September 5, 2017

Appendix F

WinSLAMM Analyses of Costco Site Redevelopment

Contents

Summary

WinSLAMM (version 10.3) was used to evaluate the total phosphorus discharge load in post-development stormwater at a proposed Costco store with a tire center; 12 gas pumps; and 610 parking spaces in the New York City Watershed. The redevelopment site selected for this analysis is located at Crompond Road, northwest of the intersection of the Taconic State Parkway and US Route 202/NYS Route 35, in the Town of Yorktown in Westchester County, New York. The site supports two Town of Yorktown wetlands and drains into the New Croton Reservoir.

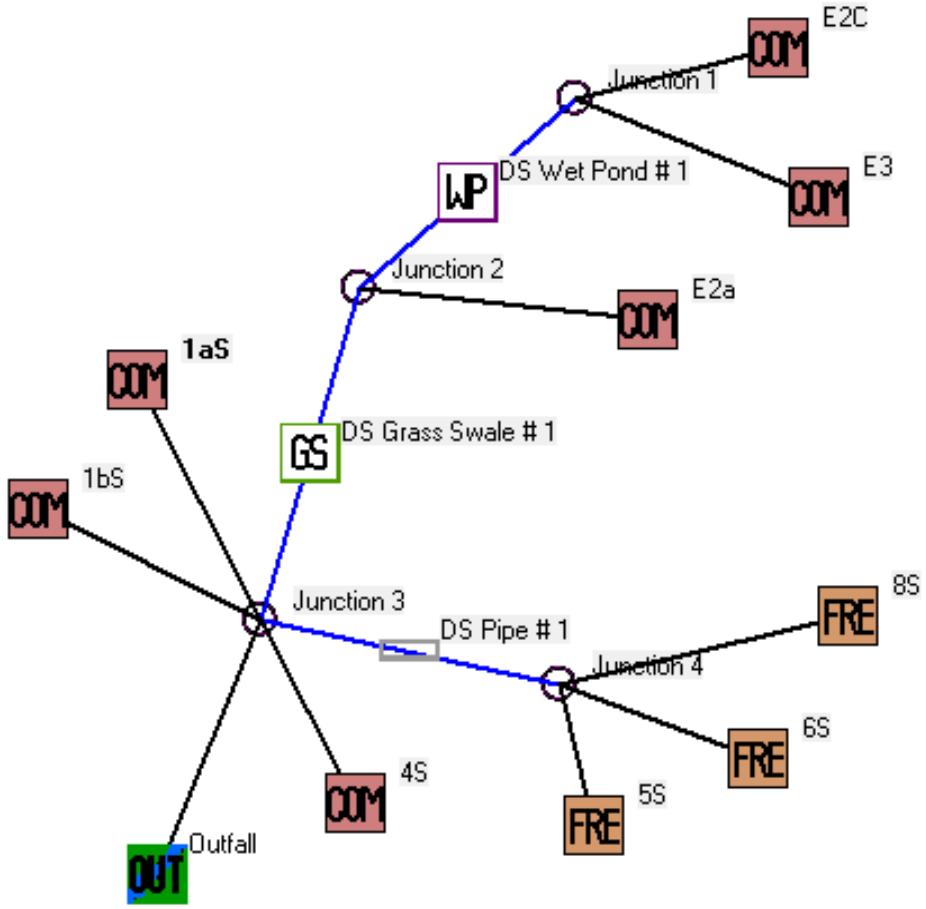
Concerning pre-development conditions, about 10 acres of the site was occupied by a plant nursery/lawn mower service center, two residential properties, a former motel, and a fence company. Table 1 lists each subarea used in the WinSLAMM analysis (subareas were provided by the HydroCad analyses). The modeled pre-redevelopment total site area is about 24 acres.

Table 1: Pre-Redevelopment Modeled Subareas

sub area	developed area (acres)
LU# 1 – Commercial: E2c	4.770
LU# 2 – Commercial: E3	4.460
LU# 3 – Commercial: E2a	6.210
LU# 4 – Commercial: 1aS	1.160
LU# 5 - Commercial: 1bS	1.430
LU# 6 – Commercial: 4S	4.080
LU# 7 – Freeway: 5S	0.620
LU# 8 – Freeway: 6S	0.300
LU# 9 – Freeway: 8S	0.590
grand total modeled:	23.620

The following modeling schematic in Figure 1 shows how these subareas are connected to one another and to the pre-redevelopment stormwater controls. Appendix F-1 in this document shows the detailed development characteristics for each of the pre-redevelopment subareas.

Figure 1: Winslamm Site Layout Showing Subarea and Treatment Area Connections for Pre-Redeveloped Portions of the Costco Site.



Two stormwater controls were being used at the site prior to redevelopment, a wet pond/wet land area and grass swale.

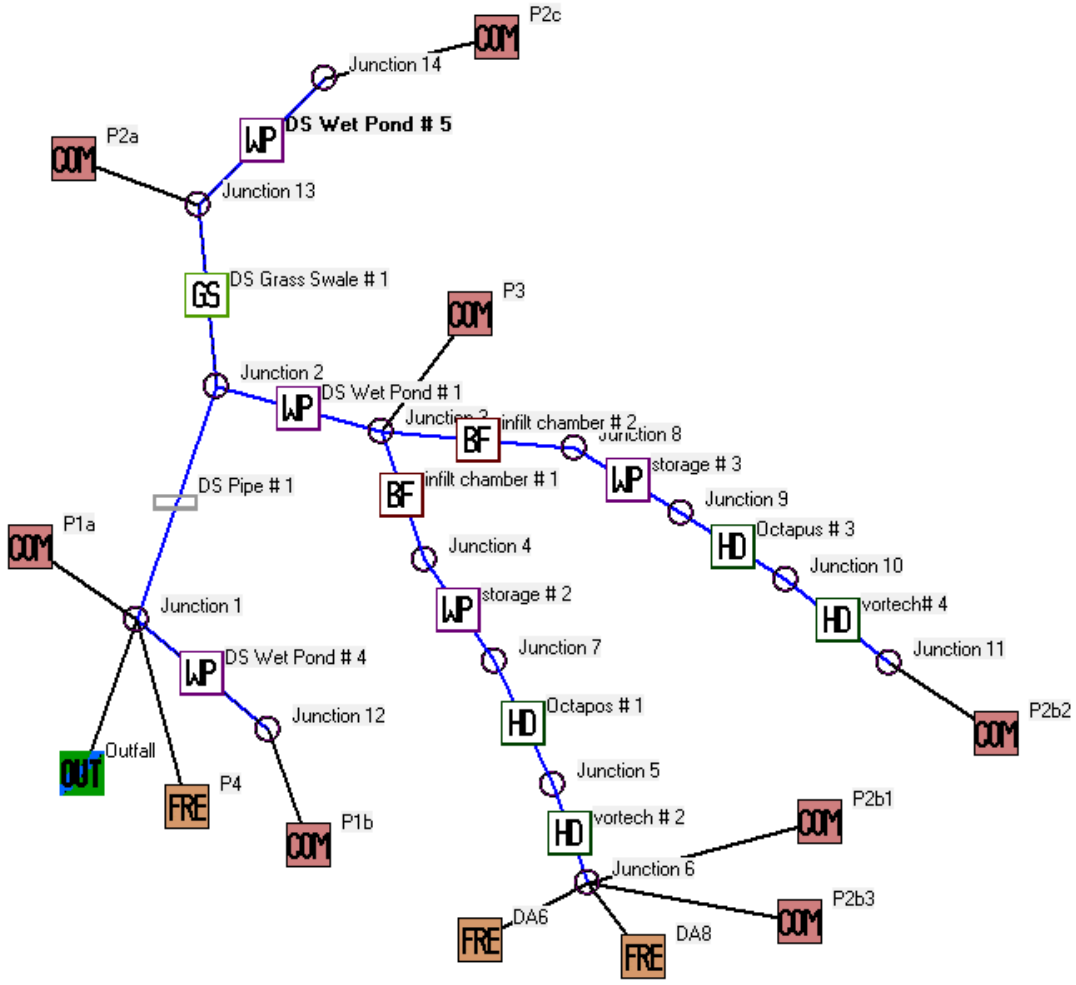
Table 2 lists each subarea used in the WinSLAMM analysis (provided by the HydroCad analyses) for the post redeveloped site. The post redevelopment total site area modeled is about 24 acres.

Table 2: Post-Redevelopment Modeled Subareas

sub area	developed area (ac)
DA6	0.410
DA8	0.870
P2b3	6.177
P2b1	2.374
P2b2	5.111
P3	0.550
P4	0.450
P1b	0.820
P1a	1.140
P2a	2.690
P2c	3.720
grand total modeled:	24.312

The following modeling schematic in Figure 2 shows how these areas are connected, along with the existing stormwater controls. Appendix F-2 in this document shows the detailed development characteristics for each of the post-redevelopment subareas.

Figure 2: Winslamm Site Layout Showing Subarea and Treatment Area Connections for Post Redevelopment of the Costco Site.



WinSLAMM was previously calibrated for East Coast conditions using data from the National Stormwater Quality Database (http://rpitt.eng.ua.edu/Publications/4_Stormwater_Characteristics_Pollutant_Sources_and_Land_Development_Characteristics/Land_development_characteristics/Standard%20Land%20Use%20file%20descriptions%20final%20April%2018%202011%20for%20EPA%20Cadmus.pdf). The HydroCad site reports indicated hydrologic soil group (HSG) B and C soils are the dominant soils at the site. The Soil Survey of Westchester County indicates that are seven types of soils on the site. With development, many of the soil characteristics will change (with compaction along with cutting and filling). However, the soil survey indicates that the clay content ranges from <10 to 35%. The clay content is very important when snowmelt runoff containing ice control

salts is infiltrated, as the salt interacts with the clay (sodium adsorption ratio issue) to dramatically reduce soil infiltration rates.

For typical development conditions, normally compacted silt soils were assumed, with infiltration rates of about 0.5 inches per hour for the infiltrating stormwater controls. Ten years (1995 through 2005) of rainfall records for Yorktown Heights, NY, were used for WinSLAMM long-term continuous modeling calculations. The meteorological station at Yorktown Heights is approximately a mile from the Costco site.

The post-development WinSLAMM analysis was only for the non-winter season (excluding rains from December 2 to March 12, based on typical temperatures and snowfall). Table 3 presents the annual runoff discharge loads for the rainy period for the pre-redeveloped site:

Table 3: Rainy Season Annual Runoff Discharge Loads for the Pre-Developed Site

	Pre-developed Costco : Value for rainy period only
Rain depth	32.80 inches per year (in/yr)
Runoff volume	506,266 cubic feet per yr (ft^3/yr) (about 4% reductions)
Total particulate solids load	5,013 pounds per year (lb/yr) (about 21% reductions)
Total particulate solids concentration	159 milligrams per liter (mg/L)
Total phosphorus load	10.40 lb/yr (about 6% reductions)
Total phosphorus concentrations	0.33 mg/L
Particulate phosphorus load	3.48 lb/yr (about 14% reductions)
Particulate phosphorus concentration	0.11 mg/L
Filterable phosphorus load	6.92 lb/yr (about 2% reductions)
Filterable phosphorus concentration	0.22 mg/L

Since WinSLAMM does not calculate snowmelt runoff, the following estimate was used to predict the discharge of total phosphorus in snowmelt at the site. The estimated amount of runoff from the pre-redeveloped area during snowmelt events (when infiltration and other runoff losses at pervious areas is significantly reduced) is estimated to be about 135,300 ft^3/yr (based on the 10-year average precipitation amount measured during the winter season. A reasonable value for snowmelt total phosphorus concentrations is 0.23 mg/L, as measured during extensive snowmelt water quality monitoring in Toronto residential and commercial areas (Pitt and McLean 1986). This estimated snowmelt total phosphorus load (snowmelt runoff volume multiplied by the concentration) is therefore estimated to be about 1.92 lb/yr. Therefore, the 23.62 acre pre-redeveloped area is calculated to have the following annual total phosphorus discharges:

Winter season load:	1.92 lb/yr
Rain season load:	10.40 lb/yr
Total:	12.32 lb/yr

The main infiltration controls after redevelopment are underground infiltration chambers. These are expected to continue to function during colder periods when surface soils are frozen.

However, directing snowmelt to the underground infiltration chambers will potentially subject them to high loads of deicing salts. Snowmelt, containing sodium from deicing salts, can react with clay in native soils on site and severely reduce infiltration rates (sodium adsorption ratio, SAR, effect). It is therefore recommended that any snowmelt (containing deicing salts) be diverted away from the underground infiltration chambers on site. Table 4 shows the calculated runoff characteristics during the rainy season after the Costco development.

Table 4: Rainy Season Annual Runoff Discharge Loads After Site Development

	Post-Costco Development Value for rainy period only
Rain depth	32.80 inches/yr
Runoff volume	676,950 ft^3/yr (about 51% reductions)
Total particulate solids load	2,338 lb/yr (about 91% reductions)
Total particulate solids concentration	55 mg/L
Total phosphorus load	8.73 lb/yr (about 62% reductions)
Total phosphorus concentrations	0.20 mg/L
Particulate phosphorus load	1.11 lb/yr (about 88% reductions)
Particulate phosphorus concentration	0.03 mg/L
Filterable phosphorus load	7.62 lb/yr (about 44% reductions)
Filterable phosphorus concentration	0.18 mg/L

The estimated runoff amount from the post redeveloped area during snowmelt events (when infiltration is likely severely reduced due to SAR effects, assuming similar runoff responses for the precipitation amounts as during the non-winter period) is estimated to be about 385,500 ft^3/yr. As noted above, a reasonable value for snowmelt total phosphorus concentrations is 0.23 mg/L, as measured during extensive snowmelt water quality monitoring in Toronto residential and commercial areas (Pitt and McLean 1986). This estimated snowmelt total phosphorus load (snowmelt runoff volume multiplied by the concentration) is estimated to be about 5.53 lb/yr. Therefore, the 24.31 acre post redeveloped area is calculated to have the following annual total phosphorus discharges:

Winter season load:	5.53 lb/yr
Rain season load:	8.73 lb/yr
Total:	14.26 lb/yr

Therefore, the rainy season total phosphorus (TP) load will be expected to decrease with redevelopment (10.40 vs. 8.73 lb/yr). However, it is not clear how snowmelt will affect the annual loads. In most similar developments, snow is removed from the roofs and parking areas and deposited in adjacent undeveloped areas to melt. The snowmelt from the snow piles will likely not enter the developed area storm drainage system. It is also likely that the parking areas and roadways will be treated with deicing salts, and the associated snowmelt from those activities will enter the site storm drainage system, with adverse effects on the underground

infiltration chambers. If snowmelt was not considered, the post redevelopment area would produce less total phosphorus than the pre-redevelopment condition. However, it is likely that some additional snowmelt will increase TP discharges at the site as much more snow handling and deicing is expected post redevelopment. Therefore, estimates for the post-redevelopment TP contributions range from about 8.7 to 14.3 lb/yr, reflecting minimal snowmelt influence to maximum effect.

Table 5 summarizes the pre and post-development total phosphorus discharges for the Costco re-development project. This table shows the calculated total phosphorus mass discharges for pre-redevelopment and post-redevelopment conditions. Estimates for snowmelt total phosphorus discharges are also shown, based on simple calculations. These snowmelt discharges account for about 40 percent of the annual total phosphorus discharges.

Table 5: Summary of Calculated Total Phosphorus Discharges at the Costco Sites (total phosphorus runoff discharges, lb/yr)

	Costco (24.3 ac redeveloped area)
A. Site as previously developed (all seasons)	12.32
B. Site redeveloped (non-winter seasons) (not including off site area)	8.73
C. Site developed snowmelt (estimate)	5.53
D. Total site redeveloped all seasons (B plus C) (not including off site area)	14.26
E. Site change with redevelopment (D minus A)	1.94
F. Off-site change due to treatment onsite	0.57 reduction
G. Net change (E minus F)	1.37

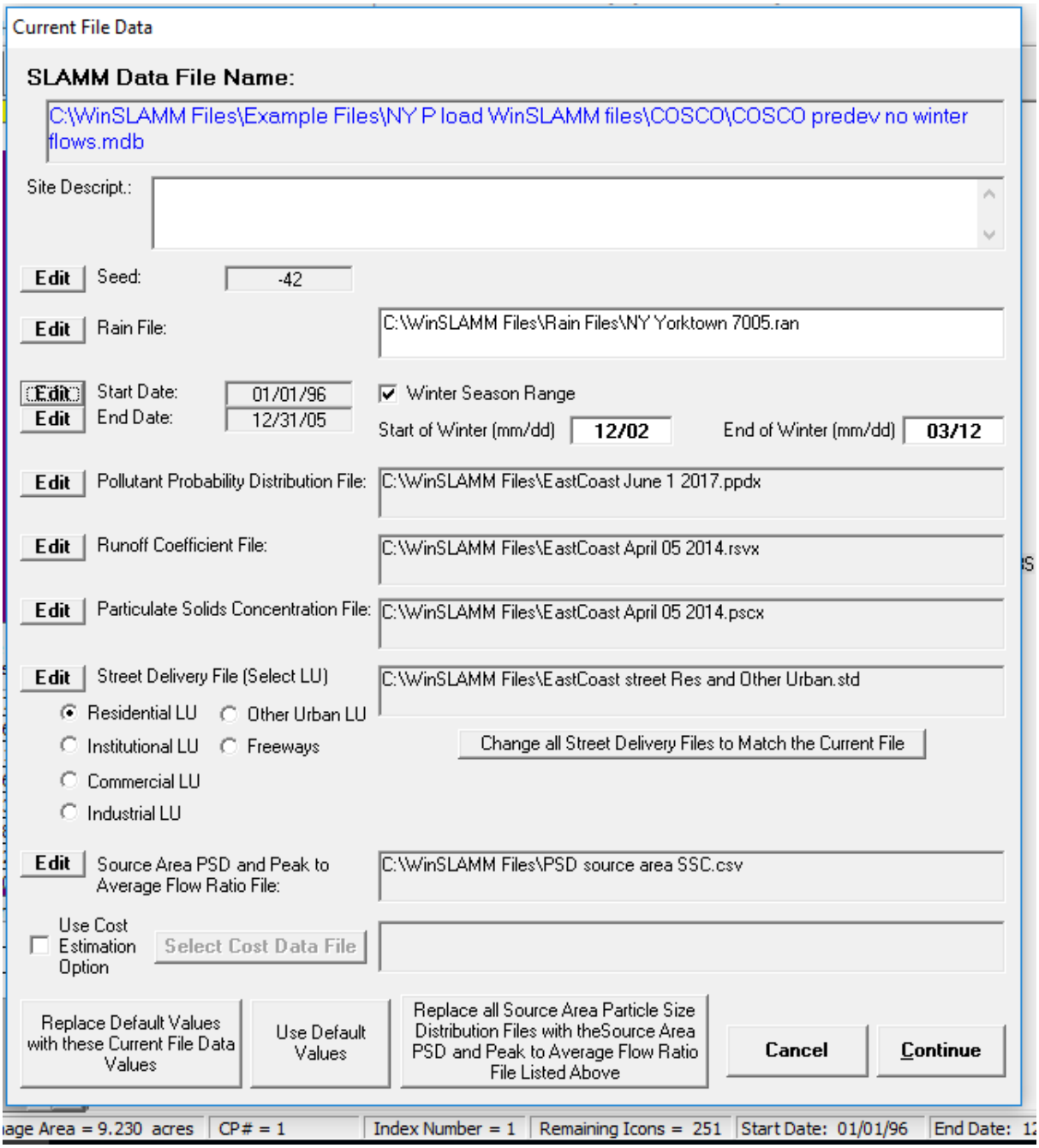
This development incorporates a wide variety and extensive use of stormwater management practices. However, it is still expected to result in increased total phosphorus discharges compared to previously developed conditions. This site also includes additional treatment of off-site stormwater that drains to site controls, providing additional, but not enough, total phosphorus reductions compared to pre-redeveloped conditions. Therefore, one method to further reduce the total phosphorus discharges would be to increase the treatment of off-site stormwater.

This example illustrates how WinSLAMM can be used to calculate complex development sites having many site stormwater controls in series. WinSLAMM routes flows, particulates, particle sizes, and pollutants through multiple controls, using the effluent characteristics from upland controls, adding new flow additions, and then routing the combined flows to downstream controls. These analyses are estimates based on calculated results and reasonable assumptions concerning source areas and stormwater control details.

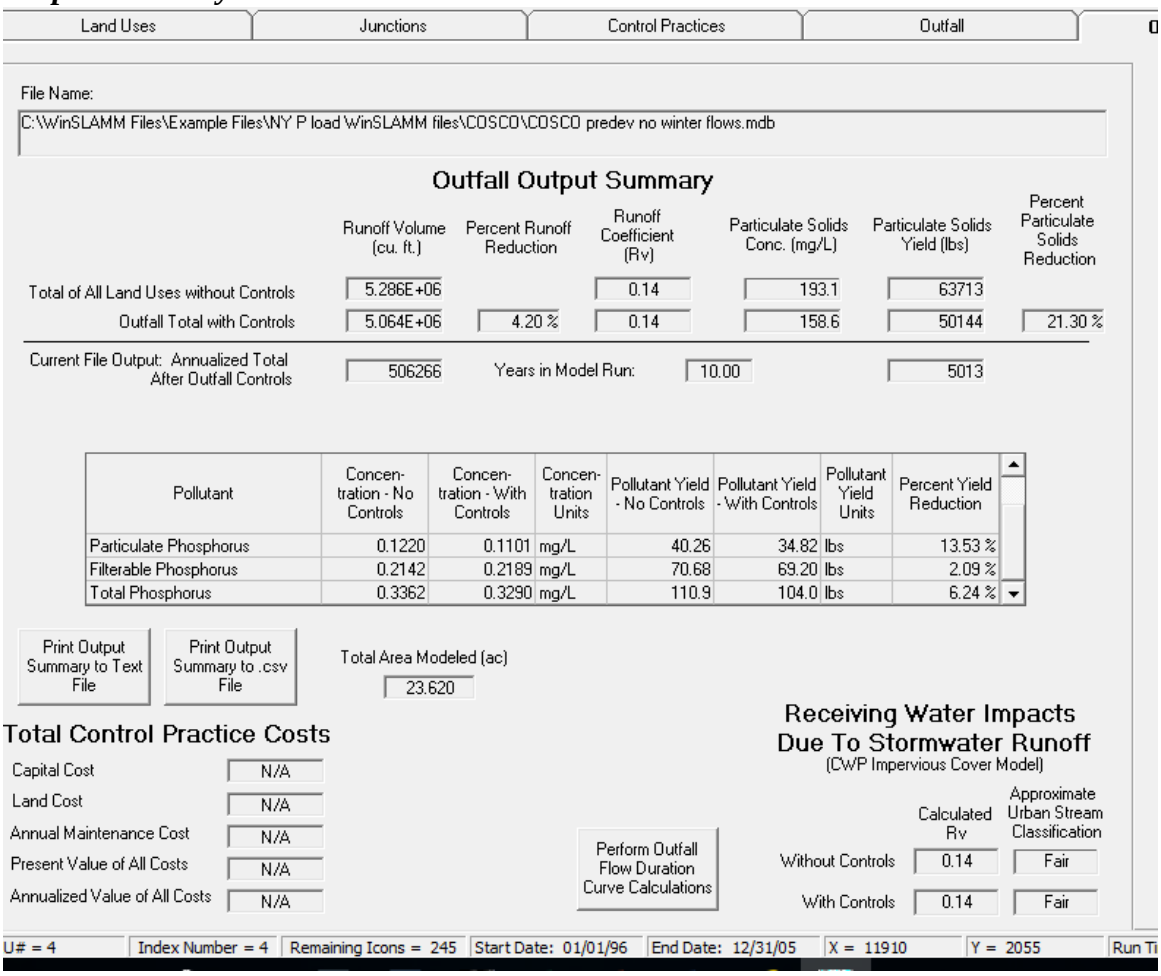
Snowmelt is also expected to contribute large amounts of TP during redevelopment, but it is not clear how snow handling and deicing controls will be applied and their effects on the TP annual discharges. More precise analyses are possible with actual measurements and specific design information.

Appendix F-1: Pre-redevelopment Costco Site

WinSLAMM Files

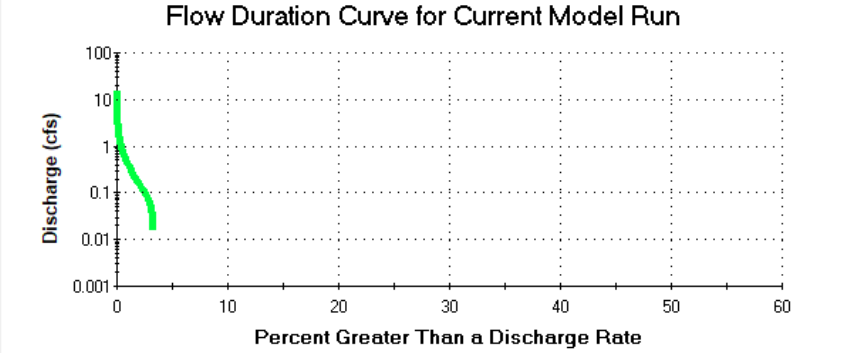


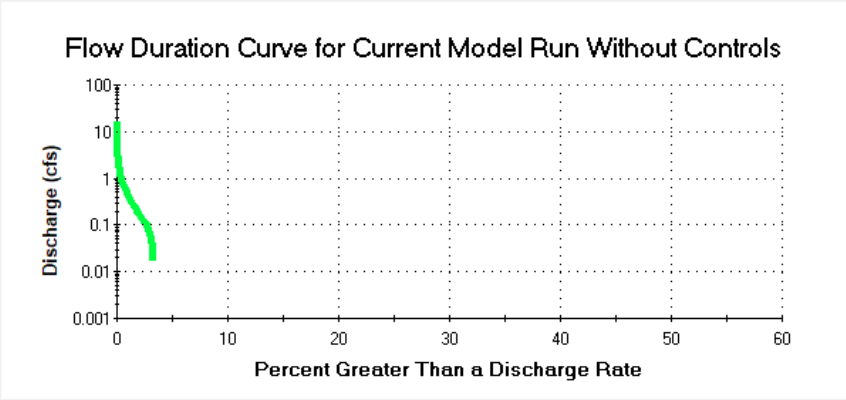
Output Summary



Flow-Duration Curves

Flow Duration Curves





Flow Duration Data

Discharge Greater Than Percent	Flow Rate (cfs) for Current Model Run	Flow Rate (cfs) Without Controls
0	15.30	16.64
0.1	2.295	2.346
1	0.4131	0.4159
3	0.04590	0.04991
5	0	0
10	0	0
20	0	0
30	0	0
40	0	0
50	0	0
60	0	0
70	0	0
80	0	0
90	0	0
100	0	0

Print Close

Description of Source Areas

LU# 1 - Commercial: E2C Total area (ac): 4.770

1 - Roofs 1: 0.010 ac. Flat Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz										
57 - Undeveloped Areas 1: 4.260 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz										
70 - Water Body Areas: 0.500 ac. Source Area PSD File:										

LU# 2 - Commercial: E3 Total area (ac): 4.460

1 - Roofs 1: 0.235 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz				
2 - Roofs 2: 0.152 ac. Flat Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz				
13 - Paved Parking 1: 0.727 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz				
25 - Driveways 1: 0.099 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz				
31 - Sidewalks 1: 0.063 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz				
45 - Large Landscaped Areas 1: 1.592 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz				
57 - Undeveloped Areas 1: 1.592 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz				

LU# 3 - Commercial: E2a Total area (ac): 6.210

1 - Roofs 1: 0.060 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz				
13 - Paved Parking 1: 0.260 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz				
45 - Large Landscaped Areas 1: 0.500 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz				
57 - Undeveloped Areas 1: 5.390 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz				

LU# 4 - Commercial: 1aS Total area (ac): 1.160

1 - Roofs 1: 0.021 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz				
19 - Unpaved Parking 1: 0.054 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz				
31 - Sidewalks 1: 0.005 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz				
45 - Large Landscaped Areas 1: 0.420 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz				
57 - Undeveloped Areas 1: 0.660 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz				

LU# 5 - Commercial: 1bS Total area (ac): 1.430

1 - Roofs 1: 0.026 ac. Flat Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz			
13 - Paved Parking 1: 0.054 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz			
31 - Sidewalks 1: 0.107 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz			
45 - Large Landscaped Areas 1: 0.097 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz			
57 - Undeveloped Areas 1: 1.146 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz			

LU# 6 - Commercial: 4S Total area (ac): 4.080

1 - Roofs 1: 0.120 ac. Flat Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz			
19 - Unpaved Parking 1: 0.220 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz			
37 - Streets 1: 0.280 ac. Intermediate Street Length = 0.231 curb-mi Street Width (assuming two curb-mi per street mile) = 20 ft			
Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz			
57 - Undeveloped Areas 1: 3.460 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz			

LU# 7 - Freeway: 5S Total area (ac): 0.620

1 - Paved Lane/Shlder Area 1: 0.370 ac. Fair/Mod Slope C&G Freeway Length = 0.1 mi Freeway Width (assuming two curb-mi per freeway mile) = 61 ft			
ADT = 10000 veh/day Default Initial St. Dirt Loading Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz			
19 - Large Turf Areas 1: 0.040 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz			
28 - Other Direct Con Imp Areas: 0.210 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz			

LU# 8 - Freeway: 6S Total area (ac): 0.300

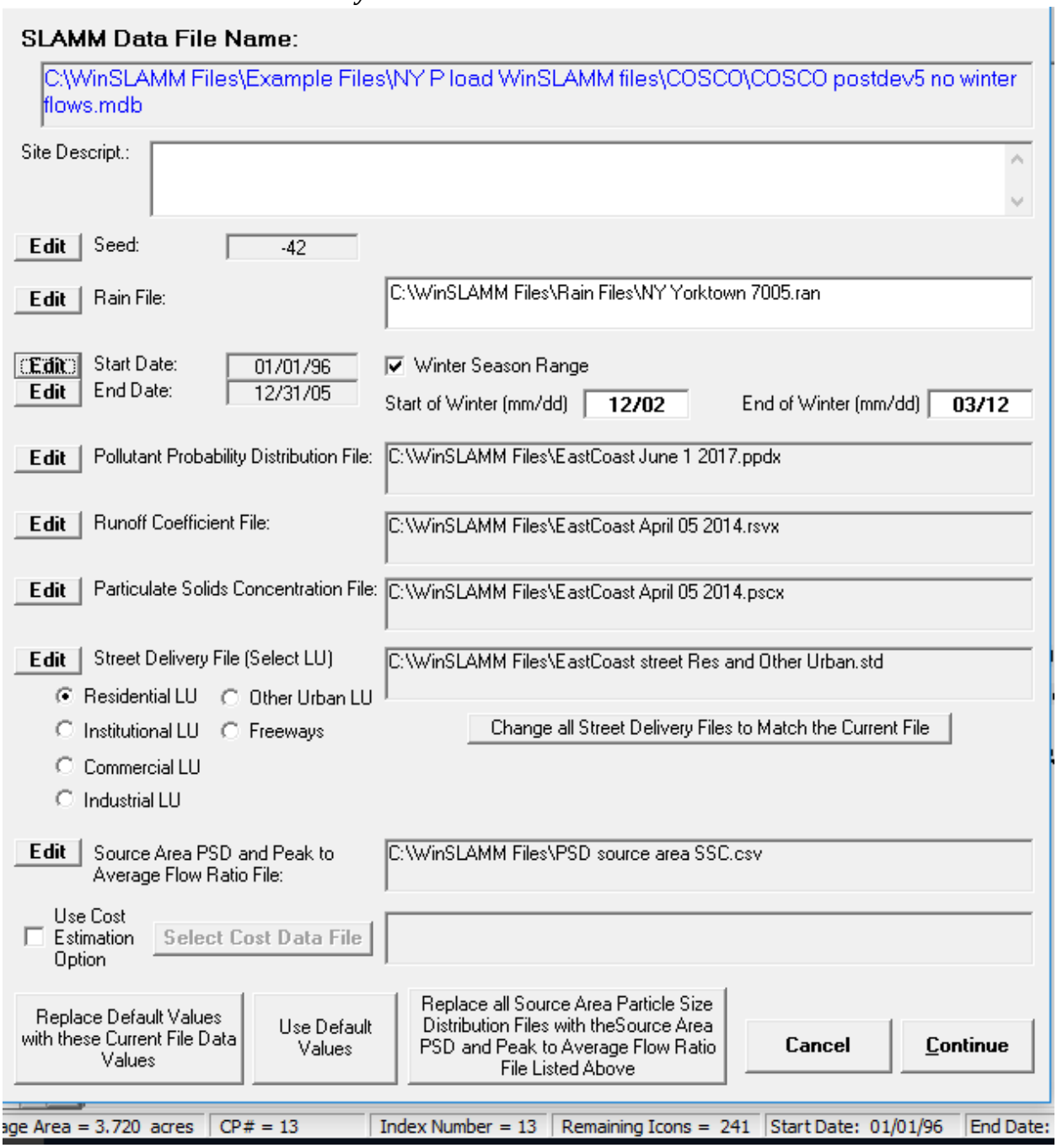
1 - Paved Lane/Shlder Area 1: 0.300 ac. Fair/Mod Slope C&G Freeway Length = 0.065 mi Freeway Width (assuming two curb-mi per freeway mile) = 76.2 ft			
ADT = 10000 veh/day Default Initial St. Dirt Loading Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz			

LU# 9 - Freeway: 8S Total area (ac): 0.590

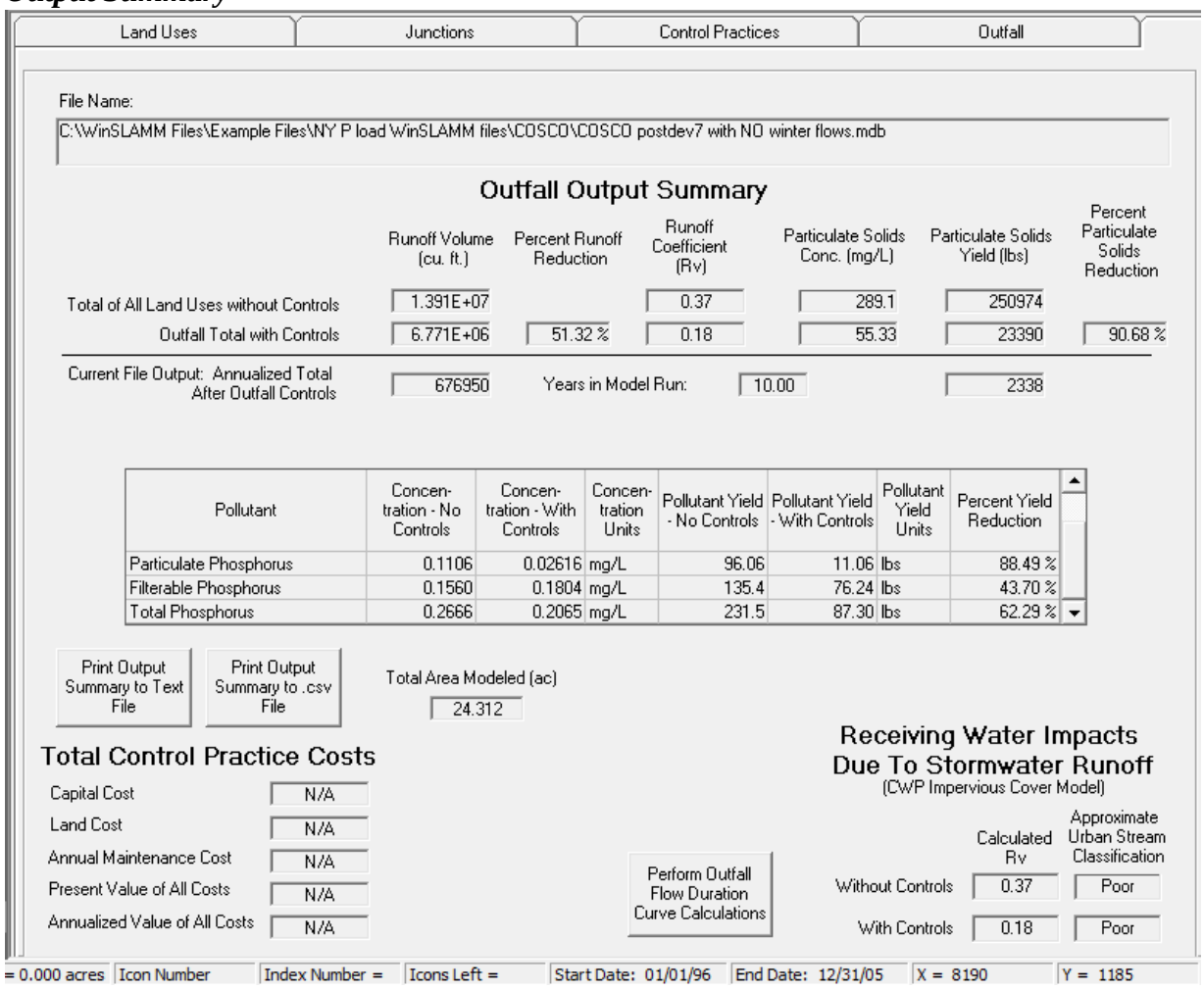
1 - Paved Lane/Shlder Area 1: 0.590 ac. Fair/Mod Slope C&G Freeway Length = 0.25 mi Freeway Width (assuming two curb-mi per freeway mile) = 38.9 ft			
ADT = 10000 veh/day Default Initial St. Dirt Loading Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz			

Appendix F-2: Post-Redevelopment of Costco Site

WinSLAMM Files used in Analyses

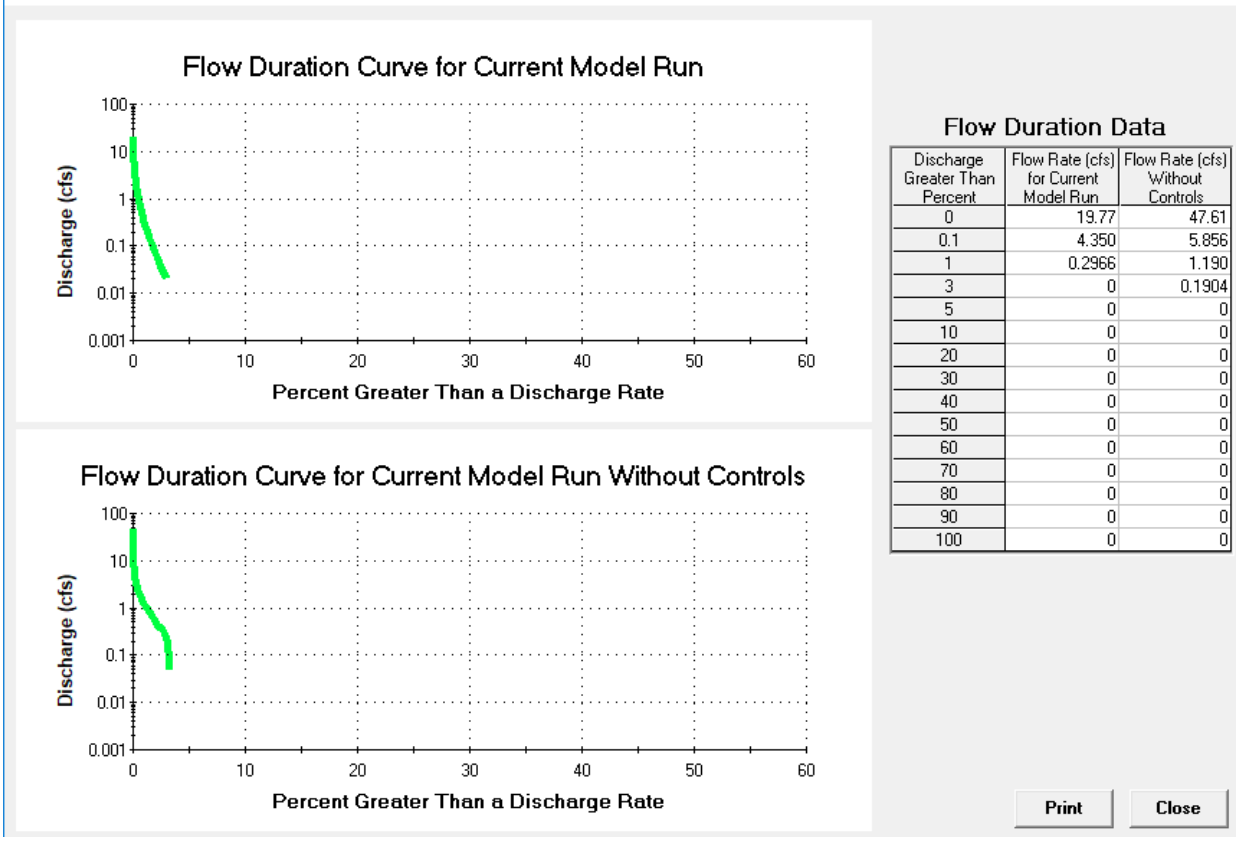


Output Summary



Flow-Duration Curves

Flow Duration Curves



Discharge Greater Than Percent	Flow Rate (cfs) for Current Model Run	Flow Rate (cfs) Without Controls
0	19.77	47.61
0.1	4.350	5.856
1	0.2966	1.190
3	0	0.1904
5	0	0
10	0	0
20	0	0
30	0	0
40	0	0
50	0	0
60	0	0
70	0	0
80	0	0
90	0	0
100	0	0

Performance of Individual Control Practices

Land Uses | Junctions | **Control Practices** | Outfall | Output Summary

Runoff Volume | Part. Solids Yield (lbs) | Part. Solids Conc. (mg/L) | **Summary Table**

Data File: C:\WinSLAMM Files\Example Files\NY P load WinSLAMM files\COSCO\COSCO postdev7 with NO winter flows.mdb
Rain File: NY Yorktown 7005.RAN
Date: 06-06-17 Time: 8:51:12 AM
Site Description:

Col. #:	2	3	4	5	6	7	8	9	10	11
Control Practice No.	Control Practice Type	Control Practice Name or Location	Total Inflow Volume (cf)	Total Outflow Volume (cf)	Percent Volume Reduction	Total Influent Load (lbs)	Total Effluent Load (lbs)	Percent Load Reduction	Flow Weighted Influent Conc (mg/L)	Flow Weighted Effluent Conc (mg/L)
1	Pipe	DS Pipe # 1	6.298E+06	6.298E+06	0	19454	19454	0	49.48	49.48
2	Wet Detention Pond	DS Wet Pond # 1	5.586E+06	4.894E+06	12.39	23223	19294	16.92	66.60	63.15
3	Biofilter	infilt chamber # 1	7.771E+06	3.383E+06	56.47	53448	15972	70.12	110.2	75.64
4	Hydrodynamic Device	Octapos # 1	7.739E+06	7.739E+06	0	91088	84556	7.171	188.5	175.0
5	Hydrodynamic Device	vortech # 2	7.739E+06	7.739E+06	0	175426	91088	48.08	363.1	188.5
6	Wet Detention Pond	storage # 2	7.739E+06	7.771E+06	-0.413	84556	53448	36.79	175.0	110.2
7	Biofilter	infilt chamber # 2	4.041E+06	2.158E+06	46.60	15472	6613	57.26	61.33	49.08
8	Wet Detention Pond	storage # 3	4.031E+06	4.041E+06	-0.248	24264	15472	36.23	96.42	61.33
9	Hydrodynamic Device	Octapus # 3	4.031E+06	4.031E+06	0	26274	24264	7.650	104.4	96.42
10	Hydrodynamic Device	vortech# 4	4.031E+06	4.031E+06	0	57243	26274	54.10	227.5	104.4
11	Wet Detention Pond	DS Wet Pond # 4	187934	184389	1.886	8269	1216	85.29	704.8	105.6
12	Grass Swales	DS Grass Swale # 1	1.611E+06	1.404E+06	12.85	241.5	159.7	33.87	2.401	1.822
13	Wet Detention Pond	DS Wet Pond # 5	1.394E+06	1.391E+06	0.2152	224.2	21.34	90.48	2.576	0.2458
14	Hydrodynamic Device	SA Device, LU# 4 ,SA# 1	1.073E+06	1.073E+06	0	7846	1610	79.48	117.1	24.04

Land Uses | Junctions | **Control Practices** | Outfall | Output Sum

Runoff Volume | Part. Solids Yield (lbs) | Part. Solids Conc. (mg/L) | **Summary Table**

Data File: C:\WinSLAMM Files\E
Rain File: NY Yorktown 7005.RA
Date: 06-06-17 Time: 8:51:12 AM
Site Description:

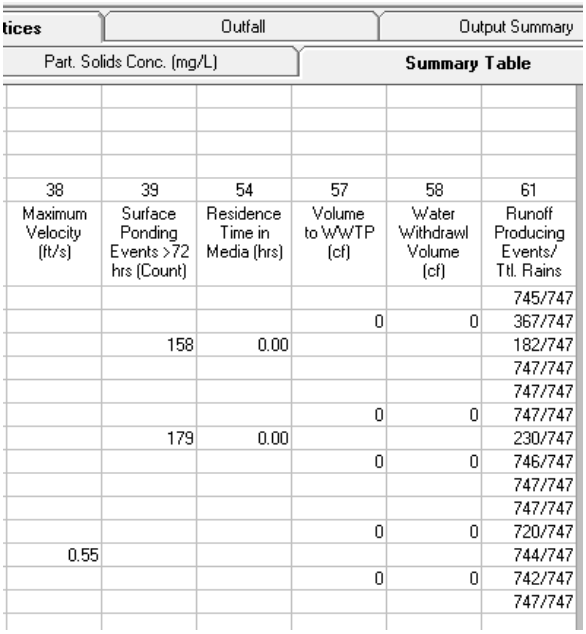
Col. #:	2	12	13	14	15	16	17	18	19	20	21
Control Practice No.	Control Practice Type	Percent Conc. Reduction	Influent Median Part. Size (microns)	Effluent Median Part. Size (microns)	Notes	Maximum Flushing Ratio	Maximum Peak Reduction Factor	Maximum Stage (ft)	Hydraulic Volume Out (cf)	Minimum Volume (cf)	% Device Volume Full
1	Pipe	0.000	2.92	2.92				0.00			
2	Wet Detention Pond	5.170	3.32	2.49	No Pond Overflows	4.7	0.56	10.64	4893745	66708	
3	Biofilter	31.345	2.68	3.09	No Biofilter Overflows			7.76	2922250		
4	Hydrodynamic Device	7.171	8.38	7.12				6.31			0.0 %
5	Hydrodynamic Device	48.076	38.88	8.38				6.27			0.0 %
6	Wet Detention Pond	37.052	7.12	2.68	No Pond Overflows	16.3	0.16	3.22	7771260	13364	
7	Biofilter	19.978	2.77	3.10	No Biofilter Overflows			7.93	1926350		
8	Wet Detention Pond	36.392	7.22	2.77	No Pond Overflows	18.7	0.11	3.08	4040827	6026	
9	Hydrodynamic Device	7.651	8.63	7.22				6.49			0.0 %
10	Hydrodynamic Device	54.100	54.95	8.63				6.51			0.0 %
11	Wet Detention Pond	85.016	36.85	1.82	No Pond Overflows	1.6	0.36	5.58	184389	4203	
12	Grass Swales	24.093	20.75	12.73				0.26			
13	Wet Detention Pond	90.459	25.25	2.88	No Pond Overflows	3.9	0.69	3.17	1389957	10356	
14	Hydrodynamic Device	79.476	110.71	7.09				3.46			0.0 %

Land Uses | Junctions | **Control Practices** | Outfall | Output Summary

Runoff Volume | Part. Solids Yield (lbs) | Part. Solids Conc. (mg/L) | **Summary Table**

Data File: C:\WinSLAMM Files\E
Rain File: NY Yorktown 7005.RA
Date: 06-06-17 Time: 8:51:12 AM
Site Description:

Col. #:	2	22	23	27	28	29	30	31	32	33	34	35
Control Practice No.	Control Practice Type	Bypass Volume (cf)	Treated Volume (cf)	Maximum Surface Ponding Time (hrs)	Maximum Subsurface Ponding Time (hrs)	Volume Infiltrated (cf)	Underdrain Discharge Vol. (cf)	Evapo-Transpir. Vol. (cf)	Minimum Soil Moist. (frac)	Surface Discharge Bypass Vol. (cf)	Evap. Vol. (cf)	Volume Supplemtl. Irrig.(cf)
1	Pipe											
2	Wet Detention Pond					0						
3	Biofilter			166.5	0.00	4824984.00	0			2922250.00		
4	Hydrodynamic Device	0	7738953									
5	Hydrodynamic Device	0	7738953									
6	Wet Detention Pond					0						
7	Biofilter			152.4	0.00	2103658.00	0			1926350.00		
8	Wet Detention Pond					0						
9	Hydrodynamic Device	0	4030978									
10	Hydrodynamic Device	0	4030978									
11	Wet Detention Pond					0						
12	Grass Swales		1404010			207097						
13	Wet Detention Pond					0						
14	Hydrodynamic Device	0	1072980									



tices | Outfall | Output Summary

Part. Solids Conc. (mg/L) | **Summary Table**

38 Maximum Velocity (ft/s)	39 Surface Ponding Events >72 hrs (Count)	54 Residence Time in Media (hrs)	57 Volume to WWTP (cf)	58 Water Withdrawl Volume (cf)	61 Runoff Producing Events/ Ttl. Rains
					745/747
			0	0	367/747
	158	0.00			182/747
					747/747
					747/747
			0	0	747/747
	179	0.00			230/747
			0	0	746/747
					747/747
					747/747
			0	0	720/747
0.55					744/747
			0	0	742/747
					747/747

Descriptions of Source Areas and Control Practices

LU# 1 - Freeway: DA6 Total area (ac): 0.410

1 - Paved Lane/Shlder Area 1: 0.400 ac. Fair/Mod Slope C&G Freeway Length = 0.04 mi Freeway Width (assuming two curb-mi per freeway mile) = 165 ft
ADT = 20000 veh/day Default Initial St. Dirt Loading Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
19 - Large Turf Areas 1: 0.010 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 2 - Freeway: DA8 Total area (ac): 0.870

1 - Paved Lane/Shlder Area 1: 0.810 ac. Fair/Mod Slope C&G Freeway Length = 0.13 mi Freeway Width (assuming two curb-mi per freeway mile) = 102.8 ft
ADT = 20000 veh/day Default Initial St. Dirt Loading Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
19 - Large Turf Areas 1: 0.060 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 3 - Commercial: P2b3 Total area (ac): 6.177

13 - Paved Parking 1: 4.284 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
25 - Driveways 1: 0.373 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 0.520 ac. Intermediate Street Length = 0.238 curb-mi Street Width (assuming two curb-mi per street mile) = 36.05042 ft
Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 1.000 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 4 - Commercial: P2b1 Total area (ac): 2.374

1 - Roofs 1: 1.148 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz HD-CP#14
13 - Paved Parking 1: 0.327 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 0.156 ac. Intermediate Street Length = 0.072 curb-mi Street Width (assuming two curb-mi per street mile) = 35.75 ft
Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 0.373 ac. Intermediate Street Length = 0.237 curb-mi Street Width (assuming two curb-mi per street mile) = 25.96835 ft
Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 0.370 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 5 - Commercial: P2b2 Total area (ac): 5.111

1 - Roofs 1: 2.179 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 1.091 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
25 - Driveways 1: 1.091 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 0.750 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 6 - Commercial: P3 Total area (ac): 0.550

51 - Small Landscaped Areas 1: 0.550 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 7 - Freeway: P4 Total area (ac): 0.450

1 - Paved Lane/Shlder Area 1: 0.140 ac. Fair/Mod Slope C&G Freeway Length = 0.025 mi Freeway Width (assuming two curb-mi per freeway mile) = 92.4 ft
ADT = 20000 veh/day Default Initial St. Dirt Loading Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
19 - Large Turf Areas 1: 0.310 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 8 - Commercial: P1b Total area (ac): 0.820

37 - Streets 1: 0.100 ac. Intermediate Street Length = 0.165 curb-mi Street Width (assuming two curb-mi per street mile) = 10 ft
Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 0.360 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
57 - Undeveloped Areas 1: 0.335 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
70 - Water Body Areas: 0.025 ac. Source Area PSD File:

LU# 9 - Commercial: P1a Total area (ac): 1.140

37 - Streets 1: 0.050 ac. Intermediate Street Length = 0.023 curb-mi Street Width (assuming two curb-mi per street mile) = 35.86956 ft
Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
57 - Undeveloped Areas 1: 1.090 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 10 - Commercial: P2a Total area (ac): 2.690

57 - Undeveloped Areas 1: 2.690 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 11 - Commercial: P2c Total area (ac): 3.720

57 - Undeveloped Areas 1: 2.740 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
70 - Water Body Areas: 0.980 ac. Source Area PSD File:

Control Practice 2: Wet Detention Pond CP# 1 (DS) - DS Wet Pond # 1

Particle Size Distribution file name: Not needed - calculated by program				
Initial stage elevation (ft): 9				
Peak to Average Flow Ratio: 0				
Maximum flow allowed into pond (cfs): No maximum value entered				
Outlet Characteristics:				
Outlet type: Orifice 1				
1. Orifice diameter (ft): 1.5				
2. Number of orifices: 2				
3. Invert elevation above datum (ft): 9				
Outlet type: Broad Crested Weir				
1. Weir crest length (ft): 18				
2. Weir crest width (ft): 10				
3. Height from datum to bottom of weir opening: 12				
Pond stage and surface area				
Entry Number	Stage (ft)	Pond Area (acres)	Natural Seepage (in/hr)	Other Outflow (cfs)
0	0.00	0.0000	0.00	0.00
1	2.00	0.1200	0.00	0.00
2	4.00	0.1700	0.00	0.00
3	6.00	0.2100	0.00	0.00
4	8.00	0.2600	0.00	0.00
5	10.00	0.3000	0.00	0.00
6	12.00	0.3500	0.00	0.00
7	14.00	0.4000	0.00	0.00
8	16.00	0.4500	0.00	0.00
9	18.00	0.5000	0.00	0.00

Control Practice 3: Biofilter CP# 1 (DS) - infilt chamber # 1

1. Top area (square feet) = 3080
2. Bottom area (square feet) = 3080
3. Depth (ft): 8.5
4. Biofilter width (ft) - for Cost Purposes Only: 10
5. Infiltration rate (in/hr) = 0.5
6. Random infiltration rate generation? No
7. Infiltration rate fraction (side): 1
8. Infiltration rate fraction (bottom): 1
9. Depth of biofilter that is rock filled (ft) 0
10. Porosity of rock filled volume = 0
11. Engineered soil infiltration rate: 0
12. Engineered soil depth (ft) = 0
13. Engineered soil porosity = 0
14. Percent solids reduction due to flow through engineered soil = 0
15. Biofilter peak to average flow ratio = 3.8
16. Number of biofiltration control devices = 1
17. Particle size distribution file: Not needed - calculated by program
18. Initial water surface elevation (ft): 0
Soil Data Soil Type Fraction in Eng. Soil
Biofilter Outlet/Discharge Characteristics:
Outlet type: Broad Crested Weir
1. Weir crest length (ft): 50
2. Weir crest width (ft): 5
3. Height of datum to bottom of weir opening: 7.5

Control Practice 4: Hydrodynamic Device CP# 1 (DS) - Octopus # 1

1. Hydrodynamic device drainage area (acres) = 1.00
2. Fraction of drainage area served by Hydrodynamic Device = 1.00
3. Number of hydrodynamic devices = 4
4. Hydrodynamic device density (units/acre) = 0.5
5. Device type: Single Chamber
6. Average sump depth below device outlet invert (feet) = 5
7. Depth of sediment in device at beginning of study period (ft) = 0
8. Typical outlet pipe diameter (ft) = 1.5
9. Typical outlet pipe Mannings n = 0.03
10. Typical outlet pipe slope (ft/ft) = 0.02
11. Typical device sump surface area (square feet) = 16
12. Device depth from sump bottom to street level (feet) = 10
13. Inflow hydrograph peak to average flow ratio = 3.8
14. Minimum allowable scour depth below outlet invert (ft)= 1
Device Flow Bypass Data
15. Diameter of orifice that controls flow to in-line sump (ft) = 0
16. Inflow orifice invert elevation (ft) = 0
17. Length (ft) of overflow structure acting as a sharp-crested weir = 0
18. Elevation of overflow structure to bypass inline sump (ft above sump base) = 0
Model device with settling tubes or plates
1. Fraction of device area with plates or tubes = 1
2. Average tube diameter or distance between plates (ft) = 0.5
3. Number of plates or tubes a vertical line will intersect = 5
Number of times device cleaned each year = 10