :  0.12
   Weighted C - site      Cpw     :  0.95
   Uncontrolled portion(s)  UPfrac  :  0.00

6. CATCHMENT TIMES (minutes)
   Time of concentration          :  9.00
   Travel time from discharge point
            to catchment outlet   :  7.00

7. OSD DESIGN
    Flow Control Device             :  basin
    Storage type                    :  On-Ground
    Rainfall zone                   :  MALDON
    ARI for OUTFLOW         (years) :  10
    ARI for STORAGE         (years) :  10
    Qptot                (L/s)      :  38.70
    Qu                   (L/s)      :  0.00
    Qp                   (L/s)      :  0.00
    Calculated PSD          (L/s)   :  47.55
    Nominated PSD           (L/s)   :  40.00
    Adopted PSD             (L/s)   :  40.00

8. STORAGE DETAILS
    Volume               (cub.m.)   :  63.71
    Time to fill storage    (mins)  :  22.3
    Time to empty storage   (mins)  :  33.9
    Critical storm duration (mins)  :  31.2

9. STORM DURATIONS & RAINFALL INTENSITIES
    PSD ..... Duration :  9.0 min.    Intensity :  82.9 mm/hr
    MAX. STORAGE ..... Duration :  31.2 min.    Intensity :  43.5 mm/hr
======================================================================
======================================================================
Generated at :  23/11/2021 9:37:56 AM
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APPENDIX B – MUSIC WATER QUALITY ANALYSIS

FIGURE B1 - MUSIC LAYOUT AND BASIN CONFIGURATION

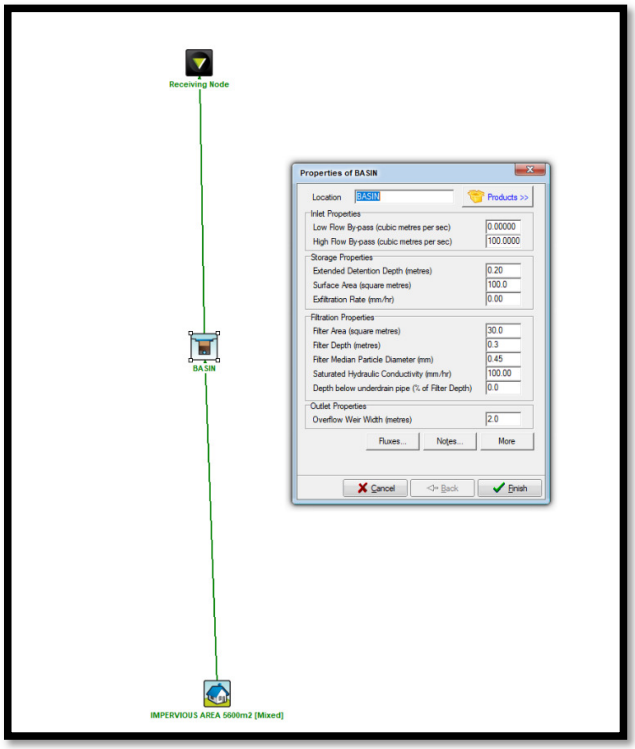


FIGURE B2 – TREATMENT TRAIN EFFECTIVENESS

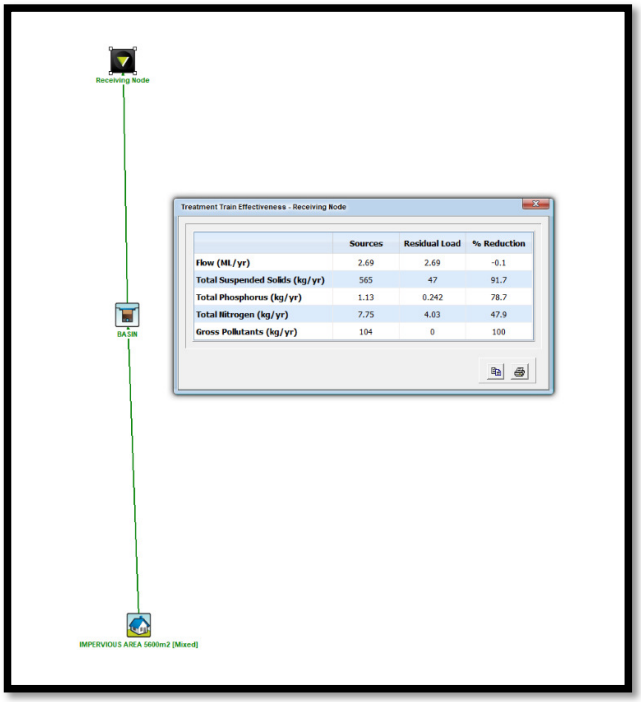
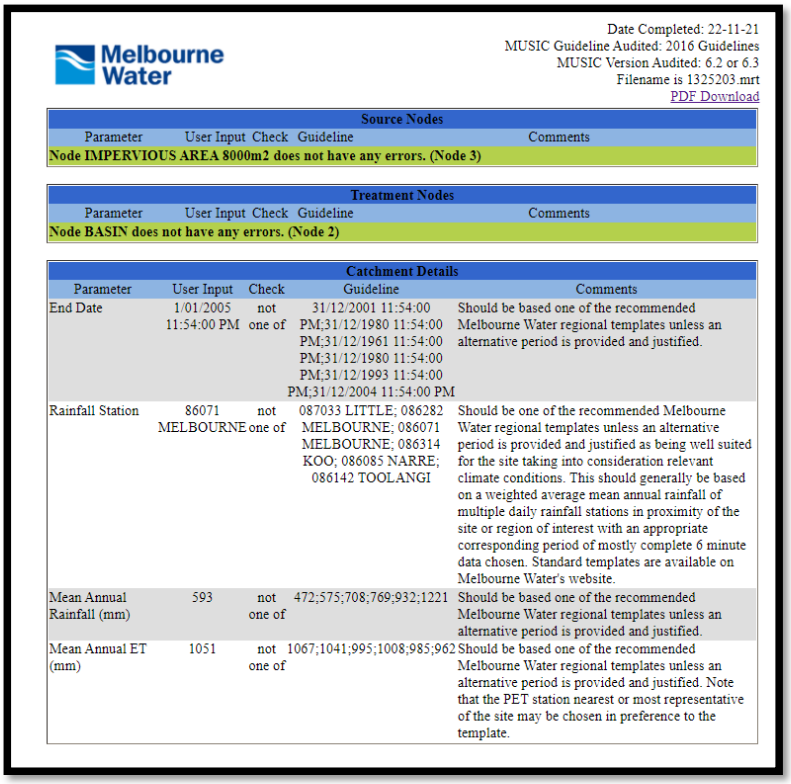


FIGURE B3 – MELBOURNE WATER AUDIT



Melbourne Water

Date Completed: 22-11-21
MUSIC Guideline Audited: 2016 Guidelines
MUSIC Version Audited: 6.2 or 6.3
Filename is 1325203.mrt
PDF Download

Source Nodes

Parameter	User Input	Check	Guideline	Comments
Node IMPERVIOUS AREA 8000m2 does not have any errors. (Node 3)				

Treatment Nodes

Parameter	User Input	Check	Guideline	Comments
Node BASIN does not have any errors. (Node 2)				

Catchment Details

Parameter	User Input	Check	Guideline	Comments
End Date	1/01/2005 11:54:00 PM	not one of	31/12/2001 11:54:00 PM;31/12/1980 11:54:00 PM;31/12/1961 11:54:00 PM;31/12/1980 11:54:00 PM;31/12/1993 11:54:00 PM;31/12/2004 11:54:00 PM	Should be based one of the recommended Melbourne Water regional templates unless an alternative period is provided and justified.
Rainfall Station	86071 MELBOURNE	not one of	087033 LITTLE; 086282 MELBOURNE; 086071 MELBOURNE; 086314 KOO; 086085 NARRE; 086142 TOOLANGI	Should be one of the recommended Melbourne Water regional templates unless an alternative period is provided and justified as being well suited for the site taking into consideration relevant climate conditions. This should generally be based on a weighted average mean annual rainfall of multiple daily rainfall stations in proximity of the site or region of interest with an appropriate corresponding period of mostly complete 6 minute data chosen. Standard templates are available on Melbourne Water's website.
Mean Annual Rainfall (mm)	593	not one of	472;575;708;769;932;1221	Should be based one of the recommended Melbourne Water regional templates unless an alternative period is provided and justified.
Mean Annual ET (mm)	1051	not one of	1067;1041;995;1008;985;962	Should be based one of the recommended Melbourne Water regional templates unless an alternative period is provided and justified. Note that the PET station nearest or most representative of the site may be chosen in preference to the template.