

Appendix D

STREAM RESTORATION AND LARGE SCALE PROJECTS COMPUTATIONS

URBAN STREAM RESTORATION INTERIM REMOVAL RATES AND ADJUSTOR CURVE METHOD WITH MS4 PERMIT LOADING RATES

Stream Restoration

Calculate the POC Reduction from the Proposed Stream Restoration Project:

Table V.H.1 - Urban Stream Restoration Interim Approved Removal Rates

BMP	How Credited	TN	TP	TSS
Stream Restoration	mass reduction/length(lbs/linear ft)	0.075	0.068	44.88
Tributary B	1355	101.62	92.14	60812.4
Windy Run	525	39.375	35.7	23562
Tributary A 1&2	1660	124.5	112.88	74500.8
Tributary A 3&4	1230	92.25	83.64	55202.4
Headwaters	480	36	32.64	21542.4

Characterize the Acres Draining to the Proposed Stream Restoration Project:

	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	
Tributary B					
Regulated AC	23.92	38.06	61.98	0.00	
Regulated APS	0.00	0.00	0.00	0.00	
Regulated VDOT	0.92	0.04	0.96	0.00	
Regulated FED	0.00	0.00	0.00	0.00	
Unregulated Land	4.99	15.33	20.32	0.00	0.00
		Total	83.26	0.00	0.00

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	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	
Windy Run					
Regulated AC	102.53	146.54	249.07	0.00	
Regulated APS	3.15	5.92	9.07	0.00	
Regulated VDOT	3.57	0.77	4.33	0.00	
Regulated FED	0.00	0.00	0.00	0.00	
Unregulated Land	1.66	5.94	7.60	0.00	0.00
		Total	270.07	0.00	0.00

	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	
Tributary A 1&2					
Regulated AC	35.00	72.78	107.78		
Regulated APS	1.10	4.23	5.33		
Regulated VDOT	0.71	0.03	0.75		
Regulated FED	0.00	0.00	0.00		
Unregulated Land	0.05	1.63	1.68	5.32	Total
		Total	115.54	5.32	120.86

	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	
Tributary A 3&4					
Regulated AC	59.10	111.59	170.69		
Regulated APS	1.15	4.78	5.93		
Regulated VDOT	1.56	0.15	1.71		
Regulated FED	0.00	0.00	0.00		
Unregulated Land	4.53	21.36	25.88	32.11	Total

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		Total	204.21	32.11	236.32
	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	
Headwaters					
Regulated AC	8.84	9.37	18.21		
Regulated APS			0.00		
Regulated VDOT	0.84	0.11	0.95		
Regulated FED			0.00		
Unregulated Land	1.25	5.28	6.53	19.52	Total
		Total	25.69	19.52	45.21

Regulated land credit for stream restoration project

Tributary B	
Regulated AC	0.74
Regulated APS	0.00
Regulated VDOT	0.01
Regulated FED	0.00
Unregulated Land	0.24
Windy Run	
Regulated AC	0.92
Regulated APS	0.03
Regulated VDOT	0.02
Regulated FED	0.00
Unregulated Land	0.03
Tributary A 1&2	
Regulated AC	0.89
Regulated APS	0.04

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Regulated VDOT	0.01
Regulated FED	0.00
Unregulated Land	0.01

Tributary A 3&4	
Regulated AC	0.72
Regulated APS	0.03
Regulated VDOT	0.01
Regulated FED	0.00
Unregulated Land	0.11
Headwater	
Regulated AC	0.40
Regulated APS	0.00
Regulated VDOT	0.02
Regulated FED	0.00
Unregulated Land	0.14

		Available Credit for Regulated land	NET Credit Received for Unregulated land	NET Credit Received for OTHER Unregulated land	NET Credit to MS4
Tributary B					
Regulated AC	TN	75.65	7.62	0.00	83.27
	TP	68.59	21.18	0.88	90.65
	TSS	45271.01	13437.05	483.35	59191.41
Windy Run					
Regulated AC	TN	36.31	0.00	0.00	36.31
	TP	32.92	0.55	0.45	33.93
	TSS	21729.57	182.80	0.00	21912.37
Tributary A 1&2					
Regulated AC	TN	111.03	0.67	1.19	5.48
	TP	100.66	1.53	5.23	4.97

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	TSS	66437.84	999.17	3256.21	3279.56
Tributary A 3&4					
Regulated AC	TN	66.63	0.00	0.00	12.54
	TP	60.41	7.83	2.06	11.37
	TSS	39871.61	4657.17	1073.61	7501.08
Headwater					
Regulated AC	TN	14.50	0.03	0.00	15.54
	TP	13.15	4.36	0.52	14.09
	TSS	8677.18	2737.52	254.26	9300.96

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Large-scale Facilities

**Characterize the Acres and Loads Draining to the Retrofit
Ballston Pond**

	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Total Load to retrofit		
				TN	TP	TSS
Regulated AC	182.73	211.52	394.25	3080.83	296.02	214035.30
Regulated APS	4.60	5.10	9.69	77.51	7.45	5385.09
Regulated VDOT	18.31	9.13	27.43	308.64	29.66	21442.57
Regulated FED	0.00	0.00	0.00	0.00	0.00	0.00
Unregulated Land	6.79	12.84	19.63	114.43	11.00	7949.95
	212.42	238.58	451.00			

Calculate retrofit removal rates and loads removed

Retrofit storage vol (ac-ft)	Runoff depth treated (in)	REMOVAL RATES per adjustor curves		
		TN	TP	TSS
6 ¹	0.338949601	20%	32%	41%

Calculate net credit to MS4

	TN	TP	TSS
Total loads removed by retrofit	1221.88	141.82	118765.69
Baseline reductions required for other regulated and unregulated land	63.74	6.48	7370.37
	1158.14	135.34	111395.32

¹ Design plans provide 6.8 ac-ft volume. Lower value used here to be conservative, and as-built data will document actual value, with computations updated accordingly.

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Summary

	TN	TP	TSS
Tributary B	83.27	90.65	59191.41
Windy Run	36.31	33.93	21912.37
Tributary A 1&2	5.48	4.97	3279.56
Tributary A 3&4	12.54	11.37	7501.08
Headwaters	15.54	14.09	9300.96
Ballston Pond	1158.14	135.34	111395.32
Total	1311.28	290.35	212580.70

Potential Reductions

Shoreline Management

Summary of Pollutant Load Reductions

Protocol	Name	Units	Pollutants	Reduction Rate	Applicable?
1	Prevented Sediment	pounds per year	Sediment	Measured TSS in sediment prevented. Calculated based on shoreline erosion with reductions for sand content and bank instability.	NO
2	Denitrification	pounds per year	TN	Measured TN removal for denitrification rate wassociated with vegetated area. 85 lbs TN/acre/yr	YES
3	Sedimentation	pounds per year	Sediment, TP	Measured TSS and TP removal rates assocaited with vegetated area. 6,959 lbs TSS/acre/yr. 5.289 lbs TP/acre/yr	YES
4	Marsh Redfield Ratio	pounds per year	TN, TP	Measured TN and TP removal rates assocaited with vegetated area. 6.83 lbs TN/acre/yr. 0.3 lbs TP/acre/yr	YES
5	Default Rate	pounds per year	TSS	164 lbsTSS/fl/yr MD, DE, DC. 42 lbs TSS/lf/yr VA	NO

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Total Year 1 Reductions

Pollutant	Protocol 1	Protocol 2	Protocol 3	Protocol 4	Year 1 Total Pollutant Load Reduction (lbs/yr)
TN	NA	48.45	NA	3.8931	52.34
TP	NA	NA	3.01473	0.171	3.19
TSS	NA	NA	3966.63	NA	3966.63

For more detail information on calculations see Stream restoration and large scale facilities spreadsheet.

Sparrow Pond

No calculations for Sparrow pond are provided because an existing conditions survey is planned to document and compare the facility's current volume to the design volume and then to compute the incremental POC reduction credits that could result from restoring the design volume (and maintaining it over time).