WATER CYCLE MANAGEMENT PLAN

FOR

RETIREMENT VILLAGE

AT

46 WINDWARD WAY,

MILTON NSW 2538

Consulting Engineers
ABN 25166672859
info@samanablue.com
+61 488 042 994

Report Title: Water Cycle Management Plan at 46 Windward Way, MILTON NSW 2324

Report Reference: 2019038smpA

Revision	Issue Date	Author	Reviewer
A	20 September 2019	AW	SK

For and on behalf of
Samana Blue Engineering Pty Ltd

SK

Stefan Koebsch B.E., M.I.E. (Aust.), CPEng, NER

CONTENTS

1. INTRODUCTION

1.1. General

Samana Blue Engineering has been engaged by the client to undertake an Integrated Water Cycle Management plan at the subject site. This report must be read in conjunction with the other Development Application documents and other relevant information, including:

- Architectural Drawings by Stephen Jones Associates;
- Shoalhaven Council's DCP 2014 Part G2 "*Sustainable Stormwater Management & Erosion/Sediment Control*" and the associated G2.3 Technical Guidelines.

This purpose of this report is to:

- Describe the site and the proposed development scheme;
- Demonstrate compliance with the water quantity (OSD) objectives;
- Demonstrate compliance with the water quality (WSUD) objectives;
- Demonstrate compliance with the water retention objectives.

This is the 3rd revision of the report; the first two revisions were done by Greenview Consulting. This revision by Samana Blue Engineering has been prepared to address recent changes to the development's layout and design, those being:

- Central Ave is now a council dedicated public road with a separate treatment system
- Changes to the major intersection on Princes Highway
- Minor archictural changes to:
    - Buildings around an existing tree to be retained
    - Internal road configuration
    - Overland flow directions

2. EXISTING CONDITIONS

2.1. Site Description

The subject site is located on the northern side of Windward Way and close to the Princes Hwy, refer **Figure 2.1**. The site is currently vacant rural land with some native remnant vegetation.

Figure 2.1: Site Location

The site includes the following lots: Lot 1 DP 780801 & Lot 1 DP 737576. The total area occupied by the subject site is approximately 14.9 ha. The site grades approximately to the north to a small creek.

2.2. Local Catchment / Waterways

The subject site is located in a relatively small catchment that is predominantly rural (open pastureland) with scattered development along the Princes Hwy. This catchment drains in a westerly direction into a tributary of Petty Ck, which in turn drains into Stony Ck. Stony Ck itself drains south-eastwards into Burrill Lakes and then into the ocean, refer also **Figure 2.2**.

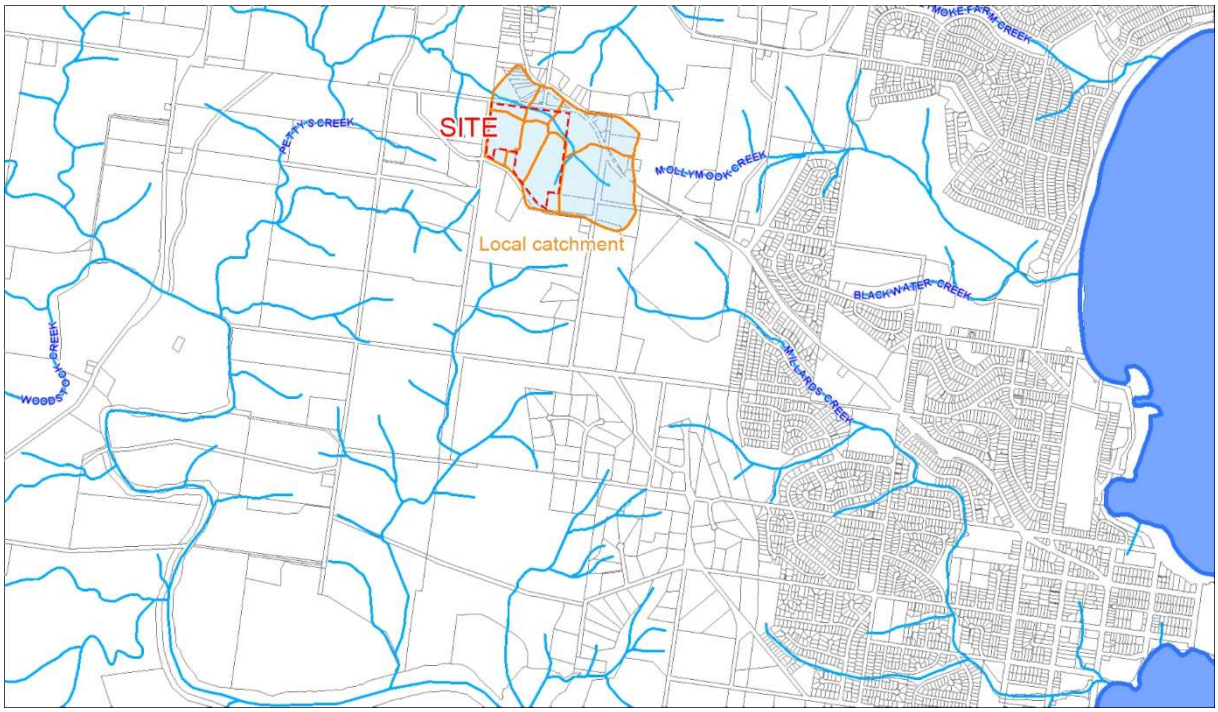

Figure 2.2: Site context

3. PROPOSED DEVELOPMENT

3.1. Proposed Development Description

The development as currently proposed consists of senior housing on a 35-acre site. The proposal incorporates the following:

- 127 x Single Dwellings in duplex / triplex arrangement
- 7 x Unit Dwellings
- Residential Care Facility
- Clubhouse and Medical Centre
- Public road reserve

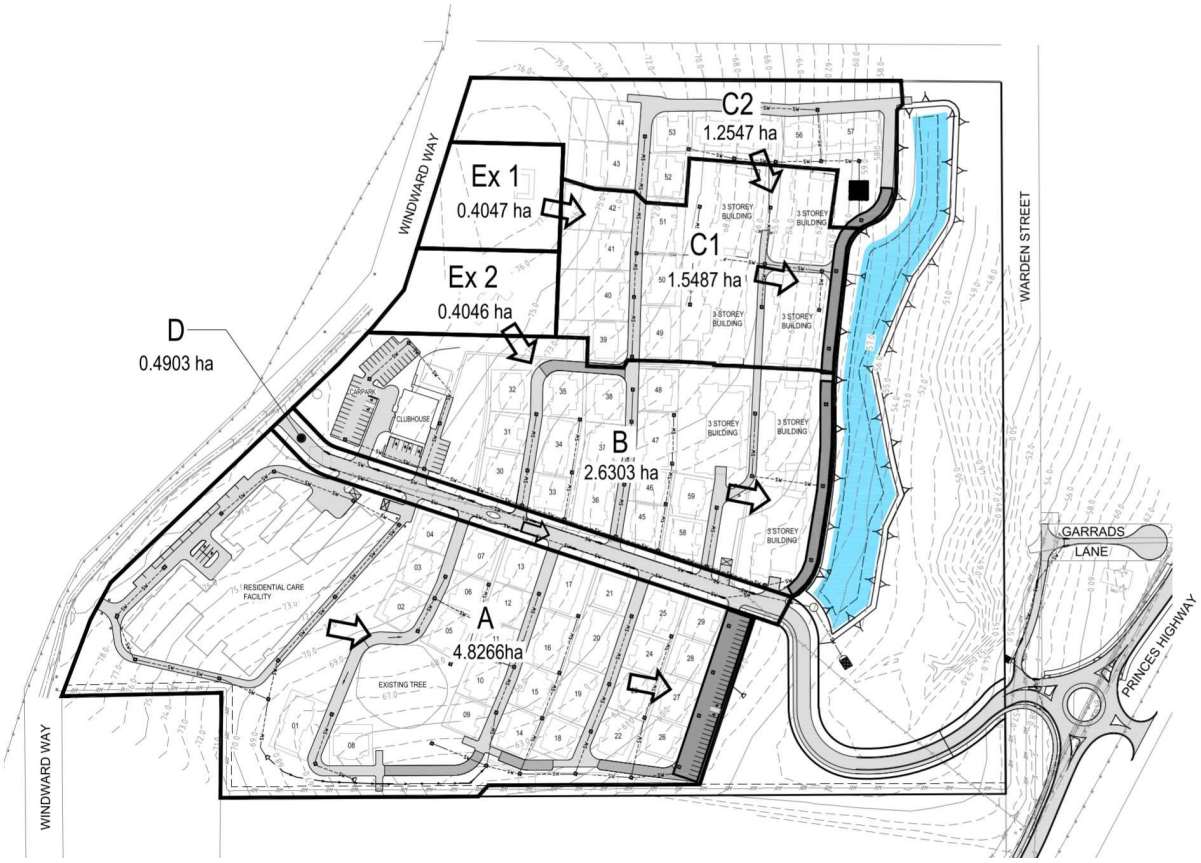

Figure 3.1: Proposed Development

4. WATER QUANTITY

4.1. Preliminary Information & OSD Modelling

As noted in Shoalhaven Council's DCP: *OSD is to be sized to match pre-development peak flow rates for the 5, 20 and 100 year ARI rain events for that site.*

Hydrological and OSD modelling was undertaken using iWBNM 2013, an updated interface to the WBNM hydrological engine. WBNM ('Watershed Bounded Network Model' Boyd et al, 2007) is an advanced storage-routing model developed in conjunction with the University of Wollongong that allows simulation of complex catchment behaviour. WBNM calculates and routes a full hydrograph through any modelled storage areas (such as onsite detention basins).

A summary of the adopted modelling parameters is provided below:

- Lag Parameter: 1.60 (recommended default)
- Stream Routing: 1.0 (default for streams)
- Initial Loss: 0.00 [mm] (to account for antecedent rainfall)
- Continuing Loss Rate: 2.50 [mm/hr]
- Raingauges: Milton (1 total)

With respect to the modelled subareas, we have assumed the site will be split into 3 catchments, with each catchment draining to an OSD tank (that will also serve a water quality purpose). These sub-catchments are depicted in **Figure 4.1** (nomenclature is A, B & C). We highlight that sub-catchments B & C will drain into their respective OSD tanks, and then into the ornamental pond (which has a secondary OSD function; approximately 2000m^3 of volume is available above the permanent standing water level). We have also included the adjacent subareas; that is, our modelling includes the entire local catchment. The primary purpose of including the local subareas was to ensure the discharge rates in the downstream watercourse will also match existing (pre-development) flowrates.

Table 4.1: OSD Subareas

Subarea	**Total Area** [ha]	**Existing Imp.%**	**Post. Imp. %**
A	6.149	<1%	67%
B	3.944	<1%	66% [a, c]
C	4.320	<1%	54% [a, c]
Sub01	13.734	10	No change
Sub02	7.783	15	17% [b]
Sub03	2.340	5	No change
Sub04	3.853	10	No change

[a] Post Imp. Area calculations include small amount of existing roof, plus new impervious areas
[b] Sub02 includes new access road area
[c] Proposed ornamental pond included as impervious area in Subs B & C

Impervious surfaces were calculated from the provided architectural site plan; the assumed areas are included in the appendices.

Figure 4.1: Site and Local Catchments

4.2. Model Results

Model results are included in the appendices and in summary form below. The required OSD sizes are as follows:

- Subarea A: 1900 m^3
- Subarea B: 1050 m^3
- Subarea C: 1020 m^3
- Ornamental pond: 1900 m^3 [storage above standing water level]

As evident from the tabulated results, the post-development flowrates will be less than pre-development (existing) flowrates at the outlet of each of the site subareas (A-C) for all events modelled. Furthermore, the flowrates at the outlet of the system will also be less than or equal to the corresponding pre-development flowrates.

Table 4.2: WBNM Results

Location	**Q5** [m^3/s]	**Q20** [m^3/s]	**Q100** [m^3/s]	**V100** [m^3]
A (Existing)	1.56	2.24	3.00	
A (Proposed)	1.45	2.00	2.61	**1873**
B (Existing)	1.10	1.57	2.09	
B (Proposed)	1.04	1.43	1.87	**1026**
C (Existing)	1.18	1.69	2.25	
C (Proposed)	1.12	1.55	2.08	**1009**
OUTLET - Existing	7.64	11.16	15.31	
OUTLET - Proposed	7.60	10.86	14.70	

[a] Q = Peak flowrates [m3/s], V = Volume of OSD required [m3]
[b] Results worst case from 25 / 90 / 120 minute durations

Hence, water quantity objectives will be achieved, provided that OSD is implemented as documented in this report and on the associated Samana Blue Engineering Civil Drawing set.

5. WATER QUALITY (WSUD)

5.1. WSUD Objectives

As noted in Shoalhaven Council's DCP 2014 Part G2 "*Sustainable Stormwater Management & Erosion/Sediment Control*", water quality targets are required for large-scale developments. These targets are post-development pollutant load reduction targets as per the following:

- Gross Pollutants: 90% reduction
- Total Suspended Solids: 85% reduction
- Total Phosphorus: 65% reduction
- Total Nitrogen: 45% reduction

5.2. Modelling Parameters & WSUD Measures

Water quality modelling for the proposed development was undertaken using MUSIC. MUSIC (Model for Urban Stormwater Improvement Conceptualisation) was developed by the Co-operative Research Centre (CRC) for Catchment Hydrology and is designed to evaluate conceptual stormwater treatment designs by simulating the performance of stormwater quality improvement measures and comparing with water quality targets.

Although the subject site is not located in the Sydney Drinking-water Catchment, the guidelines & recommendations of the SCA document "*Using MUSIC in Sydney's Drinking Water Catchment - A Sydney Catchment Authority Standard"* (December 2012) were typically adopted.

Modelling Parameters

The following modelling parameters were adopted:

- All rainfall runoff parameters and pollutant parameters as per the SCA guideline document aforementioned;
- Meteorological template for Zone 6 from the SCA guidelines, noting that the Zone 6 annual average rainfall is 1113 mm/year, and comparable to Ulladulla with 1111mm/yr of annual rainfall. We therefore believe this assumption is justifiable;
- Rainfall modelling period 1/1/1995 to 31/12/1999, refer also screenshot below;

The WSUD catchments generally matched those used in the OSD modelling, however we have limited the overall model extent to the developable area (as shown on the civil engineering drawings). We believe this is appropriate, noting that the OSD has been sized for the 100yr ARI event (where large flows will follow the natural contours), whereas the WSUD modelling targets the high-frequency events (that is, events with much lower flowrates). As such, any catchments external to the site (in high frequency events) are likely to be

captured by Windward Way and directed away from the site itself. We note that:

- The 2 existing residential cut-out lots (0.4 ha each) are included in the model;
- The new access road has been included as a bypass area.

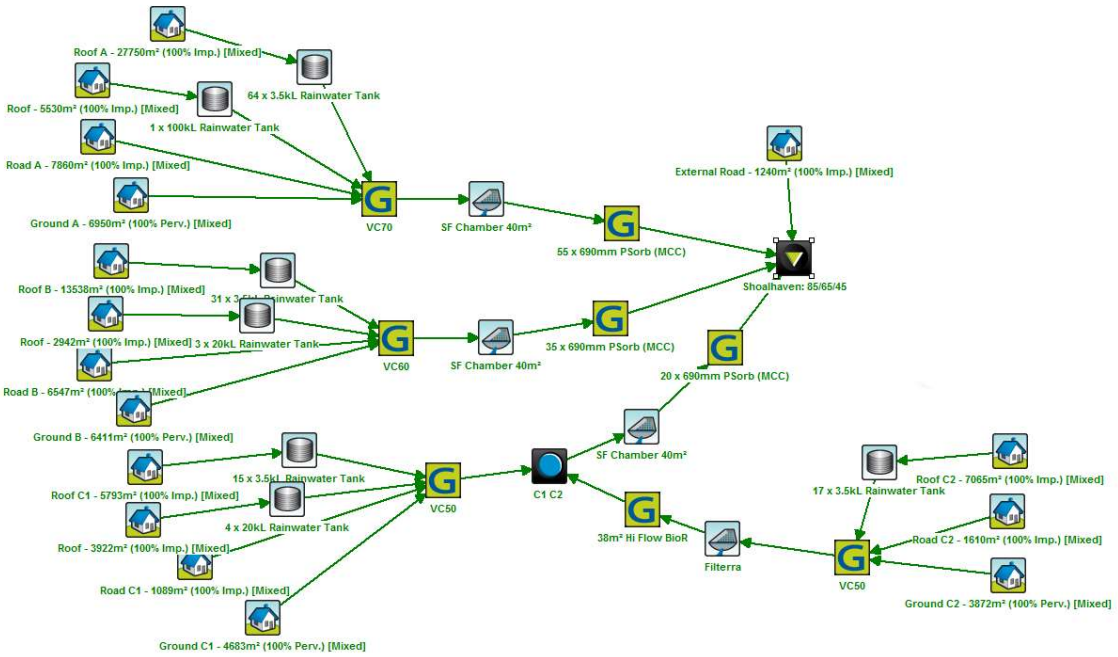

Figure 5.1: MUSIC Model

WSUD Measures

The required WSUD measures are summarised in **Figure 5.2** and below, and depicted in detail on the associated Samana Blue Engineering Civil Concept Drawing Set. The required measures are as follows:

A. All duplexes / triplex dwellings to be provided with 3.5 kL Rainwater re-use tank (RWT) per dwelling. That is, 2 per duplex and 3 per triplex. Re-use rate was assumed to be 0.45 kL / day (assumes toilet, hot water and laundry use, typical);
B. All units / apartments to be provided with a 20 kL RWT per building; re-use rate was assumed to be 0.45 kL / day;
C. The aged-care facility (97 rooms) to be provided with a 100 kL RWT with an assumed re-use rate of 0.125 kL/day/room;
D. A Stormwater360 GPT for each of the 3 subcatchments;
E. A Stormwater360 Filterra 40m^2 system for catchment C2;
F. Stormwater360 cartridges for each of the 3 OSD tanks, as noted on the Samana Blue Engineering drawing set.

We note the ornamental pond has been excluded from the water quality modelling as preliminary modelling showed it had minimal benefit towards achieving the reduction targets.

5.3. Music Results

As shown below in **Figure 5.3**, the post-development reduction targets for the subject site are met, provided the WSUD measures as documented in this report are implemented.

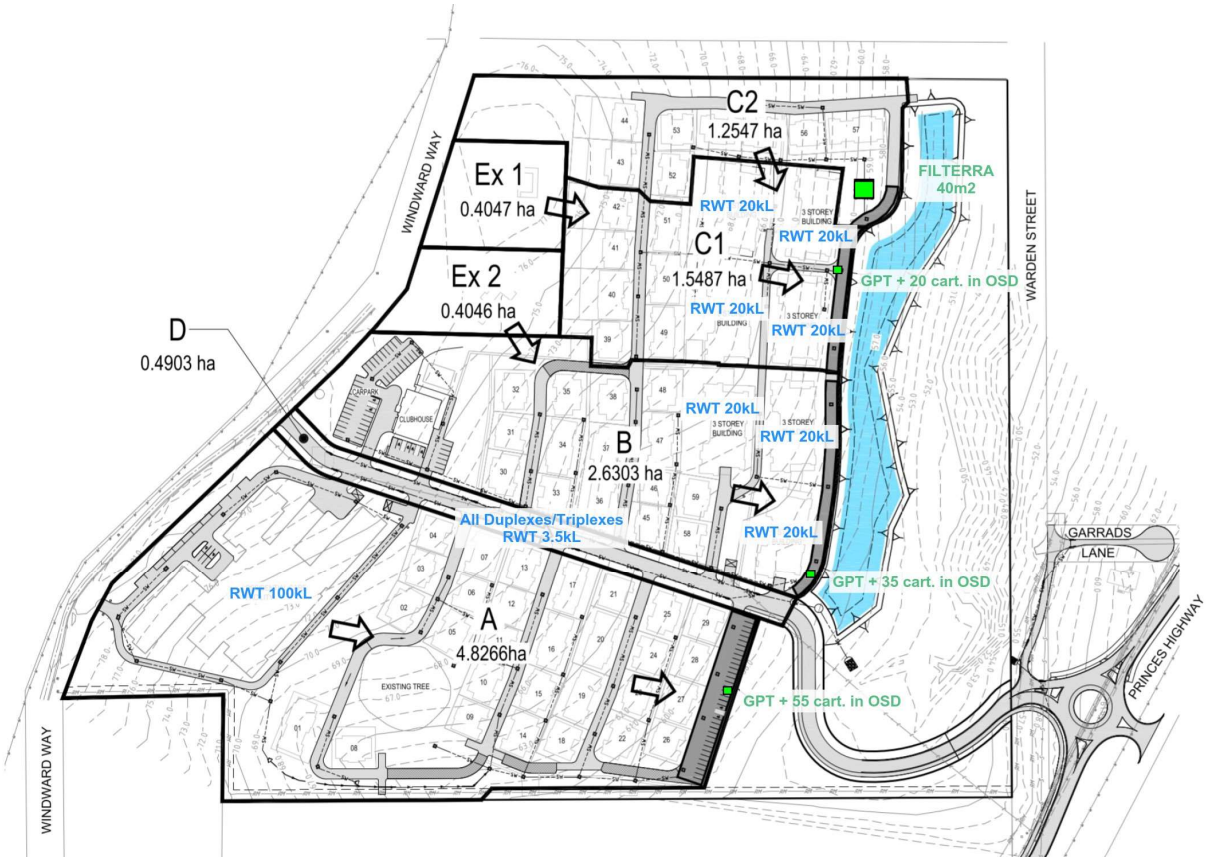

Figure 5.2: Proposed WSUD Measures

Treatment Train Effectiveness - Shoalhaven: 85/65/45

	Sources	Residual Load	% Reduction
Flow (ML/yr)	73.6	56.1	23.8
Total Suspended Solids (kg/yr)	6590	979	85.1
Total Phosphorus (kg/yr)	17.3	4.08	76.5
Total Nitrogen (kg/yr)	162	70.2	56.7
Gross Pollutants (kg/yr)	1820	22.8	98.7

Figure 5.3: MUSIC Model Results

6. RETENTION

6.1. Retention Checks

As noted in Shoalhaven Council's Technical Supplement:
[Stormwater retention] to all development where the amount of impervious surfaces post-development will be greater than the amount of impervious surfaces pre-development. The definition of retention storage for the purpose of this document is the storage volume available for reuse (e.g. rainwater tanks) and/or the volume of storage provided in systems that allow infiltration into the soil profile, e.g. bioretention trenches or wetlands. In this context, retention should not be confused with detention which does not reduce runoff volume. However, retention volume can contribute towards your detention (OSD) requirements provided the systems are interconnected. In this case 50% of the retention volume can be credited to the OSD volume.

Retention checks were performed as follows, refer also **Table 6.1**.

Retention storage = new impervious surface x storage depth
Storage depth = 9mm = 0.009m (Table 4.1, adopt Medium Density)

Table 6.1: Retention Volume calculations

Subarea	**New Imp. Area** [m^2]	**Storage depth** [m]	**Retention Volume** [m^3]
A	41,140 m2	0.009	370
B	23,027 m2	0.009	207
C	19,479 m2	0.009	175
External road	1240		11
		TOTAL Required	763 m^3

As evident from the OSD calculations, the volume provided in the proposed rainwater tanks (around 680m^3) plus the ornamental pond (1900m^3 above the standing water level) is in excess of what is required. Thus, the targets with respect to retention volumes will be exceeded.

7. OPERATION AND MAINTENANCE

7.1. Water Quality Ponds & Bio-Infiltration Maintenance

The operation tasks / maintenance procedures for the WSUD measures are straight forward, as detailed in **Tables 7.1** within the appendices.

8. CONCLUSION

We conclude that:

- The water quantity measures for the subject site will be met or exceeded provided the OSD measures are implemented as described in this report and as shown on the associated Samana Blue Engineering Concept Civil drawings;
- The water quality measures for the subject site will be met or exceeded provided the WSUD measures are implemented as described in this report and as shown on the associated Samana Blue Engineering Concept Civil drawings;
- The water retention targets are met or exceeded

Appendix 1: WSUD Maintenance

Table 7.1: Maintenance Tasks Stormwater360 elements

Unit	Task	Description	Frequency
Enviropod200	Inspection	* Check if bag is 1/2 to 2/3 full, if yes then clean * Cleaning: empty & brush filter bag (or use inductor truck) * Complete other checks (See following)	1st year of operation: monthly Subsequent years: 2-6 times/year All years: after moderate-heavy rainfall
	Check Enviropod unit	* All connections / joints checked & broken rivets replaced * Check plastic pit seals for movement / damage * Check cage for damage / movement * Check overflow diversion * Check area between pit wall and unit for debris & clean out * Check outlet pipe and flush as necessary	At every inspection
	Check Filter Bag	* Check filter bag for clogging, clean as required * Check filter bag for tears, repair as necessary * Check if filter bag is too damaged to be retained	At every inspection
	Replace Filter Bag	* If bag is too damaged, replace with new bag **Recommendations** If cleaning unit by hand, 2 people recommended More rainfall expected in summer & autumn months, therfore check more regularly in these seasons All gully pit wastes from the site are to be taken off site and disposed of at a transfer station or similar approved disposal site. Stormwater Sediments can contain Lead, Copper, Zinc, Mercury, hydrocarbons and PCBs, which are harmful to both humans and the receiving environment. Appropriate sampling and laboratory analysis may be required to classify the material as suitable for reuse, or disposal under appropriate local guidelines	As indicated by inspections, typically 2-10 years
Stormfilter	Inspection	* Check external condition of unit * Visually inspect inside of unit for solid/liquid accumulation * Check outlet pipe	Annual (x1 per year) After major storms
	Maintenance	* Replace cartridges * Remove sediment from unit * Undertake structural repairs as necessary **Recommendations** Inspection should be performed by person who is familiar with Stormfilter unit Refer to Stormfilter maintenance guide for further details For subject site, replace all cartridges at the same time Filter cartridge replacement should occur during dry weather	Every 2 years or as indicated by inspections After a chemical spill in the catchment
Vortsentry Unit	Inspection	* Check depth of sediment in Vortsentry * Check if floating oils / hydrocarbons have accumulated	x4 per year
	Maintenance	* Clean / remove sediment if depth of sediment is 1m or greater * Remove any floating material / oils / hydrocarbons **Recommendations** Refer to Vortsentry Manual for suggestions and guides for individual models Cleaning should take place during dry weather	As indicated by inspections

Appendix 2: WBNM Results

Results	OUTLET-Outflow	PEAK_Flows	VOLUMES	TIMES	Structures	CLEAR	LOAD	D:\Projects\2016 AMK (GV)\Milton - Meadows (SW)\WBNM\OSD_milton-overall-02_Meta.out	
REC 10yr_15min	5	5	5	20	20	20	100	100	100
REC	25	90	120	25	90	120	25	90	120
DESCRIPTION	5 Year ARI 25 Mins Du	5 Year ARI 90 Mins Du	5 Year ARI 120 Mins D	20 Year ARI 25 Mins D	20 Year ARI 90 Mins D	20 Year ARI 120 Mins I	100 Year ARI 25 Mins I	100 Year ARI 90 Mins I	100 Year ARI 120 Mins Duration DESIGN STORM
	1	2	3	4	5	6	7	8	9
Catch_area_ha	84.25	84.25	84.25	84.25	84.25	84.25	84.25	84.25	84.25
Impervious%	18.16	18.16	18.16	18.16	18.16	18.16	18.16	18.16	18.16
Rainfall_depth_mm	38.79	70.59	78.8	51.52	96.27	107.6	68.44	130.84	146.41
Excess_depth_mm	37.94	67.53	74.7	50.66	93.21	103.51	67.59	127.78	142.32
Calc_runoff_mm	18.66	33.1	36.07	25	45.83	50.18	33.43	62.95	69.15
VOLUMES_Outlet_m3									
ex_Sub1	5116	9028	9871	6855	12530	13769	9166	17241	19010
ex_Sub2	7975	14070	15329	10700	19547	21407	14321	26910	29578
ex_SubA	2302	4062	4445	3084	5636	6200	4123	7753	8561
ex_Sub3	11111	19585	21310	14913	27224	29779	19965	37493	41168
ex_SubB	1482	2618	2869	1984	3629	3998	2651	4989	5519
ex_SubC	1623	2865	3139	2173	3973	4375	2903	5462	6039
ex_Sub4	13963	24587	26691	18753	34201	37335	25118	47129	51650
ex_TOTAL	15585	27452	29830	20926	38174	41711	28021	52591	57690
pr_Sub1	5116	9028	9871	6855	12530	13769	9166	17241	19010
pr_Sub2	7978	14079	15342	10703	19556	21419	14324	26920	29592
pr_SubA	2361	4256	4716	3144	5834	6480	4185	7957	8856
pr_Sub3	11177	19796	21602	14981	27438	30082	20036	37717	41487
pr_SubB	1514	2731	3030	2016	3743	4164	2683	5107	5691
pr_SubC	1652	2969	3287	2202	4077	4528	2934	5570	6199
pr_OSD	3165	5693	6289	4217	7812	8653	5617	10666	11835
pr_Sub4	15722	27882	30391	21063	38609	42276	28166	53035	58257
pr_TOTAL	15722	27882	30391	21063	38609	42276	28166	53035	58257
PEAK_FLOWRATES_m3/s									
PEAK_Stream-Top									
ex_Sub1	0	0	0	0	0	0	0	0	0
ex_Sub2	2.827	3.24	3.05	3.96	4.646	4.368	5.063	6.219	5.897
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	4.351	5.472	5.454	6.193	7.962	7.921	8.101	10.84	10.831
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0
ex_Sub4	5.11	6.389	6.525	7.278	9.291	9.46	9.934	12.708	12.913
ex_TOTAL	5.87	7.519	7.637	8.395	10.912	11.155	11.791	14.996	15.314
pr_Sub1	0	0	0	0	0	0	0	0	0
pr_Sub2	2.827	3.24	3.05	3.96	4.646	4.368	5.063	6.219	5.897
pr_SubA	0	0	0	0	0	0	0	0	0
pr_Sub3	4.349	5.334	5.418	6.094	7.66	7.773	8.188	10.38	10.528
pr_SubB	0	0	0	0	0	0	0	0	0
pr_SubC	0	0	0	0	0	0	0	0	0
pr_OSD	1.994	2.158	2.145	2.688	2.982	2.967	3.416	3.952	3.926
pr_Sub4	5.935	7.28	7.365	8.239	10.33	10.475	11.199	13.92	14.096
pr_TOTAL	5.871	7.591	7.602	8.224	10.808	10.859	11.314	14.654	14.698
PEAK_Stream-Bottom									
ex_Sub1	0	0	0	0	0	0	0	0	0
ex_Sub2	1.803	2.331	2.378	2.578	3.394	3.478	3.619	4.676	4.784
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	3.977	5.024	5.143	5.668	7.313	7.477	7.835	10.031	10.223
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0

REC 10yr_15min	5	5	5	20	20	20	100	100	100
REC	25	90	120	25	90	120	25	90	120
DESCRIPTION	5 Year ARI 25 Mins Du	5 Year ARI 90 Mins Du	5 Year ARI 120 Mins D	20 Year ARI 25 Mins Di	20 Year ARI 90 Mins Di	20 Year ARI 120 Mins I	100 Year ARI 25 Mins I	100 Year ARI 90 Mins i	100 Year ARI 120 Mins Duration DESIGN STORM
	1	2	3	4	5	6	7	8	9
ex_Sub4	4.667	6.019	6.115	6.686	8.748	8.918	9.348	12.025	12.237
ex_TOTAL	5.87	7.519	7.637	8.395	10.912	11.155	11.791	14.996	15.314
pr_Sub1	0	0	0	0	0	0	0	0	0
pr_Sub2	1.803	2.331	2.378	2.578	3.394	3.478	3.619	4.676	4.784
pr_SubA	0	0	0	0	0	0	0	0	0
pr_Sub3	4.116	5.122	5.213	5.795	7.361	7.502	7.951	10.012	10.186
pr_SubB	0	0	0	0	0	0	0	0	0
pr_SubC	0	0	0	0	0	0	0	0	0
pr_OSD	1.994	2.158	2.145	2.688	2.982	2.967	3.416	3.952	3.926
pr_Sub4	5.479	6.986	7.017	7.668	9.946	10.023	10.522	13.472	13.552
pr_TOTAL	5.871	7.591	7.602	8.224	10.808	10.859	11.314	14.654	14.698
PEAK_Local-Perv									
ex_Sub1	2.189	2.637	2.579	3.113	3.824	3.726	4.044	5.176	5.064
ex_Sub2	1.429	1.645	1.577	2.02	2.368	2.258	2.605	3.177	3.04
ex_SubA	1.358	1.555	1.487	1.918	2.236	2.126	2.471	2.996	2.86
ex_Sub3	0.648	0.687	0.632	0.905	0.975	0.891	1.147	1.288	1.182
ex_SubB	0.99	1.096	1.031	1.392	1.567	1.466	1.781	2.086	1.959
ex_SubC	1.057	1.178	1.112	1.488	1.687	1.584	1.907	2.249	2.119
ex_Sub4	0.901	0.988	0.925	1.266	1.411	1.313	1.617	1.875	1.752
ex_TOTAL	0	0	0	0	0	0	0	0	0
pr_Sub1	2.189	2.637	2.579	3.113	3.824	3.726	4.044	5.176	5.064
pr_Sub2	1.405	1.615	1.547	1.987	2.324	2.215	2.56	3.117	2.98
pr_SubA	0.604	0.636	0.583	0.843	0.903	0.822	1.068	1.191	1.088
pr_Sub3	0.648	0.687	0.632	0.905	0.975	0.891	1.147	1.288	1.182
pr_SubB	0.438	0.448	0.403	0.609	0.634	0.565	0.765	0.831	0.746
pr_SubC	0.595	0.625	0.573	0.83	0.887	0.806	1.05	1.169	1.068
pr_OSD	0	0	0	0	0	0	0	0	0
pr_Sub4	0.901	0.988	0.925	1.266	1.411	1.313	1.617	1.875	1.752
pr_TOTAL	0	0	0	0	0	0	0	0	0
PEAK_Local-Imp									
ex_Sub1	0.638	0.603	0.555	0.848	0.822	0.758	1.018	1.042	0.962
ex_Sub2	0.546	0.517	0.477	0.725	0.704	0.651	0.871	0.893	0.826
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	0.058	0.056	0.053	0.077	0.077	0.073	0.092	0.097	0.092
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0
ex_Sub4	0.187	0.179	0.167	0.248	0.244	0.228	0.297	0.308	0.289
ex_TOTAL	0	0	0	0	0	0	0	0	0
pr_Sub1	0.638	0.603	0.555	0.848	0.822	0.758	1.018	1.042	0.962
pr_Sub2	0.616	0.582	0.536	0.818	0.794	0.732	0.983	1.006	0.929
pr_SubA	1.809	1.703	1.544	2.402	2.323	2.108	2.899	2.951	2.682
pr_Sub3	0.058	0.056	0.053	0.077	0.077	0.073	0.092	0.097	0.092
pr_SubB	1.173	1.105	1.008	1.558	1.507	1.377	1.877	1.912	1.75
pr_SubC	1.058	0.996	0.911	1.405	1.358	1.243	1.691	1.724	1.58
pr_OSD	0	0	0	0	0	0	0	0	0
pr_Sub4	0.187	0.179	0.167	0.248	0.244	0.228	0.297	0.308	0.289
pr_TOTAL	0	0	0	0	0	0	0	0	0
PEAK_Directed-to-Btm									
ex_Sub1	0	0	0	0	0	0	0	0	0
ex_Sub2	0	0	0	0	0	0	0	0	0
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	0	0	0	0	0	0	0	0	0

REC 10yr_15min	5	5	5	20	20	20	100	100	100
REC	25	90	120	25	90	120	25	90	120
DESCRIPTION	*5 Year ARI 25 Mins Du*	*5 Year ARI 90 Mins Du*	*5 Year ARI 120 Mins D*	*20 Year ARI 25 Mins Du*	*20 Year ARI 90 Mins Du*	*20 Year ARI 120 Mins I*	*100 Year ARI 25 Mins I*	*100 Year ARI 90 Mins I*	*100 Year ARI 120 Mins Duration DESIGN STORM*
	1	2	3	4	5	6	7	8	9
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0
ex_Sub4	0	0	0	0	0	0	0	0	0
ex_TOTAL	0	0	0	0	0	0	0	0	0
pr_Sub1	0	0	0	0	0	0	0	0	0
pr_Sub2	0	0	0	0	0	0	0	0	0
pr_SubA	0	0	0	0	0	0	0	0	0
pr_Sub3	0	0	0	0	0	0	0	0	0
pr_SubB	0	0	0	0	0	0	0	0	0
pr_SubC	0	0	0	0	0	0	0	0	0
pr_OSD	0	0	0	0	0	0	0	0	0
pr_Sub4	0	0	0	0	0	0	0	0	0
pr_TOTAL	0	0	0	0	0	0	0	0	0
PEAK_OUTLET-Inflow									
ex_Sub1	2.827	3.24	3.05	3.96	4.646	4.368	5.063	6.219	5.897
ex_Sub2	3.049	3.918	3.968	4.35	5.726	5.795	5.961	7.844	7.972
ex_SubA	1.358	1.555	1.487	1.918	2.236	2.126	2.471	2.996	2.86
ex_Sub3	4.384	5.518	5.651	6.246	8.027	8.197	8.592	11	11.2
ex_SubB	0.99	1.096	1.031	1.392	1.567	1.466	1.781	2.086	1.959
ex_SubC	1.057	1.178	1.112	1.488	1.687	1.584	1.907	2.249	2.119
ex_Sub4	5.179	6.703	6.792	7.438	9.731	9.908	10.423	13.376	13.606
ex_TOTAL	5.87	7.519	7.637	8.395	10.912	11.155	11.791	14.996	15.314
pr_Sub1	2.827	3.24	3.05	3.96	4.646	4.368	5.063	6.219	5.897
pr_Sub2	3.059	3.953	3.991	4.361	5.772	5.824	5.967	7.898	8.006
pr_SubA	2.413	2.339	2.081	3.246	3.226	2.877	3.967	4.142	3.706
pr_Sub3	4.498	5.581	5.685	6.318	8.018	8.182	8.69	10.902	11.102
pr_SubB	1.612	1.553	1.391	2.167	2.14	1.922	2.642	2.743	2.471
pr_SubC	1.652	1.621	1.439	2.234	2.246	2	2.741	2.893	2.586
pr_OSD	1.994	2.158	2.145	2.688	2.982	2.967	3.416	3.952	3.926
pr_Sub4	5.871	7.591	7.602	8.224	10.808	10.859	11.314	14.654	14.698
pr_TOTAL	5.871	7.591	7.602	8.224	10.808	10.859	11.314	14.654	14.698
PEAK_OUTLET-Outflow									
ex_Sub1	2.827	3.24	3.05	3.96	4.646	4.368	5.063	6.219	5.897
ex_Sub2	3.049	3.918	3.968	4.35	5.726	5.795	5.961	7.844	7.972
ex_SubA	1.358	1.555	1.487	1.918	2.236	2.126	2.471	2.996	2.86
ex_Sub3	4.384	5.518	5.651	6.246	8.027	8.197	8.592	11	11.2
ex_SubB	0.99	1.096	1.031	1.392	1.567	1.466	1.781	2.086	1.959
ex_SubC	1.057	1.178	1.112	1.488	1.687	1.584	1.907	2.249	2.119
ex_Sub4	5.179	6.703	6.792	7.438	9.731	9.908	10.423	13.376	13.606
ex_TOTAL	5.87	7.519	7.637	8.395	10.912	11.155	11.791	14.996	15.314
pr_Sub1	2.827	3.24	3.05	3.96	4.646	4.368	5.063	6.219	5.897
pr_Sub2	3.059	3.953	3.991	4.361	5.772	5.824	5.967	7.898	8.006
pr_SubA	1.29	1.447	1.446	1.733	1.996	1.996	2.222	2.611	2.613
pr_Sub3	4.498	5.581	5.685	6.318	8.018	8.182	8.69	10.902	11.102
pr_SubB	0.965	1.04	1.033	1.297	1.433	1.424	1.645	1.868	1.859
pr_SubC	1.029	1.118	1.113	1.391	1.549	1.543	1.771	2.084	2.067
pr_OSD	1.478	1.739	1.74	1.987	2.398	2.403	2.614	3.198	3.195
pr_Sub4	5.871	7.591	7.602	8.224	10.808	10.859	11.314	14.654	14.698
pr_TOTAL	5.871	7.591	7.602	8.224	10.808	10.859	11.314	14.654	14.698

TIME_to_PEAK_mins
TIME_Stream-Top

REC 10yr_15min	5	5	5	20	20	20	100	100	100
REC	25	90	120	25	90	120	25	90	120
DESCRIPTION	5 Year ARI 25 Mins Du	5 Year ARI 90 Mins Du	5 Year ARI 120 Mins D	20 Year ARI 25 Mins Du	20 Year ARI 90 Mins Du	20 Year ARI 120 Mins I	100 Year ARI 25 Mins I	100 Year ARI 90 Mins I	100 Year ARI 120 Mins Duration DESIGN STORM
	1	2	3	4	5	6	7	8	9
ex_Sub1	0	0	0	0	0	0	0	0	0
ex_Sub2	15	30	40	15	30	40	15	30	40
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	15	30	40	15	30	40	18	30	40
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0
ex_Sub4	21	35	44	21	34	43	22	33	42
ex_TOTAL	25	39	46	25	38	45	25	37	45
pr_Sub1	0	0	0	0	0	0	0	0	0
pr_Sub2	15	30	40	15	30	40	15	30	40
pr_SubA	0	0	0	0	0	0	0	0	0
pr_Sub3	20	33	43	20	32	42	21	32	41
pr_SubB	0	0	0	0	0	0	0	0	0
pr_SubC	0	0	0	0	0	0	0	0	0
pr_OSD	19	33	42	19	33	42	19	33	42
pr_Sub4	25	39	47	25	38	46	25	38	46
pr_TOTAL	30	44	51	29	42	50	28	42	49
TIME_Stream-Bottom									
ex_Sub1	0	0	0	0	0	0	0	0	0
ex_Sub2	26	40	48	25	39	47	26	38	46
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	24	37	46	23	36	45	25	36	45
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0
ex_Sub4	28	42	49	27	40	48	27	39	47
ex_TOTAL	25	39	46	25	38	45	25	37	45
pr_Sub1	0	0	0	0	0	0	0	0	0
pr_Sub2	26	40	48	25	39	47	26	38	46
pr_SubA	0	0	0	0	0	0	0	0	0
pr_Sub3	25	39	47	25	38	46	26	37	46
pr_SubB	0	0	0	0	0	0	0	0	0
pr_SubC	0	0	0	0	0	0	0	0	0
pr_OSD	19	33	42	19	33	42	19	33	42
pr_Sub4	31	45	52	30	43	51	30	43	50
pr_TOTAL	30	44	51	29	42	50	28	42	49
TIME_Local-Perv									
ex_Sub1	15	30	40	15	30	40	15	30	40
ex_Sub2	15	30	40	15	30	40	15	30	40
ex_SubA	15	30	40	15	30	40	15	30	40
ex_Sub3	15	30	40	15	30	40	15	30	40
ex_SubB	15	30	40	15	30	40	15	30	40
ex_SubC	15	30	40	15	30	40	15	30	40
ex_Sub4	15	30	40	15	30	40	15	30	40
ex_TOTAL	0	0	0	0	0	0	0	0	0
pr_Sub1	15	30	40	15	30	40	15	30	40
pr_Sub2	15	30	40	15	30	40	15	30	40
pr_SubA	15	30	40	15	30	40	15	30	40
pr_Sub3	15	30	40	15	30	40	15	30	40
pr_SubB	15	30	40	15	30	40	15	30	40
pr_SubC	15	30	40	15	30	40	15	30	40
pr_OSD	0	0	0	0	0	0	0	0	0
pr_Sub4	15	30	40	15	30	40	15	30	40

REC 10yr_15min	5	5	5	20	20	20	100	100	100
REC	25	90	120	25	90	120	25	90	120
DESCRIPTION	*5 Year ARI 25 Mins Du*	*5 Year ARI 90 Mins Du*	*5 Year ARI 120 Mins D*	*20 Year ARI 25 Mins Di*	*20 Year ARI 90 Mins Di*	*20 Year ARI 120 Mins I*	*100 Year ARI 25 Mins I*	*100 Year ARI 90 Mins i*	*100 Year ARI 120 Mins Duration DESIGN STORM*
	1	2	3	4	5	6	7	8	9
pr_TOTAL	0	0	0	0	0	0	0	0	0
TIME_Local-Imp									
ex_Sub1	15	30	35	15	30	35	15	30	35
ex_Sub2	15	30	35	15	30	35	15	30	35
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	15	30	35	15	30	35	15	30	35
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0
ex_Sub4	15	30	35	15	30	35	15	30	35
ex_TOTAL	0	0	0	0	0	0	0	0	0
pr_Sub1	15	30	35	15	30	35	15	30	35
pr_Sub2	15	30	35	15	30	35	15	30	35
pr_SubA	15	30	35	15	30	35	15	30	35
pr_Sub3	15	30	35	15	30	35	15	30	35
pr_SubB	15	30	35	15	30	35	15	30	35
pr_SubC	15	30	35	15	30	35	15	30	35
pr_OSD	0	0	0	0	0	0	0	0	0
pr_Sub4	15	30	35	15	30	35	15	30	35
pr_TOTAL	0	0	0	0	0	0	0	0	0
TIME_Directed-to-Btm									
ex_Sub1	0	0	0	0	0	0	0	0	0
ex_Sub2	0	0	0	0	0	0	0	0	0
ex_SubA	0	0	0	0	0	0	0	0	0
ex_Sub3	0	0	0	0	0	0	0	0	0
ex_SubB	0	0	0	0	0	0	0	0	0
ex_SubC	0	0	0	0	0	0	0	0	0
ex_Sub4	0	0	0	0	0	0	0	0	0
ex_TOTAL	0	0	0	0	0	0	0	0	0
pr_Sub1	0	0	0	0	0	0	0	0	0
pr_Sub2	0	0	0	0	0	0	0	0	0
pr_SubA	0	0	0	0	0	0	0	0	0
pr_Sub3	0	0	0	0	0	0	0	0	0
pr_SubB	0	0	0	0	0	0	0	0	0
pr_SubC	0	0	0	0	0	0	0	0	0
pr_OSD	0	0	0	0	0	0	0	0	0
pr_Sub4	0	0	0	0	0	0	0	0	0
pr_TOTAL	0	0	0	0	0	0	0	0	0
TIME_OUTLET-Inflow									
ex_Sub1	15	30	40	15	30	40	15	30	40
ex_Sub2	20	30	41	20	30	40	22	30	40
ex_SubA	15	30	40	15	30	40	15	30	40
ex_Sub3	23	36	45	22	35	45	24	35	44
ex_SubB	15	30	40	15	30	40	15	30	40
ex_SubC	15	30	40	15	30	40	15	30	40
ex_Sub4	26	40	48	25	39	47	25	38	46
ex_TOTAL	25	39	46	25	38	45	25	37	45
pr_Sub1	15	30	40	15	30	40	15	30	40
pr_Sub2	20	30	40	20	30	40	22	30	40
pr_SubA	15	30	35	15	30	35	15	30	35
pr_Sub3	25	38	46	24	37	45	25	36	45
pr_SubB	15	30	35	15	30	35	15	30	35
pr_SubC	15	30	35	15	30	35	15	30	35

REC 10yr_15min	5	5	5	20	20	20	100	100	100
REC	25	90	120	25	90	120	25	90	120
DESCRIPTION	5 Year ARI 25 Mins Du	5 Year ARI 90 Mins Du	5 Year ARI 120 Mins D	20 Year ARI 25 Mins D	20 Year ARI 90 Mins D	20 Year ARI 120 Mins I	100 Year ARI 25 Mins I	100 Year ARI 90 Mins I	100 Year ARI 120 Mins Duration DESIGN STORM
	1	2	3	4	5	6	7	8	9
pr_OSD	19	33	42	19	33	42	19	33	42
pr_Sub4	30	44	51	29	42	50	28	42	49
pr_TOTAL	30	44	51	29	42	50	28	42	49
TIME_OUTLET-Outflow									
ex_Sub1	15	30	40	15	30	40	15	30	40
ex_Sub2	20	30	41	20	30	40	22	30	40
ex_SubA	15	30	40	15	30	40	15	30	40
ex_Sub3	23	36	45	22	35	45	24	35	44
ex_SubB	15	30	40	15	30	40	15	30	40
ex_SubC	15	30	40	15	30	40	15	30	40
ex_Sub4	26	40	48	25	39	47	25	38	46
ex_TOTAL	25	39	46	25	38	45	25	37	45
pr_Sub1	15	30	40	15	30	40	15	30	40
pr_Sub2	20	30	40	20	30	40	22	30	40
pr_SubA	20	34	44	20	34	43	21	34	43
pr_Sub3	25	38	46	24	37	45	25	36	45
pr_SubB	19	33	42	19	33	42	19	33	42
pr_SubC	19	33	42	19	33	42	19	33	42
pr_OSD	28	42	50	28	42	50	29	42	50
pr_Sub4	30	44	51	29	42	50	28	42	49
pr_TOTAL	30	44	51	29	42	50	28	42	49
OUTLET_STRC_on: pr_SubA									
PEAK_Inflow_m3/s	2.413	2.339	2.081	3.246	3.226	2.877	3.967	4.142	3.706
PEAK_Outflow_m3/s	1.29	1.447	1.446	1.733	1.996	1.996	2.222	2.611	2.613
VOLUME_Inflow_m3	2362	4260	4731	3144	5839	6500	4186	7964	8884
VOLUME_Max_m3	924	1037	1037	1242	1430	1430	1593	1871	1873
WATER-ELEVATION_Max_m	0.647	0.726	0.726	0.869	1.001	1.001	1.115	1.31	1.311
OUTLET_STRC_on: pr_SubB									
PEAK_Inflow_m3/s	1.612	1.553	1.391	2.167	2.14	1.922	2.642	2.743	2.471
PEAK_Outflow_m3/s	0.965	1.04	1.033	1.297	1.433	1.424	1.645	1.868	1.859
VOLUME_Inflow_m3	1514	2732	3035	2016	3744	4169	2684	5108	5699
VOLUME_Max_m3	530	571	567	712	787	782	903	1026	1021
WATER-ELEVATION_Max_m	0.675	0.727	0.722	0.906	1.001	0.995	1.149	1.305	1.299
OUTLET_STRC_on: pr_SubC									
PEAK_Inflow_m3/s	1.652	1.621	1.439	2.234	2.246	2	2.741	2.893	2.586
PEAK_Outflow_m3/s	1.029	1.118	1.113	1.391	1.549	1.543	1.771	2.084	2.067
VOLUME_Inflow_m3	1653	2971	3293	2202	4079	4535	2935	5572	6209
VOLUME_Max_m3	514	558	555	694	773	770	884	1009	1007
WATER-ELEVATION_Max_m	0.719	0.782	0.777	0.972	1.083	1.078	1.238	1.411	1.408
OUTLET_STRC_on: pr_OSD									
PEAK_Inflow_m3/s	1.994	2.158	2.145	2.688	2.982	2.967	3.416	3.952	3.926
PEAK_Outflow_m3/s	1.478	1.739	1.74	1.987	2.398	2.403	2.614	3.198	3.195
VOLUME_Inflow_m3	3166	5699	6316	4218	7820	8690	5618	10676	11888
VOLUME_Max_m3	890	1047	1048	1197	1444	1447	1574	1901	1901
WATER-ELEVATION_Max_m	0.141	0.165	0.165	0.189	0.228	0.229	0.249	0.3	0.3

REC 10yr_15min	5	5	5	20	20	20	100	100	100
REC	25	90	120	25	90	120	25	90	120
DESCRIPTION	*5 Year ARI 25 Mins Du*	*5 Year ARI 90 Mins Du*	*5 Year ARI 120 Mins D*	*20 Year ARI 25 Mins Di*	*20 Year ARI 90 Mins Di*	*20 Year ARI 120 Mins I*	*100 Year ARI 25 Mins I*	*100 Year ARI 90 Mins I*	*100 Year ARI 120 Mins Duration DESIGN STORM*
	1	2	3	4	5	6	7	8	9
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A