



# BMP POLLUTANT REDUCTION CREDITS

**To:** Mr. Jim McLoughlin, Town Engineer  
**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 the Town of Falmouth, 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).

The Town of Falmouth identified a total of 18 existing structural stormwater BMPs throughout the Town, which are listed in **Table 1** below and shown in the attached **Attachment 1: BMPs within Impaired Watersheds**.

**Table 1 – Stormwater BMPs**

<b>BMP ID</b>	<b>Location</b>	<b>Stormwater BMP Type</b>
Swale-1	Bay Road	Swale
Swale-2	Bay Road	Swale
STC-1	Siders Pond	Proprietary Separator
STC-2	Siders Pond	Proprietary Separator
Basin	Mill Road/Surf Drive	Forebay, Detention Basin
Swale	Mill Road/Surf Drive	Swale
Swale	Walker St	Swale
Stormceptor	DPW Parking Lot	Proprietary Separator
First Defense-1	Falmouth Heights Road	Proprietary Separator
First Defense-2	Falmouth Heights Road	Proprietary Separator
STC-1	Falmouth Heights Beach Parking Lot	Proprietary Separator
STC-2	Falmouth Heights Beach Parking Lot	Proprietary Separator
STC-3	Falmouth Heights Beach Parking Lot	Proprietary Separator
Swale/Galley	Davisville Road	Swale
Sediment Forebay	Whites Landing Road	Forebay
CDS-1	Whites Landing Road	Proprietary Separator
CDS-2	Whites Landing Road	Proprietary Separator
CDS-3	Whites Landing Road	Proprietary Separator



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CEI then reviewed the final Massachusetts Year 2016 Integrated List of Waters (2016 303d List) to determine waterbodies within Falmouth that may require calculation of nutrient removals provided by stormwater BMPs. Falmouth has the following waterbodies as shown in **Table 2** subject to nitrogen or phosphorus TMDLs or impaired waters requirements and thus subject to the requirements of Appendix F or Appendix H, respectively, of the 2016 MS4 Permit.

**Table 2 – TMDL and Impaired Waters Requirements**

Waterbody Names	TMDL (if applicable)	Impairment	2016 Permit Requirements
<ul style="list-style-type: none"> <li>• Bournes Pond</li> <li>• Great Pond</li> <li>• Green Pond</li> <li>• Perch Pond</li> </ul>	Great, Green & Bournes Pond System	Nitrogen	Appendix F, Part A.IV
<ul style="list-style-type: none"> <li>• Hamblin Pond</li> <li>• Quashnet River</li> </ul>	Waquoit Bay		
<ul style="list-style-type: none"> <li>• Harbor Head</li> <li>• Oyster Pond (MA95927)</li> <li>• West Falmouth Harbor</li> </ul>	West Falmouth Harbor		
<ul style="list-style-type: none"> <li>• Fiddlers Cove</li> <li>• Rands Harbor</li> </ul>	Fiddler Cove & Rands Harbor System		
<ul style="list-style-type: none"> <li>• Wild Harbor</li> </ul>	Wild Harbor		
<ul style="list-style-type: none"> <li>• Little Pond</li> </ul>	Little Pond System		
<ul style="list-style-type: none"> <li>• Oyster Pond (MA96-62)</li> </ul>	Oyster Pond		
<ul style="list-style-type: none"> <li>• Fiddlers Cove</li> <li>• Herring Brook</li> <li>• Megansett Harbor</li> <li>• Quissett Harbor</li> <li>• Squeteague Harbor</li> <li>• Waquoit Bay</li> </ul>	N/A		
<ul style="list-style-type: none"> <li>• Ashumet Pond</li> </ul>		Phosphorus	Appendix H, Part II

As shown in **Table 2**, there are a substantial number of waterbodies subject to Cape Cod Nitrogen TMDL requirements which do not require calculation of pollutant removals provided by existing stormwater BMPs, largely due to the comparatively minor impact of stormwater on downstream water quality when compared to wastewater impacts. However, stormwater BMPs within the remaining seven waterbodies with a phosphorus, nitrogen, or estuarine bioassessments impairment (Appendix H, Part I or Part II) must be analyzed to estimate the amount of pollutant removals provided using Attachment 3 of Appendix H.

Therefore, CEI delineated the watershed areas for each of the seven applicable waterbodies. Watersheds were then overlain with a map of the Town-owned BMPs (**Attachment 1**), and it was determined that only two existing structural stormwater BMPs are located within a contributing watershed to a waterbody impaired for nitrogen or phosphorus. The two applicable BMPs, Swale-1



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and Swale-2 on Bay Road, are within the contributing watershed of Megansett Harbor, a waterbody impaired for nitrogen. Thus, these two infiltration swales must be evaluated per the 2016 MS4 Permit.

The Town provided BMP design plans as part of ongoing annual stormwater BMP inspections. CEI used the provided design plans, information obtained from annual BMP inspections, and available GIS data to calculate phosphorus, nitrogen and total suspended solids removal efficiencies for all applicable BMPs using the EPA's BMP Accounting and Tracking Tool (BATT), a tool developed for EPA to compute pollutant removals in accordance with Attachment 1 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 design plans. CEI used the design plans, 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 3** 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**.



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**Table 3 – Summary of Pollutant Load Reductions for All Town-owned Structural BMPs**

	<b>Removed Phosphorus Load (lb/yr)</b>	<b>Removed Nitrogen Load (lb/yr)</b>	<b>Removed Sediment Load (lb/yr)</b>
<b>Structural</b>	0.43	4.03	162.80
<b>Non-Structural</b>	0	0	0
<b>Land Use Conversion</b>	0	0	0
<b>Total</b>	0.43	4.03	162.80

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](mailto:ncristofori@ceiengineers.com). Thank you.

Nick Cristofori, P.E.  
Principal, Project Manager

Attachments:

- Attachment 1: BMPs within Impaired Watersheds
- 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



## **ATTACHMENT 2**

BATT INPUT DATA – SUBCATCHMENT INFORMATION

Attachment 2: BATT Input Data - Subcatchment Information					
BMP ID	Land Use Type	Hydrologic Soil Group	Impervious Area (acres)	Pervious Area (acres)	
Bay Road Swale-1	Forest	A	0.09	0.15	
Bay Road Swale-1	Forest	A/D	0.01	0.06	
Bay Road Swale-1	Low Density Residential	A	0.14	0.30	
Bay Road Swale-1	Low Density Residential	A/D	0.01	0.01	
Bay Road Swale-2	Forest	A	0.01	0.04	
Bay Road Swale-2	Low Density Residential	A	0.04	0.16	

## **ATTACHMENT 3**

BATT INPUT DATA SUMMARY

Attachment 3: BATT Input Data Summary						
BMP ID	BMP TYPE	BMP Storage Capacity (ft <sup>3</sup> )	Infiltration Rate (in/hr)	Total Subcatchment Area (acres)	Impervious Area (acres)	Impervious (%)
Bay Road Swale-1	Infiltration Swale	600	0.52	0.78	0.26	34%
Bay Road Swale-2	Infiltration Swale	200	0.52	0.25	0.05	20%

## **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 (%)	Sediment Removal Efficiency (%)
Bay Road Swale-1	0.41	3.43	138.80	84%	96%	98%
Bay Road Swale-2	0.09	0.74	26.37	94%	99%	100%