Evaluation of the Implementation of Portsmouth Stormwater BMPs

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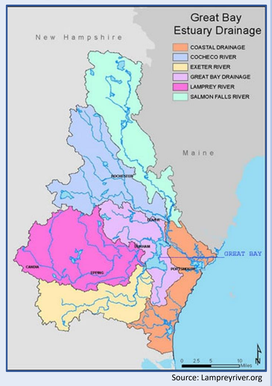
Introduction

- Water quality in the Great Bay area of NH has been declining due to excess non-point source (NPS) and wastewater treatment plant (WWTP) nitrogen discharge.
- Portsmouth, NH was issued two permits: An MS4 Stormwater discharge permit and the Great Bay general discharge permit.
- These permits require the city to remove 45% of their total nitrogen load entering the Great Bay area over the next 23 years.
- In the next 5 years, the city aims to remove 11% of their total nitrogen discharge.
- Portsmouth currently has 76 Stormwater Best Management Practices (BMPs) installed.
- The amount of nitrogen being removed by these systems has not been accounted for, but could be applied to the city's nitrogen removal.



Source: Lampreyriver.org

Objectives

- To quantify the nitrogen removal credit via currently installed BMPs which contributes to the 45% of NPS nitrogen reduction over 23 years.
- Make recommendations to the City of Portsmouth for future BMP installations based on a variety of site-specific factors.

Data Collection & Entry

To evaluate these systems, the following steps were taken:

1. Drainage area assessment
   - Some systems had drainage plans that provided the drainage area.
   - For systems without drainage plans, the drainage area was estimated based on the site's topography and catch basin drainage.
   - GIS software was used to sketch the drainage area.
2. The soil types and infiltration rates for the sites that the systems were on were determined using Web Soil Survey.

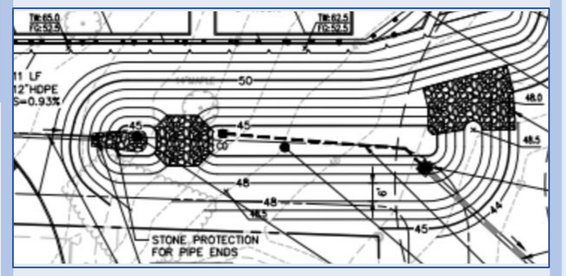
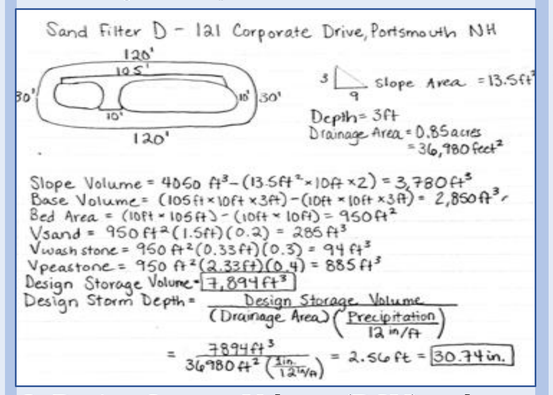


Figure 1: Example of a sand filter plan used for calculations

Figure 2: Example calculations for a sand filter



3. Design Storage Volume (DSV) and Design Storm Depth (DSD) calculations
   - Values for systems without drainage documents were evaluated using site plans and system design plans.
   - The slope within the system and the treatment cross section were also used to calculate the DSV.
   - To calculate the system's DSD, the DSV was divided by the drainage area and the value was converted to inches.

4. Once the data was collected for each system, it was entered into the Pollutant Tracking and Accounting Program (PTAP), a web based BMP evaluation system developed by the UNH Stormwater Center.
   - For each system, the following information was input to PTAP: site identification information, the BMP type, pre and post developmental land use information, the total acreage of the site, the acreage of impervious cover managed by the BMP, the system's design storage volume, the system's design storm depth, and the site's soil infiltration rate.

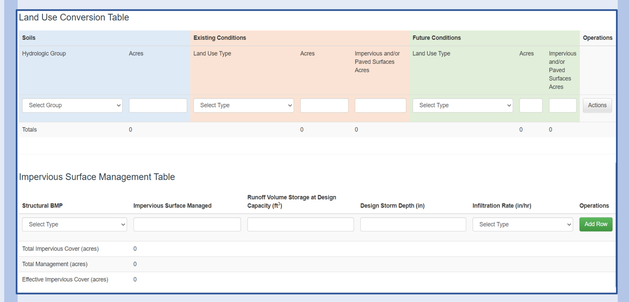


Figure 3: Example of a PTAP entry form

Results

- PTAP assumes each system operates at 100% efficiency as if it were new
- A checklist was made to assist in quantifying the nitrogen load being removed by each BMP.

Team 15

Stormwater BMP Inspection Checklist

General Site Information

Stormwater BMP Type: Sand Filter
Location: 67,73, & 121 Corporate Drive – Sand Filter D
Date: 4/9/21
Weather: Sunny
Year Installed: 2018

Visual Indicators

Pass	Fail	
☒	☐	Inlet/Outlet conditions: Can water enter and exit the system?
☒	☐	System Operability: Does the system appear to be operating as designed?
☒	☐	Inorganic/Organic Material Build-up: Is there Noticeable build-up of debris, sediment, trash, vegetation etc.?
☒	☐	System Integrity: Do system slopes look stable, is there notable damage in the system?

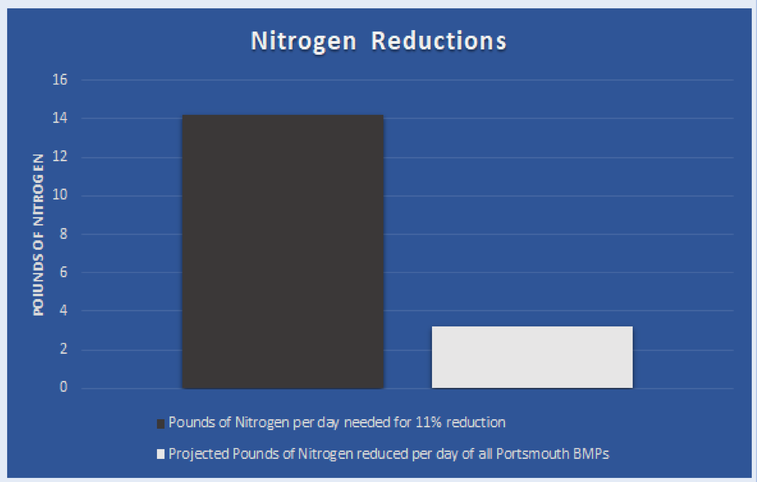
Frequency - How often is the system being Checked/Maintained?

Bi-weekly	Monthly	Quarterly	Bi- Annually	Annually	Other:_____
☐	☐	☐	☐	☐	☐

Date of Last Inspection: ___4/9/21_____
Date of Next Inspection: _____

Comments: Good Condition

- Currently 128.9 pounds of nitrogen discharge from Portsmouth into the Great Bay per day.
- To reach the goal of 45% reduction. Portsmouth needs to remove 56 lb N / day through stormwater.
- To reach the goal of 11% reduction, Portsmouth needs to remove 14.2 lb N / day.



- The projected pounds of Nitrogen removed from all 76 BMPs are entered into PTAP is believed to be roughly 3.2 lb N / day.
- This means Portsmouth is about ¼ of the way to reaching their five year goal of 11% reduction.

Cost Analysis

- Total of 1,315 lb N reduced in first 5 years from these 17 systems.
- Roughly $20/HR to input systems into PTAP.
- Takes approximately 3 hours for each system to be entered into PTAP.
- Each system removes on average 15 lb of Nitrogen per year.
- So each system costs 4$/lb of N removed.
- This cost will then be compared to cost of upgrading Portsmouth WWTP.

Next Steps

- Data collection and entry into PTAP for all currently installed BMPs into Portsmouth for full nitrogen removal quantification.
- Ensure that 11% of total NPS nitrogen load entering the Great Bay is reduced by the end of the first five year period.
- Encourage BMP installations in private developments in Portsmouth

Acknowledgments

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