FINAL REPORT

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Contractor:	Town of Shelburne
Prepared By:	Shayne Geiger, Shelburne Stormwater Superintendent
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IMPLEMENTATION OF A GRAVEL WETLAND FOR THE BOULDER HILL NEIGHBORHOOD IN SHELBURNE, VT

CONTACT INFORMATION

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PROJECT SUMMARY

This project was a retrofit of an out of compliance and undersized detention basin into a gravel wetland that will provide proper storage volume to treat to the Channel Protection Volume and to maximize Phosphorus Control Plan (PCP) reductions. This new gravel wetland exceeds the volume storage goals for the Munroe Brook Flow Restoration Plan (FRP) for this site and will remove 6.06 kg of phosphorus from Lake Champlain annually. This site is also a 3-acre site identified by the state as needing to retrofit to current standards as part of the developed lands reduction target for the Lake Champlain total maximum daily load (TMDL). This site will also be used as an educational and example leading site for other 3-acre sites in the town and recreational walkers using the adjacent nature path with the use of an informative kiosk.

CONTENTS

1. PROJECT INTRODUCTION

The Town of Shelburne has been designated as an MS4 (Municipal Separate Storm Sewer System) town by the state. Towns with this designation must prepare a Flow Restoration Plan for each stormwater-impaired watershed and a Phosphorus Control Plan for the entire town. Per state statute, Shelburne must reduce phosphorus delivered to Lake Champlain and the amount of stormwater flowing into Munroe Brook.

The Boulder Hill subdivision is located within the stormwater-impaired Monroe Brook watershed in Shelburne. This project was identified in Munroe Brook's Flow Restoration Plan (FRP) as an opportunity to reduce stormwater flow and improve water quality per the Total Maximum Daily Load (TMDL) flow target. It was also included in the Town's Phosphorous Control Plan (PCP) as a priority for reducing phosphorus loading. An existing pre-2002 stormwater detention basin was located on one of the conservation parcels that collects stormwater before discharging to a Class II wetland tributary of Monroe Brook. The basin provided little detention benefit and even less phosphorus removal. Additionally, the site is a 3-acre site that must obtain new stormwater permit coverage.

This project aligns with several LCBP goals:

Goal I: Clean Water as described in the Opportunities for Action, the implementation of this clean water project falls under Objective I.C. Reduce Nutrient Loading, I.C.3: Reduce nutrient inputs from developed lands. I.C.3.b: Fund and promote green stormwater infrastructure design and installation, especially in combined stormwater-sewer service areas and in critical watersheds.

This project will reduce nutrient loading to Lake Champlain through the implementation of a gravel wetland practice, which will result in a significant phosphorus loading reduction, 6.06 kg/yr, which is as much phosphorus as should be in 125,000,000 gallons of Lake Champlain in the Shelburne Bay segment. Munroe Brook experiences large flow events after heavy rains that cause erosion and result in nutrient rich sediments flowing into the stream and then the lake. This project increased the storage volume for stormwater runoff, thus reducing the high flow events Munroe Brook experiences during rains and reducing the erosion along the Brook, for additional unmeasurable phosphorus reductions. Munroe Brook is a stormwater impaired watershed so treating stormwater in this watershed is critical. Additionally, this gravel wetland is the leading green infrastructure system to treat stormwater in areas that cannot infiltrate stormwater.

Goal III: Thriving Communities as described in the Opportunities for Action, the implementation of this clean water project falls under Objective III.B Support water-wise economic development, III.B.3 – Support implementation of green stormwater infrastructure (GSI). This project is a GSI Gravel Wetland and can be counted towards the total "Number of GSI projects supported with LCBP funds (corresponds with Clean Water goal)".

Goal IV: Informed and Involved Public as described in the Opportunities for Action, the implementation of an informative kiosk falls under Objective IV.B Build awareness of the Lake Champlain Basin through informal learning across all communities. This is applicable to task IV.B.1.b –Interpretation: Develop wayside and interpretive exhibits, brochures, fact sheets, and other print materials that explain natural and cultural resources, including watershed issues and concepts and CVNHP interpretive themes. An informative kiosk at the site gives an

understanding to the public of the issues facing the lake and how this GSI system helps to reduce those impacts. The location of this site is prime for such outreach because it is at the beginning of a trailhead access point to the adjacent forested areas and connected to a large network of trails. This is easily seen by residents passing by and the site will be broadcast as an example to other 3-acre residential sites in Shelburne to help inform them of why they should move forward towards compliance.

2. TASKS COMPLETED

Task #	Task Title	Objective	Deliverable(s)
1	Construction and Approved Quarterly and Final Reports	Construction of the gravel wetland completed. Quarterly and final reporting requirements completed.	Photos of completed gravel wetland; approved quarterly and final reports with attachments including photos, project metrics report

The gravel wetland has been fully constructed and is treating stormwater and reducing nutrients flowing to Lake Champlain. There were minor field adjustments made to account for a significant ledge found during excavation, requiring the basin to be about one and a half feet shallower than originally designed. The footprint was expanded significantly to accommodate for that loss in volume. The resulting gravel wetland has a slightly larger storage and treatment volume, which will further support the goals of this project.

Photo 1: Gravel wetland under construction in October 2025

Photo 2: Completed and winterized gravel wetland in December 2025.

3. METHODOLOGY

As the construction contractors hit ledge several feet deep, they worked with our supervising engineers to find and calculate various options. The final option we chose was the expanded footprint and removal of central berm to allow for an even greater storage volume. The contractors still had to jack hammer some ledge in areas but were able to avoid major blasting or months of jackhammering which would have come with extremely increased costs.

4. DELIVERABLES SUBMITTED

Deliverable	Date Submitted	Method of Submission
Photos of completed gravel wetland	12/18/2025	Email
Quarterly and final reporting	Quarterly and with this report	Quarterly by email and with this report

5. PROJECT METRICS

Metric	Final value
Category of Organization	Municipal
Non-match eligible funds utilized	$5,065 federal funds as part of MS4 formula grant, remainder funded by State Clean Water funds from MS4 grant and Shelburne's stormwater utility fund.
Phosphorus reduced	6.06 kg/year
Impervious surface treated	232,610 sqft
Number of stormwater runoff reducing infrastructure practices installed	1
Audience types engaged	Landowners, municipal leaders and community members
New interpretive displays and materials developed	1
Constructing Gravel Wetland	$346,237

6. CONCLUSIONS

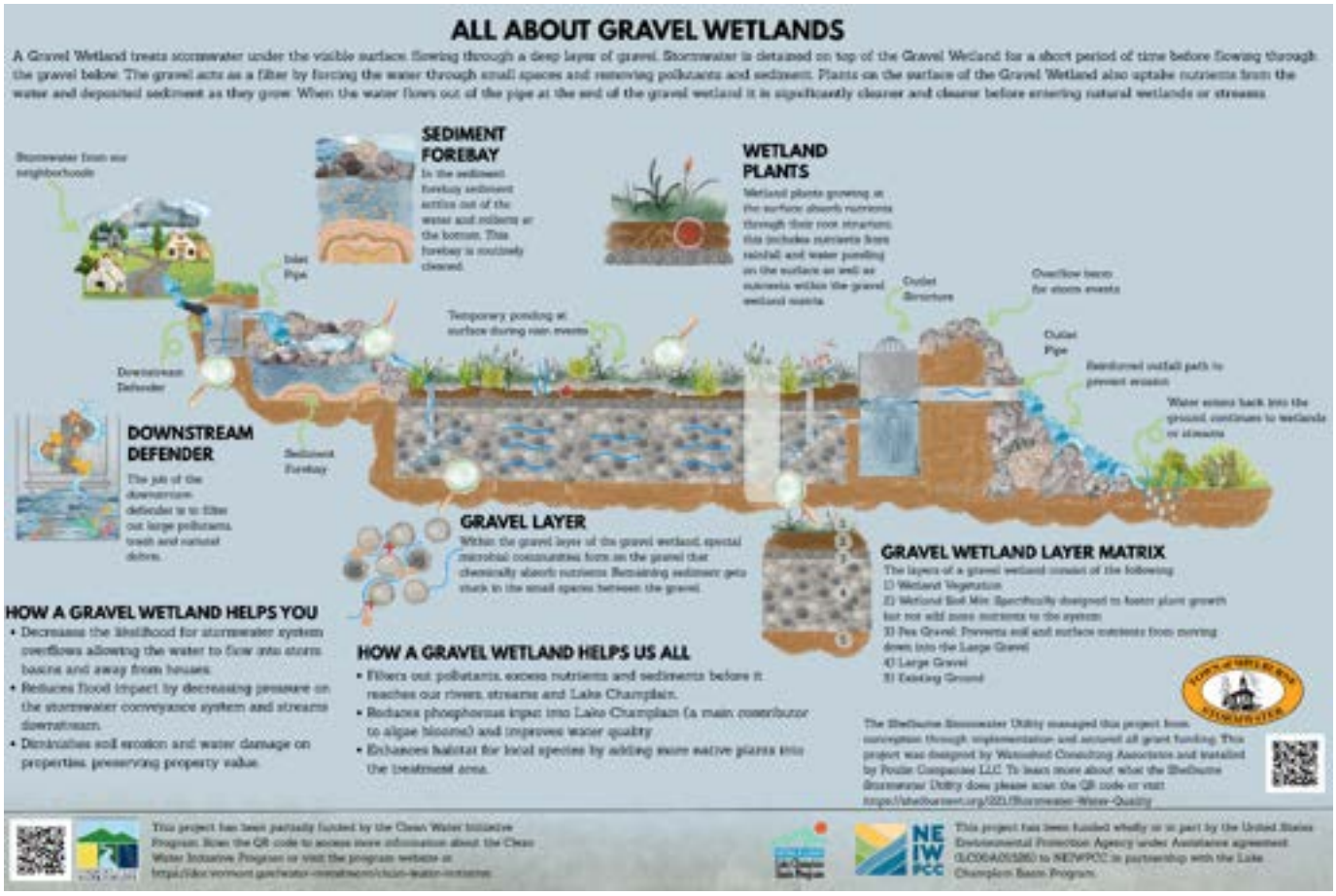
This project was completed on budget, which is always a huge plus. Some lessons learned were especially centered around encountering the ledge. In the future I would like all projects to do test boring where treatment practices will be located to get an idea of the depth to bedrock. We were able to adapt and still create a good project. I did appreciate working with the selected contractor, Poulin Inc., their project leadership and quality of work exceeded expectations.

We have other treatment practice retrofits upcoming, and we hope to work with LCBP/NEIWPCC, Poulin, and WCA again in the future.

7. APPENDICES

Appended Documents:

Educational Sign to be installed beside the wetland:


ALL ABOUT GRAVEL WETLANDS
A Gravel Wetland treats stormwater under the visible surface flowing through a deep layer of gravel. Stormwater is detained on top of the Gravel Wetland for a short period of time before flowing through the gravel below. The gravel acts as a filter by forcing the water through small spaces and removing pollutants and sediment. Plants on the surface of the Gravel Wetland also uptake nutrients from the water and deposited sediment as they grow. When the water flows out of the pipe at the end of the gravel wetland it is significantly cleaner and cleaner before entering natural wetlands or streams.
Stormwater from our neighborhoods
SEDIMENT FOREBAY
In the sediment forebay sediment settles out of the water and collects at the bottom. This forebay is routinely cleaned.
WETLAND PLANTS
Wetland plants growing at the surface absorb nutrients through their root structure; this includes nutrients from rainfall and water ponding on the surface as well as nutrients within the gravel wetland media
Inlet Pipe
Temporary ponding at surface during rain events
Outlet Structure
Overflow berm for storm events
Outlet Pipe
Reinforced outfall path to prevent erosion
Water enters back into the ground, continues to wetlands or streams
Downstream Defender
Sediment Forebay
DOWNSTREAM DEFENDER
The job of the downstream defender is to filter out large pollutants, trash and natural debris.
GRAVEL LAYER
Within the gravel layer of the gravel wetland, special microbial communities form on the gravel that chemically absorb nutrients. Remaining sediment gets stuck in the small spaces between the gravel.
GRAVEL WETLAND LAYER MATRIX
The layers of a gravel wetland consist of the following:
1) Wetland Vegetation
2) Wetland Soil Mix: Specifically designed to foster plant growth but not add more nutrients to the system
3) Pea Gravel: Prevents soil and surface nutrients from moving down into the Large Gravel
4) Large Gravel
5) Existing Ground
HOW A GRAVEL WETLAND HELPS YOU
• Decreases the likelihood for stormwater system overflows allowing the water to flow into storm basins and away from houses.
• Reduces flood impact by decreasing pressure on the stormwater conveyance system and streams downstream.
• Diminishes soil erosion and water damage on properties, preserving property value.
HOW A GRAVEL WETLAND HELPS US ALL
• Filters out pollutants, excess nutrients and sediments before it reaches our rivers, streams and Lake Champlain.
• Reduces phosphorous input into Lake Champlain (a main contributor to algae blooms) and improves water quality.
• Enhances habitat for local species by adding more native plants into the treatment area.
The Shelburne Stormwater Utility managed this project from conception through implementation and secured all grant funding. This project was designed by Watershed Consulting Associates and installed by Poulin Companies LLC. To learn more about what the Shelburne Stormwater Utility does please scan the QR code or visit https://shelburnevt.org/221/Stormwater-Water-Quality
This project has been partially funded by the Clean Water Initiative Program. Scan the QR code to access more information about the Clean Water Initiative Program or visit the program website at https://dec.vermont.gov/water-investment/clean-water-initiative
NE IW PCC
This project has been funded wholly or in part by the United States Environmental Protection Agency under Assistance agreement (LC00A05285) to NEIWPCC in partnership with the Lake Champlain Basin Program.

Stormwater treatment practice calculator, from VT DEC:

Stormwater Treatment Practice Calculator

Identification

Date	10/26/2021	
WPD ID	9096	
STP Name	Boulder Hill - Gravel Wetland	

Loading Information

Drainage Area	6 - Laplatte River	
Impervious Area	5.34	acres
Pervious Area	27.979	acres

STP Information

STP Type	Gravel Wetland	
Storage Volume	49998	ft^3
Infiltration Rate		in/hr
Filter Course Depth		in

Estimated Phosphorus Reduction

Load	9.9	kg/year
STP Capacity	1.03	in
Efficiency	61.22	%
Reduction	6.06	kg/year