Pond 1 Calculations

Catchment Area		2.31 ha
Pre-development land-use	5%	0.1155 ha
	95%	2.1945 ha
Post-development land-use	65%	1.5015 ha
	35%	0.8085 ha

Impervious CN	98
Pervious CN	74
Impervious CN	98
Pervious CN	74

Trapezoidal shaped ponds are computed by:

$$V = LWD + (L+W)Z\,D^2 + \frac{4}{3}Z^2 D^3$$

Design Storm	Rainfall across 24hrs (mm)	Climate Change Increase	Rainfall incl CC (mm)
90th percentile	25		
95th percentile	32		
50% AEP	70	9%	76
10% AEP	120	13.20%	136
1% AEP	190	16.80%	222

Storage (S imp)	5	mm
Storage (S per)	89	mm
Ia (imp)	0	mm
Ia (per)	5	mm

90th percentile
Runoff depth (imp)	21	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	311	m3
Runoff volume (per)	30	m3
PWV	**341**	**m3**
Forebay volume (PWV x 15%)	51	m3

95th percentile
Runoff depth (imp)	28	mm
Runoff depth (per)	6	mm
Runoff volume (imp)	413	m3
Runoff volume (per)	51	m3
Detention volume for stream protection	464	m3
Average release rate Q(avg) over 24hr period	0.005	m3/s
Maximum release rate Qmax = 2 x Q(avg)	0.011	m3/s
Orifice Dia.	0.15	m
Orifice gradient	1.5%	
Orifice Capacity (based on Colebrook-White)	0.020	m3/s

Permanent Water Level Area (with Live Storage)	85	m2
Pond Base Area	232	m2
Depth coefficient	2.0	m
Length	**42**	**m**
Width	**14**	**m**
Permanent Water Level Area (with Live Storage)	588	m2
Pond Volume	1252	m3

	Unit	Pre-Development	Post-Development	
50% AEP				
c* (imp)		0.88	0.88	
Specific peak flow rate (imp)		0.14	0.163	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.012	0.187	
c* (per)		0.27	0.27	
Specific peak flow rate (per)		0.070	0.076	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.117	0.047	
Total Peak Flow Rate	m3	0.130	0.234	
Runoff depth (imp)	mm	71.45	71.45	
Runoff depth (per)	mm	31.67	31.67	
Runoff volume (imp)	m3	83	1073	
Runoff volume (per)	m3	695	256	
Total runoff volume	m3	777	1329	
Runoff Volume Difference	m3		551	
10% AEP				
c* (imp)		0.93	0.93	
Specific peak flow rate (imp)		0.152	0.164	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.024	0.335	
c* (per)		0.41	0.41	
Specific peak flow rate (per)		0.0975	0.113	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.291	0.124	
Total Peak Flow Rate	m3	0.314	0.459	
Runoff depth (imp)	mm	130.85	130.85	
Runoff depth (per)	mm	77.78	77.78	
Runoff volume (imp)	m3	151	1965	
Runoff volume (per)	m3	1707	629	
Total runoff volume	m3	1858	2594	
Runoff Volume Difference	m3		735	
Total Volume (inc PWV)	**m3**		**1076**	
Average release rate Q(avg) over 24hr period	m3/s		0.009	
Maximum release rate Qmax = 2 x Q(avg)	m3/s		0.017	
1% AEP				
c* (imp)		0.96	0.96	
Specific peak flow rate (imp)		0.148	0.168	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.038	0.560	
c* (per)		0.54	0.54	
Specific peak flow rate (per)		0.115	0.132	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.560	0.237	
Total Peak Flow Rate	m3	0.598	0.797	
Runoff depth (imp)	mm	216.85	216.85	
Runoff depth (per)	mm	153.69	153.69	
Runoff volume (imp)	m3	250	3256	
Runoff volume (per)	m3	3373	1243	
Total runoff volume	m3	3623	4499	
Runoff Volume Difference	m3		875	
Total Volume (inc PWV)	**m3**		**1216**	

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
42	14	2.0	3	1

Water depth (RL) WL (m)	Storage (m3)	Area (m2)
0.5	299	597
0.6	360	599
0.7	421	601
0.8	482	603
0.9	544	605
1	607	607
1.1	670	609
1.2	733	611
1.3	796	613
1.4	860	614
1.5	925	616
1.6	989	618
1.7	1054	620
1.8	1120	622
1.9	1186	624
2	1252	626

Pond 2 Calculations

Catchment Area   1.25 ha
Pre-development land-use   5%   0.0625 ha
     95%   1.1875 ha
Post-development land-use   65%   0.8125 ha
     35%   0.4375 ha

Impervious CN	98
Pervious CN	74
Impervious CN	98
Pervious CN	74

Trapezoidal shaped ponds are computed by:

$$V = LWD + (L+W)Z\,D^2 + \frac{4}{3}Z^2 D^3$$

Design Storm	Rainfall across 24hrs (mm)	Climate Change Increase	Rainfall incl CC (mm)
90th percentile	25		
95th percentile	32		
50% AEP	70	9%	76
10% AEP	120	13.20%	136
1% AEP	190	16.80%	222

Storage (S imp)	5	mm
Storage (S per)	89	mm
Ia (imp)	0	mm
Ia (per)	5	mm

90th percentile

Runoff depth (imp)	21	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	168	m3
Runoff volume (per)	16	m3
PWV	184	m3
Forebay volume (PWV x 15%)	28	m3

95th percentile

Runoff depth (imp)	28	mm
Runoff depth (per)	6	mm
Runoff volume (imp)	224	m3
Runoff volume (per)	27	m3
Detention volume for stream protection	251	m3
Average release rate Q(avg) over 24hr period	0.003	m3/s
Maximum release rate Qmax = 2 x Q(avg)	0.006	m3/s
Orifice Dia.	0.15	m
Orifice gradient	1.0%	
Orifice Capacity (based on Colebrook-White)	0.015	m3/s

Permanent Water Level Area (with Live Storage)	46	m2
Pond Base Area	126	m2
Depth coefficient	2.0	m
Length	**33**	m
Width	**11**	m
Permanent Water Level Area (with Live Storage)	363	m2
Pond Volume	786	m3

50% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.88	0.88	
Specific peak flow rate (imp)		0.14	0.163	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.007	0.101	
c* (per)		0.27	0.27	
Specific peak flow rate (per)		0.070	0.076	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.063	0.025	
Total Peak Flow Rate	m3	0.070	0.126	
Runoff depth (imp)	mm	71.45	71.45	
Runoff depth (per)	mm	31.67	31.67	
Runoff volume (imp)	m3	45	580	
Runoff volume (per)	m3	376	139	
Total runoff volume	m3	421	719	
Runoff Volume Difference	m3		298	

10% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.93	0.93	
Specific peak flow rate (imp)		0.152	0.164	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.013	0.181	
c* (per)		0.41	0.41	
Specific peak flow rate (per)		0.0975	0.113	from TP108 Figure 5.1
Peak Flow Rate (per)		0.157	0.067	
Total Peak Flow Rate	m3	0.170	0.248	
Runoff depth (imp)	mm	130.85	130.85	
Runoff depth (per)	mm	77.78	77.78	
Runoff volume (imp)	m3	82	1063	
Runoff volume (per)	m3	924	340	
Total runoff volume	m3	1005	1403	
Runoff Volume Difference	m3		398	
Total Volume (inc PWV)	m3		582	
Average release rate Q(avg) over 24hr period	m3/s		0.005	
Maximum release rate Qmax = 2 x Q(avg)	m3/s		0.009	

1% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.96	0.96	
Specific peak flow rate (imp)		0.148	0.168	from TP108 Figure 5.1
Peak Flow Rate (imp)		0.021	0.303	
c* (per)		0.54	0.54	
Specific peak flow rate (per)		0.115	0.132	from TP108 Figure 5.1
Peak Flow Rate (per)		0.303	0.128	
Total Peak Flow Rate	m3	0.324	0.431	
Runoff depth (imp)	mm	216.85	216.85	
Runoff depth (per)	mm	153.69	153.69	
Runoff volume (imp)	m3	136	1762	
Runoff volume (per)	m3	1825	672	
Total runoff volume	m3	1961	2434	
Runoff Volume Difference	m3		474	
Total Volume (inc PWV)	m3		658	

Volume storage curve

Length	Width	Depth	Side slope Horizontal	Vertical
33	11	2.0	3	1

Water depth (RL)	WL (m)	Storage (m3)	Area (m2)
	0.5	185	370
	0.6	223	372
	0.7	261	373
	0.8	300	375
	0.9	339	376
	1	378	378
	1.1	417	379
	1.2	457	381
	1.3	497	382
	1.4	537	384
	1.5	578	385
	1.6	619	387
	1.7	660	388
	1.8	702	390
	1.9	744	391
	2	786	393

Pond 3 Calculations

Catchment Area			**2.16** ha			
Pre-development land-use	5%	0.108 ha		Impervious CN	**98**	
	95%	2.052 ha		Pervious CN	**74**	
Post-development land-use	65%	1.404 ha		Impervious CN	**98**	
	35%	0.756 ha		Pervious CN	**74**	

Trapezoidal shaped ponds are computed by:

$$V = LWD + (L+W)Z\,D^2 + \frac{4}{3}Z^2 D^3$$

Design Storm	Rainfall across 24hrs (mm)	Climate Change Increase	Rainfall incl CC (mm)
90th percentile	25		
95th percentile	32		
50% AEP	**70**	9%	76
10% AEP	**120**	13.20%	136
1% AEP	**190**	16.80%	222

Storage (S imp)	5	mm
Storage (S per)	89	mm
Ia (imp)	0	mm
Ia (per)	5	mm

90th percentile

Runoff depth (imp)	21	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	291	m3
Runoff volume (per)	28	m3
PWV	318	m3
Forebay volume (PWV x 15%)	48	m3

95th percentile

Runoff depth (imp)	28	mm
Runoff depth (per)	6	mm
Runoff volume (imp)	387	m3
Runoff volume (per)	47	m3
Detention volume for stream protection	434	m3
Average release rate Q(avg) over 24hr period	0.005	m3/s
Maximum release rate Qmax = 2 x Q(avg)	0.010	m3/s
Orifice Dia.	**0.15**	m
Orifice gradient	**1.0%**	
Orifice Capacity (based on Colebrook-White)	**0.015**	m3/s

Permanent Water Level Area (with Live Storage)	80	m2
Pond Base Area	217	m2
Depth coefficient	2.0	m
Length	**42**	m
Width	**14**	m
Permanent Water Level Area (with Live Storage)	588	m2
Pond Volume	1252	m3

50% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.88	0.88	
Specific peak flow rate (imp)		**0.14**	**0.163**	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.012	0.175	
c* (per)		0.27	0.27	
Specific peak flow rate (per)		**0.070**	**0.076**	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.110	0.044	
Total Peak Flow Rate	m3	0.121	0.218	
Runoff depth (imp)	mm	71.45	71.45	
Runoff depth (per)	mm	31.67	31.67	
Runoff volume (imp)	m3	77	1003	
Runoff volume (per)	m3	650	239	
Total runoff volume	m3	727	1242	
Runoff Volume Difference	m3		516	

10% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.93	0.93	
Specific peak flow rate (imp)		**0.152**	**0.164**	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.022	0.313	
c* (per)		0.41	0.41	
Specific peak flow rate (per)		**0.0975**	**0.113**	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.272	0.116	
Total Peak Flow Rate	m3	0.294	0.429	
Runoff depth (imp)	mm	130.85	130.85	
Runoff depth (per)	mm	77.78	77.78	
Runoff volume (imp)	m3	141	1837	
Runoff volume (per)	m3	1596	588	
Total runoff volume	m3	1737	2425	
Runoff Volume Difference	m3		688	
Total Volume (inc PWV)	m3		1006	
Average release rate Q(avg) over 24hr period	m3/s		0.008	
Maximum release rate Qmax = 2 x Q(avg)	m3/s		0.016	

1% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.96	0.96	
Specific peak flow rate (imp)		**0.148**	**0.168**	from TP108 Figure 5.1
Peak Flow Rate (imp)		0.035	0.523	
c* (per)		0.54	0.54	
Specific peak flow rate (per)		**0.115**	**0.132**	from TP108 Figure 5.1
Peak Flow Rate (per)		0.524	0.221	
Total Peak Flow Rate	m3	0.559	0.745	
Runoff depth (imp)	mm	216.85	216.85	
Runoff depth (per)	mm	153.69	153.69	
Runoff volume (imp)	m3	234	3045	
Runoff volume (per)	m3	3154	1162	
Total runoff volume	m3	3388	4207	
Runoff Volume Difference	m3		819	
Total Volume (inc PWV)	m3		1137	

Volume storage curve

			Side slope	
Length	Width	Depth	Horizontal	Vertical
42	14	2.0	**3**	**1**

Water depth (RL)	WL (m)	Storage (m3)	Area (m2)
	0.5	299	597
	0.6	360	599
	0.7	421	601
	0.8	482	603
	0.9	544	605
	1	607	607
	1.1	670	609
	1.2	733	611
	1.3	796	613
	1.4	860	614
	1.5	925	616
	1.6	989	618
	1.7	1054	620
	1.8	1120	622
	1.9	1186	624
	2	1252	626

Pond 4 Calculations

Catchment Area		2.07	ha
Pre-development land-use	5%	0.1035	ha
	95%	1.9665	ha
Post-development land-use	65%	1.3455	ha
	35%	0.7245	ha

Impervious CN	98
Pervious CN	74
Impervious CN	98
Pervious CN	74

Trapezoidal shaped ponds are computed by:

$$V = LWD + (L+W)Z\,D^2 + \frac{4}{3}Z^2 D^3$$

Design Storm	Rainfall across 24hrs (mm)	Climate Change Increase	Rainfall incl CC (mm)
90th percentile	25		
95th percentile	32		
50% AEP	70	9%	76
10% AEP	120	13.20%	136
1% AEP	190	16.80%	222

Storage (S imp)	5	mm
Storage (S per)	89	mm
Ia (imp)	0	mm
Ia (per)	5	mm

90th percentile

Runoff depth (imp)	21	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	279	m3
Runoff volume (per)	27	m3
PWV	305	m3
Forebay volume (PWV x 15%)	46	m3

95th percentile

Runoff depth (imp)	28	mm
Runoff depth (per)	6	mm
Runoff volume (imp)	371	m3
Runoff volume (per)	45	m3
Detention volume for stream protection	416	m3
Average release rate Q(avg) over 24hr period	0.005	m3/s
Maximum release rate Qmax = 2 x Q(avg)	0.010	m3/s
Orifice Dia.	0.1	m
Orifice gradient	3.0%	
Orifice Capacity (based on Colebrook-White)	0.009	m3/s

Permanent Water Level Area (with Live Storage)	76	m2
Pond Base Area	208	m2
Depth coefficient	2.0	m
Length	**42**	m
Width	**14**	m
Permanent Water Level Area (with Live Storage)	588	m2
Pond Volume	1252	m3

	Unit	Pre-Development	Post-Development	
50% AEP				
c* (imp)		0.88	0.88	
Specific peak flow rate (imp)		0.14	0.163	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.011	0.167	
c* (per)		0.27	0.27	
Specific peak flow rate (per)		0.070	0.076	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.105	0.042	
Total Peak Flow Rate	m3	0.116	0.209	
Runoff depth (imp)	mm	71.45	71.45	
Runoff depth (per)	mm	31.67	31.67	
Runoff volume (imp)	m3	74	961	
Runoff volume (per)	m3	623	229	
Total runoff volume	m3	697	1191	
Runoff Volume Difference	m3		494	
10% AEP				
c* (imp)		0.93	0.93	
Specific peak flow rate (imp)		0.152	0.164	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.021	0.300	
c* (per)		0.41	0.41	
Specific peak flow rate (per)		0.0975	0.113	from TP108 Figure 5.1
Peak Flow Rate (per)		0.260	0.111	
Total Peak Flow Rate	m3	0.282	0.411	
Runoff depth (imp)	mm	130.85	130.85	
Runoff depth (per)	mm	77.78	77.78	
Runoff volume (imp)	m3	135	1761	
Runoff volume (per)	m3	1530	564	
Total runoff volume	m3	1665	2324	
Runoff Volume Difference	m3		659	
Total Volume (inc PWV)	m3		**964**	
Average release rate Q(avg) over 24hr period	m3/s		0.008	
Maximum release rate Qmax = 2 x Q(avg)	m3/s		0.015	
1% AEP				
c* (imp)		0.96	0.96	
Specific peak flow rate (imp)		0.148	0.168	from TP108 Figure 5.1
Peak Flow Rate (imp)		0.034	0.502	
c* (per)		0.54	0.54	
Specific peak flow rate (per)		0.115	0.132	from TP108 Figure 5.1
Peak Flow Rate (per)		0.502	0.212	
Total Peak Flow Rate	m3	0.536	0.714	
Runoff depth (imp)	mm	216.85	216.85	
Runoff depth (per)	mm	153.69	153.69	
Runoff volume (imp)	m3	224	2918	
Runoff volume (per)	m3	3022	1113	
Total runoff volume	m3	3247	4031	
Runoff Volume Difference	m3		785	
Total Volume (inc PWV)	m3		**1090**	

Table: Elevation - Storage relationship

Volume storage curve			Side slope	
Length	Width	Depth	Horizontal	Vertical
42	14	2.0	3	1

Water depth (RL)	WL (m)	Storage (m3)	Area(m2)
	0.5	299	597
	0.6	360	599
	0.7	421	601
	0.8	482	603
	0.9	544	605
	1	607	607
	1.1	670	609
	1.2	733	611
	1.3	796	613
	1.4	860	614
	1.5	925	616
	1.6	989	618
	1.7	1054	620
	1.8	1120	622
	1.9	1186	624
	2	1252	626

Pond 5 Calculations

Catchment Area		3.41	ha		Impervious CN	98	
Pre-development land-use	5%	0.1705	ha		Pervious CN	74	
	95%	3.2395	ha		Impervious CN	98	
Post-development land-use	65%	2.2165	ha		Pervious CN	74	
	35%	1.1935	ha				

Trapezoidal shaped ponds are computed by:

$$V = LWD + (L+W)Z\,D^2 + \frac{4}{3}Z^2 D^3$$

Design Storm	Rainfall across 24hrs (mm)	Climate Change Increase	Rainfall incl CC (mm)
90th percentile	25		
95th percentile	32		
50% AEP	70	9%	76
10% AEP	120	13.20%	136
1% AEP	190	16.80%	222

Storage (S imp)	5	mm
Storage (S per)	89	mm
Ia (imp)	0	mm
Ia (per)	5	mm

90th percentile		
Runoff depth (imp)	21	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	459	m3
Runoff volume (per)	44	m3
PWV	**503**	**m3**
Forebay volume (PWV x 15%)	75	m3

95th percentile		
Runoff depth (imp)	28	mm
Runoff depth (per)	6	mm
Runoff volume (imp)	610	m3
Runoff volume (per)	75	m3
Detention volume for stream protection	685	m3
Average release rate Q(avg) over 24hr period	0.008	m3/s
Maximum release rate Qmax = 2 x Q(avg)	0.016	m3/s
Orifice Dia.	0.1	m
Orifice gradient	1.5%	
Orifice Capacity (based on Colebrook-White)	0.006	m3/s

Permanent Water Level Area (with Live Storage)	168	m2
Pond Base Area	457	m2
Depth coefficient	1.5	m
Length	**60**	**m**
Width	**20**	**m**
Permanent Water Level Area (with Live Storage)	1200	m2
Pond Volume	1861	m3

50% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.88	0.88	
Specific peak flow rate (imp)		0.14	0.163	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.018	0.276	
c* (per)		0.27	0.27	
Specific peak flow rate (per)		0.070	0.076	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.173	0.069	
Total Peak Flow Rate	**m3**	**0.191**	**0.345**	
Runoff depth (imp)	mm	71.45	71.45	
Runoff depth (per)	mm	31.67	31.67	
Runoff volume (imp)	m3	122	1584	
Runoff volume (per)	m3	1026	378	
Total runoff volume	m3	1148	1962	
Runoff Volume Difference	**m3**		**814**	

10% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.93	0.93	
Specific peak flow rate (imp)		0.152	0.164	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.035	0.494	
c* (per)		0.41	0.41	
Specific peak flow rate (per)		0.0975	0.113	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.429	0.183	
Total Peak Flow Rate	**m3**	**0.464**	**0.677**	
Runoff depth (imp)	mm	130.85	130.85	
Runoff depth (per)	mm	77.78	77.78	
Runoff volume (imp)	m3	223	2900	
Runoff volume (per)	m3	2520	928	
Total runoff volume	m3	2743	3829	
Runoff Volume Difference	**m3**		**1086**	
Total Volume (inc PWV)	**m3**		**1588**	
Average release rate Q(avg) over 24hr period	m3/s		0.013	
Maximum release rate Qmax = 2 x Q(avg)	m3/s		0.025	

1% AEP

	Unit	Pre-Development	Post-Development	
c* (imp)		0.96	0.96	
Specific peak flow rate (imp)		0.148	0.168	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.056	0.826	
c* (per)		0.54	0.54	
Specific peak flow rate (per)		0.115	0.132	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.827	0.350	
Total Peak Flow Rate	**m3**	**0.883**	**1.176**	
Runoff depth (imp)	mm	216.85	216.85	
Runoff depth (per)	mm	153.69	153.69	
Runoff volume (imp)	m3	370	4807	
Runoff volume (per)	m3	4979	1834	
Total runoff volume	m3	5349	6641	
Runoff Volume Difference	**m3**		**1292**	
Total Volume (inc PWV)	**m3**		**1795**	

Table: Elevation - Storage relationship

Volume storage curve			Side slope	
Length	Width	Depth	Horizontal	Vertical
60	20	1.5	3	1

Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	607	1213	
	0.6	730	1216	
	0.7	853	1219	
	0.8	977	1221	
	0.9	1102	1224	
	1	1227	1227	
	1.1	1352	1230	
	1.2	1479	1232	
	1.3	1605	1235	
	1.4	1733	1238	
	1.5	1861	1240	
	1.6	1989	1243	
	1.7	2118	1246	
	1.8	2247	1248	
	1.9	2377	1251	
	2	2508	1254	

Pond 6 Calculations

Catchment Area		5.45	ha
Pre-development land-use	5%	0.2725	ha
	95%	5.1775	ha
Post-development land-use	65%	3.5425	ha
	35%	1.9075	ha

Impervious CN	98
Pervious CN	74
Impervious CN	98
Pervious CN	74

Trapezoidal shaped ponds are computed by:

$$V = LWD + (L+W)Z\,D^2 + \frac{4}{3}Z^2 D^3$$

Design Storm	Rainfall across 24hrs (mm)	Climate Change Increase	Rainfall incl CC (mm)
90th percentile	25		
95th percentile	32		
50% AEP	70	9%	76
10% AEP	120	13.20%	136
1% AEP	190	16.80%	222

Storage (S imp)	5	mm
Storage (S per)	89	mm
Ia (imp)	0	mm
Ia (per)	5	mm

90th percentile

Runoff depth (imp)	21	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	734	m3
Runoff volume (per)	70	m3
PWV	803	m3
Forebay volume (PWV x 15%)	121	m3

95th percentile

Runoff depth (imp)	28	mm
Runoff depth (per)	6	mm
Runoff volume (imp)	976	m3
Runoff volume (per)	120	m3
Detention volume for stream protection	1095	m3
Average release rate Q(avg) over 24hr period	0.013	m3/s
Maximum release rate Qmax = 2 x Q(avg)	0.025	m3/s
Orifice Dia.	0.1	m
Orifice gradient	3.0%	
Orifice Capacity (based on Colebrook-White)	0.009	m3/s

Permanent Water Level Area (with Live Storage)	201	m2
Pond Base Area	548	m2
Depth coefficient	2.0	m
Length	**66**	m
Width	**22**	m
Permanent Water Level Area (with Live Storage)	1452	m2
Pond Volume	3023	m3

	Unit	Pre-Development	Post-Development	
50% AEP				
c* (imp)		0.88	0.88	
Specific peak flow rate (imp)		0.14	0.163	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.029	0.441	
c* (per)		0.27	0.27	
Specific peak flow rate (per)		0.070	0.076	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.277	0.111	
Total Peak Flow Rate	m3	0.306	0.551	
Runoff depth (imp)	mm	71.45	71.45	
Runoff depth (per)	mm	31.67	31.67	
Runoff volume (imp)	m3	195	2531	
Runoff volume (per)	m3	1639	604	
Total runoff volume	m3	1834	3135	
Runoff Volume Difference	m3		1301	
10% AEP				
c* (imp)		0.93	0.93	
Specific peak flow rate (imp)		0.152	0.164	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.056	0.789	
c* (per)		0.41	0.41	
Specific peak flow rate (per)		0.0975	0.113	from TP108 Figure 5.1
Peak Flow Rate (per)		0.686	0.293	
Total Peak Flow Rate	m3	0.742	1.082	
Runoff depth (imp)	mm	130.85	130.85	
Runoff depth (per)	mm	77.78	77.78	
Runoff volume (imp)	m3	357	4635	
Runoff volume (per)	m3	4027	1484	
Total runoff volume	m3	4384	6119	
Runoff Volume Difference	m3		1735	
Total Volume (inc PWV)	m3		2539	
Average release rate Q(avg) over 24hr period	m3/s		0.020	
Maximum release rate Qmax = 2 x Q(avg)	m3/s		0.040	
1% AEP				
c* (imp)		0.96	0.96	
Specific peak flow rate (imp)		0.148	0.168	from TP108 Figure 5.1
Peak Flow Rate (imp)		0.090	1.321	
c* (per)		0.54	0.54	
Specific peak flow rate (per)		0.115	0.132	from TP108 Figure 5.1
Peak Flow Rate (per)		1.321	0.559	
Total Peak Flow Rate	m3	1.411	1.880	
Runoff depth (imp)	mm	216.85	216.85	
Runoff depth (per)	mm	153.69	153.69	
Runoff volume (imp)	m3	591	7682	
Runoff volume (per)	m3	7957	2932	
Total runoff volume	m3	8548	10614	
Runoff Volume Difference	m3		2065	
Total Volume (inc PWV)	m3		2869	

Table: Elevation - Storage relationship

	Volume storage curve		Side slope	
Length	Width	Depth	Horizontal	Vertical
66	22	2.0	3	1

Water depth (RL)	WL (m)	Storage (m3)	Area(m2)
	0.5	733	1467
	0.6	882	1470
	0.7	1031	1473
	0.8	1180	1476
	0.9	1331	1479
	1	1481	1481
	1.1	1633	1484
	1.2	1785	1487
	1.3	1937	1490
	1.4	2091	1493
	1.5	2245	1496
	1.6	2399	1499
	1.7	2554	1502
	1.8	2710	1505
	1.9	2866	1508
	2	3023	1511

Pond 7 Calculations

Catchment Area		1.46 ha
Pre-development land-use	5%	0.073 ha
	95%	1.387 ha
Post-development land-use	65%	0.949 ha
	35%	0.511 ha

Impervious CN	98
Pervious CN	74
Impervious CN	98
Pervious CN	74

Trapezoidal shaped ponds are computed by:

$$V = LWD + (L+W)Z\,D^2 + \frac{4}{3}Z^2\,D^3$$

Design Storm	Rainfall across 24hrs (mm)	Climate Change Increase	Rainfall incl CC (mm)
90th percentile	25		
95th percentile	32		
50% AEP	70	9%	76
10% AEP	120	13.20%	136
1% AEP	190	16.80%	222

Storage (S imp)	5	mm
Storage (S per)	89	mm
Ia (imp)	0	mm
Ia (per)	5	mm

90th percentile		
Runoff depth (imp)	21	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	197	m3
Runoff volume (per)	19	m3
PWV	215	m3
Forebay volume (PWV x 15%)	32	m3

95th percentile		
Runoff depth (imp)	28	mm
Runoff depth (per)	6	mm
Runoff volume (imp)	261	m3
Runoff volume (per)	32	m3
Detention volume for stream protection	293	m3
Average release rate Q(avg) over 24hr period	0.003	m3/s
Maximum release rate Qmax = 2 x Q(avg)	0.007	m3/s
Orifice Dia.	0.1	m
Orifice gradient	3.0%	
Orifice Capacity (based on Colebrook-White)	0.009	m3/s

Permanent Water Level Area (with Live Storage)	54	m2
Pond Base Area	147	m2
Depth coefficient	2.0	m
Length	33	m
Width	11	m
Permanent Water Level Area (with Live Storage)	363	m2
Pond Volume	786	m3

	Unit	Pre-Development	Post-Development	
50% AEP				
c* (imp)		0.88	0.88	
Specific peak flow rate (imp)		0.14	0.163	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.008	0.118	
c* (per)		0.27	0.27	
Specific peak flow rate (per)		0.070	0.076	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.074	0.030	
Total Peak Flow Rate	m3	0.082	0.148	
Runoff depth (imp)	mm	71.45	71.45	
Runoff depth (per)	mm	31.67	31.67	
Runoff volume (imp)	m3	52	678	
Runoff volume (per)	m3	439	162	
Total runoff volume	m3	491	840	
Runoff Volume Difference	m3		348	
10% AEP				
c* (imp)		0.93	0.93	
Specific peak flow rate (imp)		0.152	0.164	from TP108 Figure 5.1
Peak Flow Rate (imp)	m3	0.015	0.211	
c* (per)		0.41	0.41	
Specific peak flow rate (per)		0.0975	0.113	from TP108 Figure 5.1
Peak Flow Rate (per)	m3	0.184	0.078	
Total Peak Flow Rate	m3	0.199	0.290	
Runoff depth (imp)	mm	130.85	130.85	
Runoff depth (per)	mm	77.78	77.78	
Runoff volume (imp)	m3	96	1242	
Runoff volume (per)	m3	1079	397	
Total runoff volume	m3	1174	1639	
Runoff Volume Difference	m3		465	
Total Volume (inc PWV)	m3		680	
Average release rate Q(avg) over 24hr period	m3/s		0.005	
Maximum release rate Qmax = 2 x Q(avg)	m3/s		0.011	
1% AEP				
c* (imp)		0.96	0.96	
Specific peak flow rate (imp)		0.148	0.168	from TP108 Figure 5.1
Peak Flow Rate (imp)		0.024	0.354	
c* (per)		0.54	0.54	
Specific peak flow rate (per)		0.115	0.132	from TP108 Figure 5.1
Peak Flow Rate (per)		0.354	0.150	
Total Peak Flow Rate	m3	0.378	0.504	
Runoff depth (imp)	mm	216.85	216.85	
Runoff depth (per)	mm	153.69	153.69	
Runoff volume (imp)	m3	158	2058	
Runoff volume (per)	m3	2132	785	
Total runoff volume	m3	2290	2843	
Runoff Volume Difference	m3		553	
Total Volume (inc PWV)	m3		769	

Table: Elevation - Storage relationship

Volume storage curve			Side slope	
Length	Width	Depth	Horizontal	Vertical
33	11	2.0	3	1

Water depth (RL)	WL (m)	Storage (m3)	Area(m2)
	0.5	185	370
	0.6	223	372
	0.7	261	373
	0.8	300	375
	0.9	339	376
	1	378	378
	1.1	417	379
	1.2	457	381
	1.3	497	382
	1.4	537	384
	1.5	578	385
	1.6	619	387
	1.7	660	388
	1.8	702	390
	1.9	744	391
	2	786	393