BMP POLLUTANT REDUCTION CREDITS

To: Mr. Rob Oliva, Town of Lunenburg DPW

From: Mr. Nick Cristofori, P.E., Comprehensive Environmental Inc.

Date: April 5, 2021

Subject: BMP Pollutant Reduction Estimate Summary

Under the Environmental Protection Agency's (EPA's) 2016 National Pollutant Discharge and Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit, regulated communities such as Lunenburg are required to estimate pollutant load reductions provided by stormwater Best Management Practices (BMPs) within the regulated Urbanized Area (UA) that discharge to the following waterbodies:

- Those with an out-of-state nitrogen or phosphorus Total Maximum Daily Load (TMDL) (Appendix F, Part B.I or B.II of the 2016 MS4 Permit, respectively); or
- Those impaired for nitrogen and phosphorous (Appendix H, Part I or II of the 2016 MS4 Permit, respectively)

Per discussions with the Town of Lunenburg after completing the most recent round of stormwater BMP inspections in mid-2020, the Lunenburg DPW has identified sixteen different locations or sites with existing structural stormwater BMPs which are listed in **Table 1** below and shown in the attached **Attachment 1: Stormwater BMPs Map**.

Table 1 – Stormwater BMPs

BMP ID	Location	Stormwater BMP Type
BL-1	Butterfly Ln	Infiltration Basin
BL-2	Butterfly Ln	Infiltration Basin
CC-1	Cortland Circle	Detention Basin
FP-1	Fire/Police Station	Detention Basin
FP-2	Fire/Police Station	Detention Basin
LF-1	Landfill – south	Infiltration Basin
LF-2	Landfill – west	Infiltration Basin
LF-3	Landfill – east	Detention Basin
PL-1	Public Library	Detention Basin
RW-1	Richard's Way	Detention Basin
RW-2	Richard's Way	Detention Basin
RW-3	Richard's Way	Detention Basin
RH-5	Robbs Hill	Detention Basin
SC-1	Memorial Drive Senior Ctr.	Swale Conveyance
WC-1	Whitetail Crossing	Detention Basin
WC-2	Whitetail Crossing	Detention Basin

To determine the waterbodies within Lunenburg that may require calculation of nutrient removals provided by stormwater BMPs, CEI reviewed the final Massachusetts Year 2016 Integrated List of Waters (2016 303d List). Although none of Lunenburg's waterbodies have specific impairments for nitrogen or phosphorus, the entire town is located within the Nashua River watershed, a waterbody impaired for phosphorus. Thus, pollutant removals must be computed for all stormwater BMPs

within Lunenburg's regulated Urbanized Area using Attachment 1 of Appendix H of the 2016 MS4 Permit.

Due to a lack of available as-built plan information for the Town's BMPs, additional field investigations were performed to determine the size and storage volume of each BMP in order to estimate pollutant load reductions. CEI then calculated phosphorus, nitrogen and total suspended solids removal efficiencies for each BMP using EPA's BMP Accounting and Tracking Tool (BATT), a tool developed for EPA to compute pollutant removals in accordance with Attachment 3 of Appendix H of the permit. The BATT calculator requires two different categories of information in order to determine removal efficiencies:

1. Subcatchment information (e.g., subcatchment area, land use, pervious/impervious area, hydrologic soil group etc.); and,
2. BMP-specific information (e.g., BMP type, storage volume, infiltration rate, location, operation & maintenance, etc.)

Under the subcatchment information category, CEI used GIS data including topography and drainage infrastructure mapping to delineate subcatchment areas of all applicable BMPs. Land uses, impervious/pervious areas, and hydrologic soil groups (HSG) within each subcatchment area was obtained by layering GIS data and distinguishing all unique land use types within the subcatchment (i.e., Low Density Residential, Pervious, HSG B; or Highway, Impervious). Note that impervious areas are not assigned an HSG. Under the BMP-specific information category, BMP types were assigned to each BMP per the most recent field observations. CEI used geotifs (geo-referenced aerial imagery), field measurements, AutoCAD, and Excel to approximate the storage volume of all applicable BMPs. Where applicable, BMP infiltration rates were approximated based on saturated hydraulic conductivity for hydrologic soil groups (USDA, 2010). All information was entered into the BATT calculator to estimate the pollutant removal efficiency of the BMP. All other BMP-specific information, including location and operation & maintenance, was obtained from the most recent inspection report and readily available tax parcel information online.

A detailed breakdown of subcatchment information, including land use types, impervious/pervious area, and hydrologic soil group, for each BMP is provided as **Attachment 2: BATT Input Data – Subcatchment Information**. A summary of BMP-specific information and subcatchment information for each BMP is provided as **Attachment 3: BATT Input Data Summary**. After processing all of the inputted data, the BATT calculator outputs annual reduction credits for phosphorus, nitrogen, and sediment from the inputted BMPs. A summary of total pollutant removal from all applicable BMPs is shown in **Table 2** and a summary of individual pollutant removal from each BMP, along with pollutant loading to each BMP and pollutant removal efficiency of each BMP, is provided as **Attachment 4: BATT Output Data Summary**.

Table 2 – Summary of Pollutant Load Reductions for All Town-owned Structural BMPs

	Removed Phosphorus Load (lb/yr)	Removed Nitrogen Load (lb/yr)	Removed Sediment Load (lb/yr)
Structural	4.91	53.08	3,725.82
Non-Structural	0	0	0
Land Use Conversion	0	0	0
Total	4.91	53.08	3,725.82

BMP POLLUTANT REDUCTION CREDITS

Note that these pollutant removal estimates are based on the available stormwater infrastructure information that has been obtained as of the date of this memo. As infrastructure mapping is updated or changed (i.e., additions of catch basins, piping networks, and outfalls), subcatchment contributing areas to the BMPs may increase or decrease which will affect estimated pollutant removals. Per MS4 permit requirements, these estimates should be updated if any changes are made to existing BMPs, or as new Town-owned stormwater BMPs are located or constructed. In the event that any of these occur, the Town should notify CEI and we will update all required calculations.

If you have any further questions or would like additional information, please feel free to contact me at 800.725.2550 x303 or ncristofori@ceiengineers.com. Thank you.

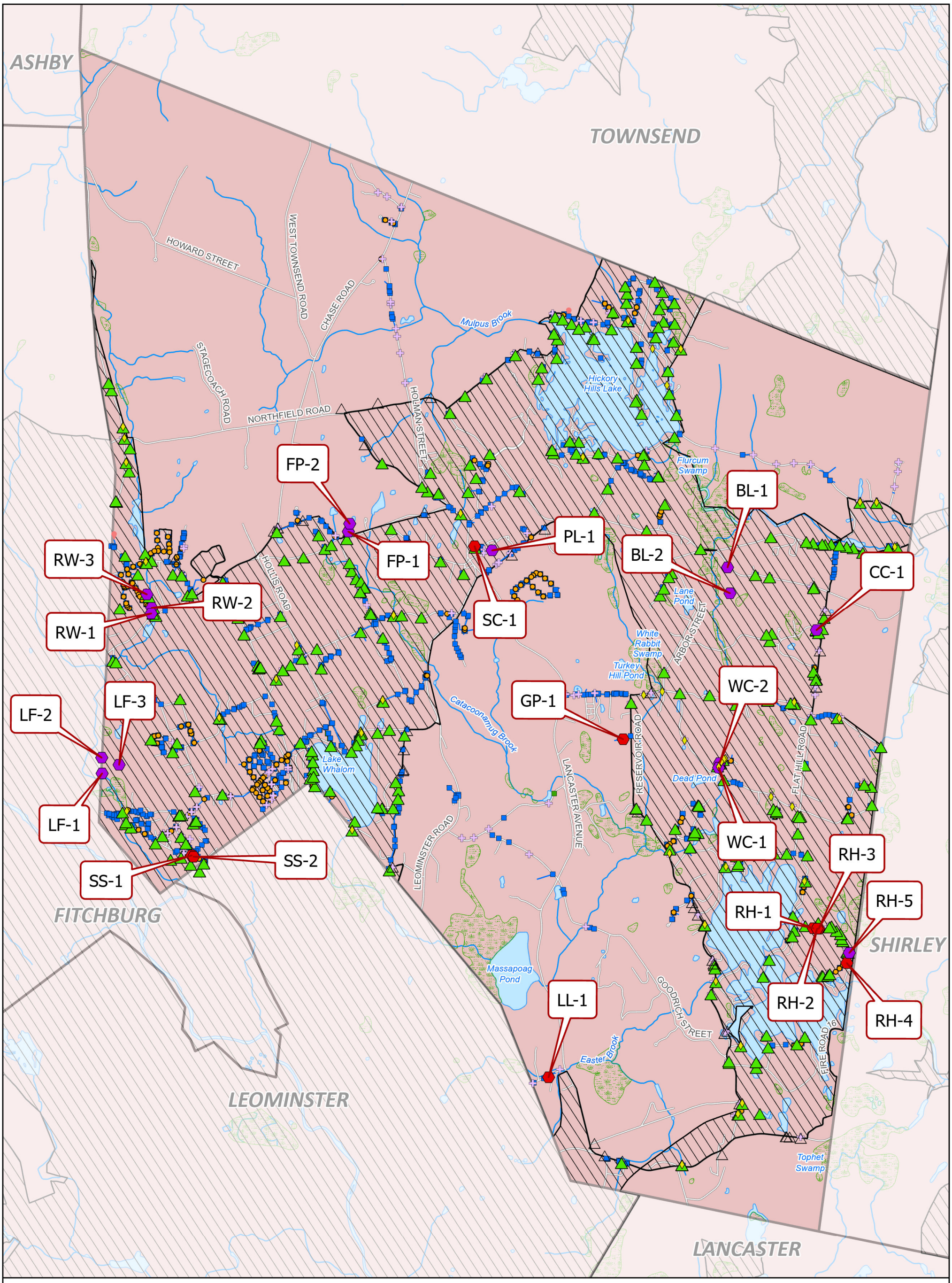
Nick Cristofori, P.E., Principal, Project Manager

Attachments:

- Attachment 1: Stormwater BMP Map
- Attachment 2: BATT Input Data – Subcatchment Information
- Attachment 3: BATT Input Data Summary
- Attachment 4: BATT Output Data Summary

ATTACHMENT 1

BMPS WITHIN IMPAIRED WATERSHEDS



- Detention Basin
- Infiltration Basin
- Outfall
- Outfall not in UA
- Culvert
- Detention or Infiltration Basin (BMP)
- Catch Basin
- Leaching Catch Basin
- Drainage Manhole
- Inlet
- Dry Well
- Drainage Pipes
- Lake, Pond, Reservoir
- Wetland, Marsh, Swamp
- Stream, Brook
- Urbanized Area
- Nashua River Watershed

N W E S

0 1
Miles

BMPs in Nashua River Watershed Lunenburg, MA

Comprehensive Environmental Incorporated

Data Sources: MassGIS, Town of Lunenburg, CEI

9/17/2020

ATTACHMENT 2

BATT INPUT DATA – SUBCATCHMENT INFORMATION

Attachment 2: BATT Input Data - Subcatchment Information				
BMP Type	**Land Use Type**	**Hydrologic Soil Group**	**Impervious Area (acres)**	**Pervious Area (acres)**
BL-1	Forest	A	0.1252908	0.2656178
BL-1	Low Density Residential	A	0.1627197	0.2674733
BL-2	Forest	A	0.2485389	0.9191018
BL-2	Low Density Residential	A	0.0106499	0.1490086
CC-1	Forest	C/D	0.4906919	1.4489219
CC-1	Low Density Residential	C/D	0.1285952	0.8210448
CC-1	Water	C/D		0.1849864
FP-1	Commercial	B	0.0000937	
FP-1	Commercial		0.1491557	0.009277
FP-1	Forest		0.0083052	0.1185117
FP-2	Commercial	B	0.0639936	0.155738
FP-2	Forest	B	0.0041457	0.6514446
FP-2	Low Density Residential	B		0.0036853
LF-1	Forest	A		0.1243109
LF-1	Forest	B/D		0.0100091
LF-1	Forest			0.142601
LF-1	Open Land	A	0.0250503	0.5349504
LF-1	Open Land	B/D		0.001285
LF-1	Open Land		0.2504396	1.0789846
LF-2	Forest	A	0.0049139	0.409744
LF-2	Forest			0.0010663
LF-2	Open Land	A	0.1239162	0.5635007
LF-2	Open Land		0.1919692	1.0793707
LF-3	Forest	A	0.0024575	0.3431864
LF-3	Open Land	A	1.2836194	1.0662976
LF-3	Open Land		0.9292002	1.2224851
PL-1	Commercial	C	0.0398562	
PL-1	Commercial	C/D	1.3646655	0.1291694
RH-5	Forest	A	0.0182134	0.1525853
RH-5	Low Density Residential	A	0.3035845	0.646063
RH-5	Low Density Residential	C	0.1756635	0.7912217
RW-1	Commercial	A	0.4701565	0.3126764
RW-1	Commercial	C/D	0.3804821	0.4800454
RW-1	Forest	C/D		0.4597402
RW-1	Industrial	A	0.000469	
RW-1	Industrial	C/D	0.0059868	
RW-1	Medium Density Residential	C/D	0.0587003	0.089387
RW-2	Commercial	A	0.02479	0.0288895
RW-2	Commercial	C/D	0.1531191	0.1816686
RW-2	Forest	A	0.0378216	0.076401
RW-2	Forest	B	0.0003895	0.0274782
RW-2	Forest	C/D	0.2077827	3.1546755
RW-2	Forest	D	0.053091	0.1793072

Attachment 2: BATT Input Data - Subcatchment Information				
BMP Type	**Land Use Type**	**Hydrologic Soil Group**	**Impervious Area (acres)**	**Pervious Area (acres)**
RW-2	High Density Residential	C/D	0.0666096	0.0078712
RW-2	Medium Density Residential	B	0.1558166	1.2878239
RW-2	Medium Density Residential	C/D	0.296431	1.5044926
RW-3	Agriculture	B	0.026122	0.7001844
RW-3	Agriculture	C/D	0.20388	0.6658337
RW-3	Forest	C/D	0.0195749	0.9232784
RW-3	High Density Residential	B	0.0102864	0.4938315
RW-3	High Density Residential	C/D	0.5654829	1.3273687
RW-3	Medium Density Residential	B		0.1603855
RW-3	Medium Density Residential	C/D	0.1983309	0.5149273
RW-3	Open Land	C/D		0.390498
SC-1	Commercial	C	0.2016069	0.3982305
SC-1	Commercial	C/D	0.6451417	0.8559065
SC-1	High Density Residential	C/D	0.30121	0.5575903
SC-1	Low Density Residential	C	0.0219124	0.1545933
SC-1	Low Density Residential	C/D	0.2105821	0.2876529
WC-1	Forest	A	0.0014495	0.4631507
WC-1	Industrial	A	0.2321076	0.1336623
WC-2	Forest	A		2.454715
WC-2	Forest	B		1.812664
WC-2	Forest	C		0.537423
WC-2	Forest	C/D		0.057141
WC-2	Forest	D		0.06274
WC-2	Low Density Residential	A	2.888938	7.511814
WC-2	Low Density Residential	B	0.357785	1.540912
WC-2	Low Density Residential	C	0.226338	0.71381

ATTACHMENT 3

BATT INPUT DATA SUMMARY

Attachment 3: BATT Input Data Summary									
BMP ID	**BMP Type**	**BMP Storage Capacity (ft^3)**	**Infiltration Rate (in/hr)**	**Total Subcatchment Area (acres)**	**Impervious Area (acres)**	**Impervious Area (%)**	**Pervious Area (acres)**	**Pervious Area (%)**	**Hydrologic Soil Groups**
BL-1	INFILTRATION BASIN	1,900	2.41	0.29	0.53	1.85	0.82	2.85	A
BL-2	INFILTRATION BASIN	10,000	0.52	1.33	0.26	0.20	1.07	0.80	A
CC-1	EXTENDED DRY DETENTION POND	32,400	N/A	3.07	0.62	0.20	2.45	0.80	C/D
FP-1	EXTENDED DRY DETENTION POND	20,000	N/A	0.16	0.13	0.81	0.29	1.81	B
FP-2	EXTENDED DRY DETENTION POND	10,000	N/A	0.07	0.81	11.90	0.88	12.90	B
LF-1	INFILTRATION BASIN	13,000	0.27	2.17	0.28	0.13	1.89	0.87	A & B & D
LF-2	INFILTRATION BASIN	5,900	0.52	0.32	2.05	6.40	2.37	7.40	A
LF-3	EXTENDED DRY DETENTION POND	31,600	N/A	4.85	2.22	0.46	2.63	0.54	A
PL-1	EXTENDED DRY DETENTION POND	10,000	N/A	1.53	1.40	0.92	0.13	0.08	C & C/D
RH-5	EXTENDED DRY DETENTION POND	23,000	N/A	2.09	0.50	0.24	1.59	0.76	A & C
RW-1	EXTENDED DRY DETENTION POND	3,800	N/A	2.26	0.92	0.41	1.34	0.59	A & C/D
RW-2	EXTENDED DRY DETENTION POND	22,300	N/A	7.44	1.00	0.13	6.45	0.87	A & B & C/D
RW-3	EXTENDED DRY DETENTION POND	106,000	N/A	6.20	1.02	0.17	5.18	0.83	B & C/D
SC-1	GRASS SWALE (CONVEYANCE)	100	N/A	3.63	1.38	0.38	2.25	0.62	C & C/D
WC-1	EXTENDED DRY DETENTION POND	41,700	N/A	0.83	0.23	0.28	0.60	0.72	A
WC-2	EXTENDED DRY DETENTION POND	22,000	N/A	18.16	3.47	0.19	14.69	0.81	A & B & C & C/D & D

ATTACHMENT 4

BATT OUTPUT DATA SUMMARY

Attachment 4: BATT Output Data Summary									
BMP ID	**Total Phosphorus Loading (lb/yr)**	**Total Nitrogen Loading (lb/yr)**	**Total Sediment Loading (lb/yr)**	**Phosphorus Removal Efficiency (%)**	**Nitrogen Removal Efficiency (%)**	**Total Sediment Removal Efficiency (%)**	**Phosphorus Load Reduction (lb/yr)**	**Nitrogen Load Reduction (lb/yr)**	**Total Sediment Load Reduction (lb/yr)**
BL-1	0.299	3.075	136.855	14.00	23.13	49.00	0.20	2.59	242.00
BL-2	0.504	3.513	194.676	14.00	23.13	49.00	0.04	0.56	32.61
CC-1	0.197	2.591	0.564	14.00	23.13	49.00	0.03	0.36	24.81
FP-1	0.041	0.041	0.564	62.60	78.23	84.23	0.30	3.07	136.85
FP-2	0.030	0.358	24.807	94.20	98.00	100.00	0.56	4.26	234.80
LF-1	0.793	7.213	285.920	14.00	23.13	49.00	0.49	5.99	717.90
LF-2	0.558	4.257	234.799	14.00	23.13	49.00	0.35	4.97	263.68
LF-3	0.487	5.991	717.902	0.83	0.39	4.96	0.01	0.04	13.78
PL-1	0.354	4.974	263.683	14.00	23.13	49.00	0.26	3.65	199.86
RH-5	0.080	0.035	13.781	14.00	23.13	49.00	0.40	5.05	370.55
RW-1	0.262	3.654	199.858	0.05	0.02	0.30	0.00	0.01	2.29
RW-2	0.402	5.055	370.548	14.00	23.13	49.00	0.07	0.88	50.37
RW-3	0.002	0.006	2.289	98.80	100.00	100.00	0.50	3.51	194.68
SC-1	0.013	0.075	41.411	91.50	98.00	99.00	0.79	7.21	285.92
WC-1	0.066	0.878	50.368	0.40	0.28	5.78	0.01	0.07	41.41
WC-2	0.901	11.400	917.198	12.75	17.23	46.75	0.89	10.85	914.32
						TOTAL	4.91	53.08	3725.82