

Catchment 1 - Wetland Calculations

Catchment Area		22.19	ha
Pre-development land-use	8%	1.78	ha
	92%	20.41	ha
Post-development land-use	100%	22.19	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	4888	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	4888	m3
Forebay volume (PWV x 15%)	733	m3
PWV (50% reduced for Stream Protection)	2444	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	4888	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	7297	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	7297	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.434	5.850
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		3.200	0.000
Total Peak Flow Rate	m3	3.633	5.850
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	2764	34555
Runoff volume (per)	m3	20213	0
Total runoff volume	m3	22977	34555
Runoff Volume Difference	m3		11578

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	200 m
Width	40 m
Depth	2 m
Area (approx.)	8161 m2
Volume (approx.)	16321 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
200	40	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	4020	8040	
	0.6	4829	8048	
	0.7	5639	8056	
	0.8	6451	8064	
	0.9	7265	8072	
	1	8080	8080	
	1.1	8897	8088	
	1.2	9715	8096	
	1.3	10536	8104	
	1.4	11357	8112	
	1.5	12181	8120	
	1.6	13005	8128	
	1.7	13832	8136	
	1.8	14660	8144	
	1.9	15490	8153	
	2	16321	8161	

Catchment 2 - Wetland Calculations

Catchment Area		11.59	ha
Pre-development land-use	8%	0.93	ha
	92%	10.66	ha
Post-development land-use	100%	11.59	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	2553	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	2553	m3
Forebay volume (PWV x 15%)	383	m3
PWV (50% reduced for Stream Protection)	1276	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	2553	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	3811	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	3811	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.227	3.055
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		1.671	0.000
Total Peak Flow Rate	m3	1.898	3.055
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	1444	18048
Runoff volume (per)	m3	10557	0
Total runoff volume	m3	12001	18048
Runoff Volume Difference	m3		6047

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	150 m
Width	30 m
Depth	2 m
Area (approx.)	4621 m2
Volume (approx.)	9241 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
150	30	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	2265	4530	
	0.6	2722	4536	
	0.7	3179	4542	
	0.8	3638	4548	
	0.9	4099	4554	
	1	4560	4560	
	1.1	5023	4566	
	1.2	5487	4572	
	1.3	5952	4578	
	1.4	6418	4584	
	1.5	6886	4590	
	1.6	7354	4596	
	1.7	7824	4602	
	1.8	8295	4608	
	1.9	8768	4615	
	2	9241	4621	

Catchment 3 - Wetland Calculations

Catchment Area		6.66	ha
Pre-development land-use	8%	0.53	ha
	92%	6.13	ha
Post-development land-use	100%	6.66	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	1467	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	1467	m3
Forebay volume (PWV x 15%)	220	m3
PWV (50% reduced for Stream Protection)	734	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	1467	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	2190	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	2190	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.130	1.756
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.960	0.000
Total Peak Flow Rate	m3	1.090	1.756
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	830	10371
Runoff volume (per)	m3	6067	0
Total runoff volume	m3	6896	10371
Runoff Volume Difference	m3		3475

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	110 m
Width	22 m
Depth	2 m
Area (approx.)	2509 m2
Volume (approx.)	5017 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
110	22	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	1221	2442	
	0.6	1468	2446	
	0.7	1716	2451	
	0.8	1964	2455	
	0.9	2214	2460	
	1	2464	2464	
	1.1	2715	2469	
	1.2	2968	2473	
	1.3	3221	2477	
	1.4	3475	2482	
	1.5	3730	2486	
	1.6	3985	2491	
	1.7	4242	2495	
	1.8	4499	2500	
	1.9	4758	2504	
	2	5017	2509	

Catchment 4 - Wetland Calculations

Catchment Area		1.59	ha
Pre-development land-use	8%	0.13	ha
	92%	1.46	ha
Post-development land-use	100%	1.59	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	350	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	350	m3
Forebay volume (PWV x 15%)	53	m3
PWV (50% reduced for Stream Protection)	175	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	350	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	523	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	523	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.031	0.419
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.229	0.000
Total Peak Flow Rate	m3	0.260	0.419
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	198	2476
Runoff volume (per)	m3	1448	0
Total runoff volume	m3	1646	2476
Runoff Volume Difference	m3		830

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	55 m
Width	11 m
Depth	2 m
Area (approx.)	650 m2
Volume (approx.)	1299 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
55	11	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	308	616	
	0.6	371	618	
	0.7	434	620	
	0.8	498	623	
	0.9	562	625	
	1	627	627	
	1.1	692	629	
	1.2	758	632	
	1.3	824	634	
	1.4	891	636	
	1.5	958	638	
	1.6	1025	641	
	1.7	1093	643	
	1.8	1161	645	
	1.9	1230	647	
	2	1299	650	

Catchment 5 - Wetland Calculations

Catchment Area		1.65	ha
Pre-development land-use	8%	0.13	ha
	92%	1.52	ha
Post-development land-use	100%	1.65	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	363	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	363	m3
Forebay volume (PWV x 15%)	55	m3
PWV (50% reduced for Stream Protection)	182	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	363	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	543	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	543	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.032	0.435
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.238	0.000
Total Peak Flow Rate	m3	0.270	0.435
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	206	2569
Runoff volume (per)	m3	1503	0
Total runoff volume	m3	1709	2569
Runoff Volume Difference	m3		861

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	55 m
Width	11 m
Depth	2 m
Area (approx.)	650 m2
Volume (approx.)	1299 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
55	11	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	308	616	
	0.6	371	618	
	0.7	434	620	
	0.8	498	623	
	0.9	562	625	
	1	627	627	
	1.1	692	629	
	1.2	758	632	
	1.3	824	634	
	1.4	891	636	
	1.5	958	638	
	1.6	1025	641	
	1.7	1093	643	
	1.8	1161	645	
	1.9	1230	647	
	2	1299	650	

Catchment 6 - Wetland Calculations

Catchment Area		3.13	ha
Pre-development land-use	8%	0.25	ha
	92%	2.88	ha
Post-development land-use	100%	3.13	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	689	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	689	m3
Forebay volume (PWV x 15%)	103	m3
PWV (50% reduced for Stream Protection)	345	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	689	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	1029	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	1029	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.061	0.825
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.451	0.000
Total Peak Flow Rate	m3	0.512	0.825
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	390	4874
Runoff volume (per)	m3	2851	0
Total runoff volume	m3	3241	4874
Runoff Volume Difference	m3		1633

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	75 m
Width	15 m
Depth	2 m
Area (approx.)	1186 m2
Volume (approx.)	2371 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
75	15	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	570	1140	
	0.6	686	1143	
	0.7	802	1146	
	0.8	919	1149	
	0.9	1037	1152	
	1	1155	1155	
	1.1	1274	1158	
	1.2	1393	1161	
	1.3	1514	1164	
	1.4	1634	1167	
	1.5	1756	1170	
	1.6	1877	1173	
	1.7	2000	1176	
	1.8	2123	1179	
	1.9	2247	1183	
	2	2371	1186	

Catchment 7 - Wetland Calculations

Catchment Area		2.76	ha
Pre-development land-use	8%	0.22	ha
	92%	2.54	ha
Post-development land-use	100%	2.76	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	608	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	608	m3
Forebay volume (PWV x 15%)	91	m3
PWV (50% reduced for Stream Protection)	304	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	608	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	908	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	908	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.054	0.728
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.398	0.000
Total Peak Flow Rate	m3	0.452	0.728
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	344	4298
Runoff volume (per)	m3	2514	0
Total runoff volume	m3	2858	4298
Runoff Volume Difference	m3		1440

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	70 m
Width	14 m
Depth	2 m
Area (approx.)	1037 m2
Volume (approx.)	2073 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
70	14	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	497	994	
	0.6	598	997	
	0.7	700	1000	
	0.8	802	1002	
	0.9	905	1005	
	1	1008	1008	
	1.1	1112	1011	
	1.2	1217	1014	
	1.3	1322	1017	
	1.4	1427	1019	
	1.5	1534	1022	
	1.6	1640	1025	
	1.7	1748	1028	
	1.8	1856	1031	
	1.9	1964	1034	
	2	2073	1037	

Catchment 8 - Wetland Calculations

Catchment Area		1.62	ha
Pre-development land-use	8%	0.13	ha
	92%	1.49	ha
Post-development land-use	100%	1.62	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	357	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	357	m3
Forebay volume (PWV x 15%)	54	m3
PWV (50% reduced for Stream Protection)	178	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	357	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	533	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	533	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.032	0.427
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.234	0.000
Total Peak Flow Rate	m3	0.265	0.427
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	202	2523
Runoff volume (per)	m3	1476	0
Total runoff volume	m3	1677	2523
Runoff Volume Difference	m3		845

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	55 m
Width	11 m
Depth	2 m
Area (approx.)	650 m2
Volume (approx.)	1299 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
55	11	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	308	616	
	0.6	371	618	
	0.7	434	620	
	0.8	498	623	
	0.9	562	625	
	1	627	627	
	1.1	692	629	
	1.2	758	632	
	1.3	824	634	
	1.4	891	636	
	1.5	958	638	
	1.6	1025	641	
	1.7	1093	643	
	1.8	1161	645	
	1.9	1230	647	
	2	1299	650	

Catchment 9 - Wetland Calculations

Catchment Area		4.05	ha
Pre-development land-use	8%	0.32	ha
	92%	3.73	ha
Post-development land-use	100%	4.05	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	892	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	892	m3
Forebay volume (PWV x 15%)	134	m3
PWV (50% reduced for Stream Protection)	446	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	892	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	1332	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	1332	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.079	1.068
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.584	0.000
Total Peak Flow Rate	m3	0.663	1.068
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	505	6307
Runoff volume (per)	m3	3689	0
Total runoff volume	m3	4194	6307
Runoff Volume Difference	m3		2113

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	85 m
Width	17 m
Depth	2 m
Area (approx.)	1514 m2
Volume (approx.)	3027 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
85	17	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	731	1462	
	0.6	879	1465	
	0.7	1028	1469	
	0.8	1178	1472	
	0.9	1328	1476	
	1	1479	1479	
	1.1	1631	1483	
	1.2	1783	1486	
	1.3	1936	1489	
	1.4	2090	1493	
	1.5	2245	1496	
	1.6	2400	1500	
	1.7	2555	1503	
	1.8	2712	1507	
	1.9	2869	1510	
	2	3027	1514	

Catchment 10 - Wetland Calculations

Catchment Area		2.83	ha
Pre-development land-use	8%	0.23	ha
	92%	2.60	ha
Post-development land-use	100%	2.83	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	623	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	623	m3
Forebay volume (PWV x 15%)	94	m3
PWV (50% reduced for Stream Protection)	312	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	623	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	931	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	931	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.055	0.746
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.408	0.000
Total Peak Flow Rate	m3	0.463	0.746
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	353	4407
Runoff volume (per)	m3	2578	0
Total runoff volume	m3	2930	4407
Runoff Volume Difference	m3		1477

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	75 m
Width	15 m
Depth	2 m
Area (approx.)	1186 m2
Volume (approx.)	2371 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
75	15	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	570	1140	
	0.6	686	1143	
	0.7	802	1146	
	0.8	919	1149	
	0.9	1037	1152	
	1	1155	1155	
	1.1	1274	1158	
	1.2	1393	1161	
	1.3	1514	1164	
	1.4	1634	1167	
	1.5	1756	1170	
	1.6	1877	1173	
	1.7	2000	1176	
	1.8	2123	1179	
	1.9	2247	1183	
	2	2371	1186	

Catchment 11 - Wetland Calculations

Catchment Area		3.78	ha
Pre-development land-use	8%	0.30	ha
	92%	3.48	ha
Post-development land-use	100%	3.78	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	833	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	833	m3
Forebay volume (PWV x 15%)	125	m3
PWV (50% reduced for Stream Protection)	416	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	833	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	1243	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	1243	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.074	0.996
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.545	0.000
Total Peak Flow Rate	m3	0.619	0.996
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	471	5886
Runoff volume (per)	m3	3443	0
Total runoff volume	m3	3914	5886
Runoff Volume Difference	m3		1972

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	90 m
Width	18 m
Depth	2 m
Area (approx.)	1693 m2
Volume (approx.)	3385 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
90	18	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	819	1638	
	0.6	985	1642	
	0.7	1152	1645	
	0.8	1319	1649	
	0.9	1487	1653	
	1	1656	1656	
	1.1	1826	1660	
	1.2	1996	1663	
	1.3	2167	1667	
	1.4	2339	1671	
	1.5	2512	1674	
	1.6	2685	1678	
	1.7	2859	1682	
	1.8	3034	1685	
	1.9	3209	1689	
	2	3385	1693	

Catchment 12 - Wetland Calculations

Catchment Area		5.94	ha
Pre-development land-use	8%	0.48	ha
	92%	5.46	ha
Post-development land-use	100%	5.94	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	1308	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	1308	m3
Forebay volume (PWV x 15%)	196	m3
PWV (50% reduced for Stream Protection)	654	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	1308	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	1953	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	1953	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.116	1.566
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.856	0.000
Total Peak Flow Rate	m3	0.973	1.566
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	740	9250
Runoff volume (per)	m3	5411	0
Total runoff volume	m3	6151	9250
Runoff Volume Difference	m3		3099

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	105 m
Width	21 m
Depth	2 m
Area (approx.)	2290 m2
Volume (approx.)	4579 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
105	21	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	1113	2226	
	0.6	1338	2230	
	0.7	1564	2234	
	0.8	1791	2239	
	0.9	2019	2243	
	1	2247	2247	
	1.1	2477	2251	
	1.2	2707	2256	
	1.3	2938	2260	
	1.4	3170	2264	
	1.5	3403	2268	
	1.6	3636	2273	
	1.7	3871	2277	
	1.8	4106	2281	
	1.9	4342	2285	
	2	4579	2290	

Catchment 13 - Wetland Calculations

Catchment Area		4.29	ha
Pre-development land-use	8%	0.34	ha
	92%	3.95	ha
Post-development land-use	100%	4.29	ha
	0%	0	ha

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

Trapezoidal shaped ponds are computed by:

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

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.084	1.131
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.619	0.000
Total Peak Flow Rate	m3	0.702	1.131
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	534	6680
Runoff volume (per)	m3	3908	0
Total runoff volume	m3	4442	6680
Runoff Volume Difference	m3		2238

from TP108 Figure 5.1

from TP108 Figure 5.1

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	945	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	945	m3
Forebay volume (PWV x 15%)	142	m3
PWV (50% reduced for Stream Protection)	472	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	945	m2

Proposed Wetland Dimensions (Indicative)	
Length	85 m
Width	17 m
Depth	2 m
Area (approx.)	1514 m2
Volume (approx.)	3027 m3

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	1411	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	1411	m3

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
85	17	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	731	1462	
	0.6	879	1465	
	0.7	1028	1469	
	0.8	1178	1472	
	0.9	1328	1476	
	1	1479	1479	
	1.1	1631	1483	
	1.2	1783	1486	
	1.3	1936	1489	
	1.4	2090	1493	
	1.5	2245	1496	
	1.6	2400	1500	
	1.7	2555	1503	
	1.8	2712	1507	
	1.9	2869	1510	
	2	3027	1514	

Catchment 14 - Wetland Calculations

Catchment Area		4.01	ha
Pre-development land-use	8%	0.32	ha
	92%	3.69	ha
Post-development land-use	100%	4.01	ha
	0%	0	ha

Design Storm	Rainfall across 24hrs (mm)	Climate Change 2.1° Increase	Rainfall incl CC (mm)
90th percentile	26.4		
95th percentile	37.4		
50% AEP	85.5	9%	93.2
10% AEP	142	13.20%	160.7
1% AEP	212.3	16.80%	248.0

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

90th percentile		
Runoff depth (imp)	22	mm
Runoff depth (per)	4	mm
Runoff volume (imp)	883	m3
Runoff volume (per)	0	m3
Permanent Water Volume (PWV)	883	m3
Forebay volume (PWV x 15%)	132	m3
PWV (50% reduced for Stream Protection)	442	m3
Depth coefficient (d)	0.5	m
Minimum Surface Area of wetland	883	m2

95th percentile		
Runoff depth (imp)	33	mm
Runoff depth (per)	9	mm
Runoff volume (imp)	1319	m3
Runoff volume (per)	0	m3
Detention volume for stream protection	1319	m3

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

	Unit	Pre-Development	Post-Development
10% AEP			
c* (imp)		0.94	0.94
Specific peak flow rate (imp)		0.152	0.164
Peak Flow Rate (imp)	m3	0.078	1.057
c* (per)		0.46	0.46
Specific peak flow rate (per)		0.0975	0.113
Peak Flow Rate (per)		0.578	0.000
Total Peak Flow Rate	m3	0.657	1.057
Runoff depth (imp)	mm	155.72	155.72
Runoff depth (per)	mm	99.01	99.01
Runoff volume (imp)	m3	500	6244
Runoff volume (per)	m3	3653	0
Total runoff volume	m3	4152	6244
Runoff Volume Difference	m3		2092

from TP108 Figure 5.1

from TP108 Figure 5.1

Proposed Wetland Dimensions (Indicative)	
Length	80 m
Width	16 m
Depth	2 m
Area (approx.)	1345 m2
Volume (approx.)	2689 m3

Trapezoidal shaped ponds are computed by:

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

Volume storage				
			Side slope	
Length	Width	Depth	Horizontal	Vertical
80	16	2.0	3	1
Water depth (RL)	WL (m)	Storage (m3)	Area (m2)	
	0.5	648	1296	
	0.6	780	1299	
	0.7	912	1302	
	0.8	1045	1306	
	0.9	1178	1309	
	1	1312	1312	
	1.1	1447	1315	
	1.2	1582	1319	
	1.3	1718	1322	
	1.4	1855	1325	
	1.5	1993	1328	
	1.6	2131	1332	
	1.7	2269	1335	
	1.8	2409	1338	
	1.9	2549	1341	
	2	2689	1345	