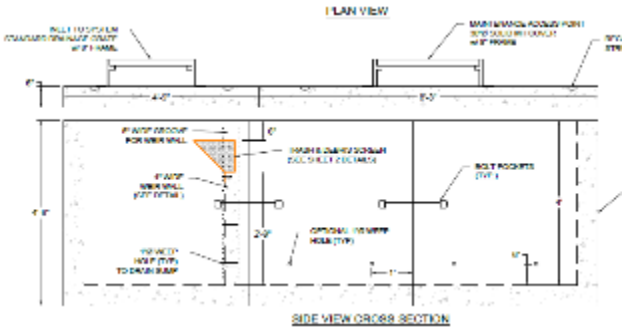
TOWN OF WALLINGFORD–

STORMWATER MASTER PLAN

WALLINGFORD,

VERMONT



FINAL REPORT

February 22, 2019

Prepared for:

Town of Wallingford

75 School Street

Wallingford, VT 05773

Prepared by:

Watershed Consulting Associates, LLC

430 Shelburne Road P.O. Box 4413

Burlington, VT 05406

P: 802.497.2367

info@watershedca.com

TABLE OF CONTENTS

LIST OF FIGURES:

LIST OF TABLES:

LIST OF ATTACHMENTS:

Task 2 Summary Memo
2.1 – Wallingford Stormwater Permits (PDF & Excel file)
2.2 – Wallingford Data Library (ESRI geodatabase)
2.3 – Related Documents (provided as folder of various PDFs)
Task 3a Summary Memo
3a.1 – Initial Project Locations Maps
3a.2 – Sites List
Task 3b Summary Memo
3b.1 – Field Assessment Site Locations Maps
3b.2 – Field Assessment Sheets
Task 4 Summary Memo
4.1 – Prioritized Sites Maps
4.2 – Prioritized Sites Table (PDF & Excel file)
4.3 – All Sites Table
Task 5 Summary Memo
5.1 - VT DEC Correspondence
5.2 - Media Box Filter
5.3 - VTrans Correspondence
5.4 - Family Dollar Correspondence
Task 6 Summary Memo
6.1 - 30% Concept Plans – Non-Road Sites
6.2 - Road Erosion Sites – Solutions
6.3 Batch Import File – Wallingford (PDF & Excel file)
6.4 - BMP template for P Estimation_NonMS4 (PDF & Excel file)
6.5 - Road Erosion Solutions - Quick Reference Manual

I. Disclaimer

The intent of this report is to present the data collected, evaluations, analysis, designs, and cost estimates for the Town of Wallingford ('Wallingford') Stormwater Master Plan under a contract between the Town of Wallingford and Watershed Consulting Associates, LLC ('Watershed'). Funding for the project was provided from the Vermont Ecosystem Restoration Program (ERP). The plan presented is intended to provide the watershed's stakeholders a means by which to identify and prioritize future stormwater management efforts. This planning study presents a recommended potential collection of Best Management Practices (BMPs) that would address specific concerns relating to stormwater in Wallingford. There are certainly other BMP strategies that could be implemented in the Town – these are the sites and practices that project stakeholders felt would have the greatest impact and the greatest probability of implementation. **This report does not represent a regulatory obligation of any sort.**

1 Project Overview

In May 2013, the State of Vermont Department of Environmental Conservation (VTDEC) issued a document titled Vermont Stormwater Master Planning Guidelines. This document is designed to provide communities in Vermont with a standardized guideline and series of templates to assist them in planning for future stormwater management practices and programs. Vermont has had stormwater regulations in place since 1978, with updates concerning unified sizing criteria in 2002. In 2017 the VT DEC issued a new stormwater management manual and regulations to reflect the current state of Best Management Practices. The State recognizes that managing stormwater can be a costly endeavor – the guidelines are written to help identify the appropriate practices for each watershed, community, and site in order to maximize the use of funds.

The guidelines encourage each stormwater master plan (SWMP) to follow the same procedures. They are:

- Problem Definition
- Collection of Existing Data
- Development of New Data
- Existing and Proposed Program, Procedure, or Practice Evaluation
- Summary and Recommendations

This stormwater master plan follows those guidelines to maximize the cost-benefit ratio associated with developing meaningful stormwater management solutions in Wallingford, VT.

2 Background

2.1 *Problem Definition*

The Town of Wallingford is a small, mostly rural municipality with a moderately developed downtown area. Much of the town is rural and split geographically between the toe of the Green Mountains to the East and flatter areas adjacent to the Otter Creek to the West. Wallingford is 27,553 acres total. Of this, 403 acres is impervious cover (as delineated by the 2011 Lake Champlain Impervious Coverage remotely-sensed GIS layer) – paved roads and parking lots, roof tops, gravel road and parking lots, and other impervious coverage areas. These areas make up 1.4% of the total town area. Of these 403 acres of impervious coverage, 210 acres or 0.07% are public roads. The remainder is split between public and private parcels of development.

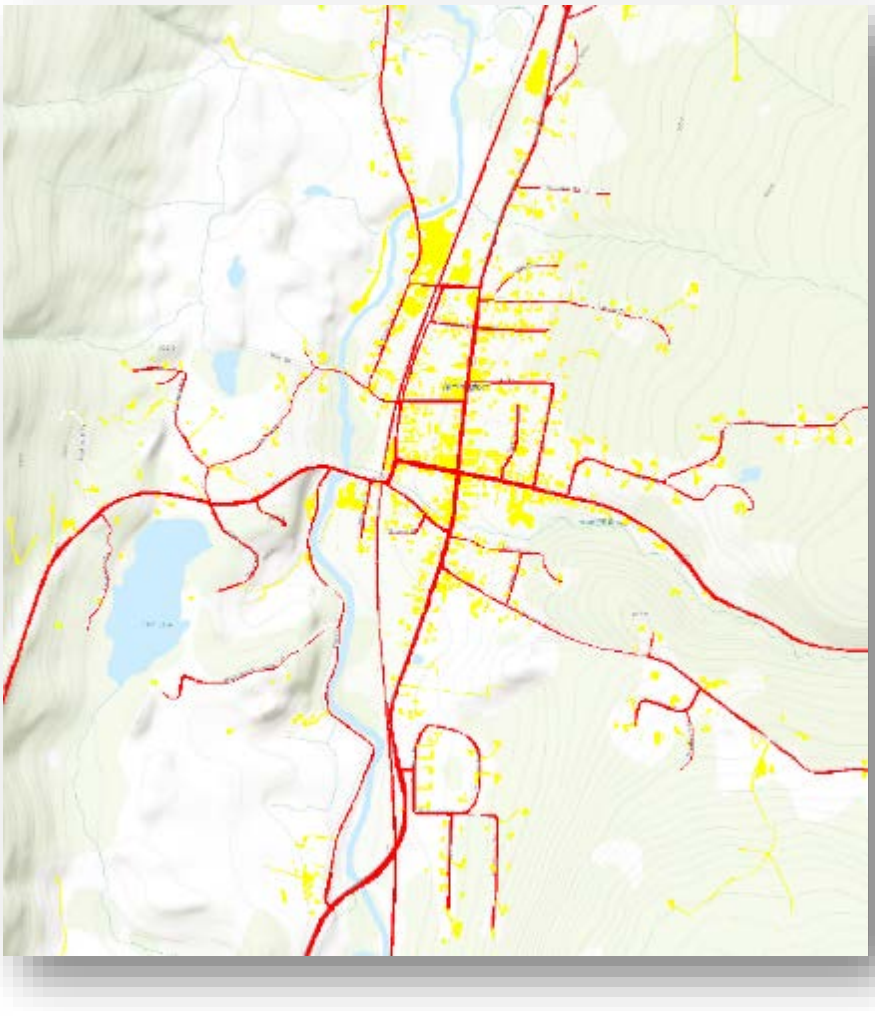


Figure 1: Downtown Wallingford showing road-related impervious cover in red and all other impervious cover in yellow. Approximately half the impervious cover in Wallingford is road-related.

The project team identified all parcels within the Town of Wallingford with 3 acres or more of impervious coverage as of 2011 (this is the most current dataset for the Lake Champlain Basin). There is one parcel with more than three acres of impervious cover. This is the True Temper factory location. This site is covered by a Multisector General Permit (MSGP). Road surfaces are not counted in this tally as those will be dealt with under the Municipal Roads General Permit guidelines.

The Town drains to the Otter Creek, either directly or via smaller tributaries, with the exception of the Village of East Wallingford which drains to the Mill River (which is a tributary of the Otter Creek). The impairments associated with these water bodies are detailed in Attachment 2.1 – Data Library Memo but generally include:

- Stormwater runoff impacts from developed surfaces
- Buffer degradation associated with various types of land development
- Varying degrees of planform stability or change according to Phase 1 & 2 Stream Geomorphic Assessment
- Nutrient and sediment pollution (particularly phosphorus as the Otter Creek is a tributary of Lake Champlain and is subject to the Lake Champlain Total Maximum Daily Load (TMDL) regulations

This study has found potential projects that rely on a mixture of Green Stormwater Infrastructural development whenever possible, and more traditional end-of-pipe stormwater Best Management Practices where applicable in order to use the most effective tools. These practices are designed to eliminate sediment in stormwater runoff to the greatest degree and to help mitigate the effects of channel-changing storms.

2.2 Data Library

The master planning project team completed a comprehensive review of existing data related to Wallingford and have summarized our review as part of the Task 2 – Data Library Memo. A GIS geodatabase of relevant data was also complied and organized as part of this Attachment (note – this is in ESRI geodatabase format). All stormwater permits are included in Attachment 2.1 – Wallingford Stormwater Permits (Excel spreadsheet). Any relevant paper documents and reports have been provided in the folder Attachment 2.3.

2.2.1 Data Review

The purpose of the data review was to assess the availability and quality of data related to stormwater management within Wallingford and to identify any data gaps and/or needs prior to the start of the retrofit assessment. The data library will also serve as a complete compiled source of data that can be easily accessed throughout the project.

2.2.1.1 *Permit Files:*

The State of Vermont's Open Geodata Portal provided by the Vermont Center for Geographic Information (VCGI) and other publishers like the Agency of Natural Resources (ANR) and Vermont Agency of Transportation (VTrans) was used to identify all stormwater issued permits within the town boundary of Wallingford. Issued stormwater permits were assessed for ownership, from which the publicly owned permits were identified. In Wallingford, there are none. There are only five total stormwater permits in Wallingford, three of which are Multi-sector General Permits (MSGP) while two are short-duration Construction General Permits (CGP).

2.2.1.2 *GIS Data Files:*

GIS data files related to the project were drawn from a variety of public resources including the VCGI Open Data Portal, United States Geological Survey (USGS), and United States Department of Agriculture (USDA). WCA performed select processing of the data to ensure that it was relevant and responsive to the needs of this particular SWMP. Individual ArcGIS shapefiles were then combined into a geodatabase file structure for ease of use and data migration from platform to platform. These files represent the most current available data, however GIS data within the State of Vermont is very dynamic – these files should not be regarded as the 'final' version. The geodatabase was provided as part of Task 2.

2.2.1.3 *Past Watershed Studies:*

The Related Documents (Attachment 2.3 – Related Documents folder) contain all available reports pertaining to the Otter Creek and Town of Wallingford that the master planning project team was able to find after speaking with various contacts, Town officials, and searching reports on the Internet. These reports include

- Otter Creek Water Quality Management Plan
- Upper Otter Creek Buffer Assessment
- Various Stream Geomorphic Assessments for the Upper Otter Creek (Phase 1 and 2) and Mill River (Phase 1 and 2)
- Mill River Corridor Management Plan
- VT DEC Stormwater Mapping Report (Wallingford and Village of East Wallingford)

Two additional documents were also included in this deliverable. They are:

- VT League of Cities and Towns LID GSI Bylaw Template

- Don't P on Your Lawn (fertilizer guidance for homeowners)

A more complete summary of the materials related to stormwater management can be seen in the Task 2 Summary Memo.

2.2.1.4 Data Needs:

Our review of the currently available data and reports highlighted needs within the Town of Wallingford.

One is the need to develop a polygon layer showing approximate public roads rights-of-way in which street-related stormwater management features could be installed on public land. Watershed developed this layer during the course of the desktop assessment phase.

The Town was also scheduled to have the Rutland County Regional Planning Commission (RPC) inventory all hydrologically connected roads for the Municipal Roads General Permit (MRGP). This work was scheduled to take place during the summer of 2018. Watershed did not rely on the results of this survey for its road-related stormwater management practices, instead choosing to survey the Town's road foreman regarding which unpaved roads are hydrologically connected and experience chronic erosion issues. Survey data for these areas was the collected by Watershed staff.

The presence or absence of land use regulations and zoning bylaws concerning stormwater management are also of interest in this project. The Town of Wallingford does not currently have a specific stormwater ordinance. It is important to note that the Vermont League of Cities and Towns has a model draft stormwater ordinance which is available here (http://vlct.org/assets/MAC/2015-LID-GSI-model-bylaw.docx). This may be an ordinance which the Town could adopt for future stormwater management efforts.

3 Initial Priority Sites Assessment (Task 3)

3.1 Desktop Assessment (Task 3a)

WCA worked with the Town of Wallingford and the Rutland County NRCD to identify locations with existing drainage problems or concerns during the kickoff meeting. This information was utilized during the project scoping process.

WCA conducted a desktop assessment of stormwater-related issues and opportunities for retrofits in the Town, which involved a thorough review of existing GIS resources and associated attribute data. This included, but was not limited to, storm sewer infrastructure, soils classifications, parcel data, wetlands, and river corridors. This data was used to identify and map stormwater subwatersheds with particularly high impervious cover, stormwater subwatersheds that are more directly connected to water bodies (direct pipes to streams or via overland flow), and parcels with ≥3 acres of impervious cover without a current stormwater permit.

A 'green streets' assessment was also conducted to identify any road segments throughout the drainage area appropriate for green stormwater infrastructure (GSI) retrofit opportunities. Streets were evaluated and scored according to width, slope, and soil permeability utilizing a methodology adapted from the "Promoting Green Streets" report published by the River Network. Preference was given to those highest-scoring road segments in more urban areas.
The methodology was modified to better fit specific conditions found in the study area. The analysis utilized two prerequisites and one secondary consideration.

Prerequisites:
Road Slope

- 1-5% Slope = Ideal (Score: 2 points)
- 5-7.5% Slope = Potential (Score: 1 point)
- >7.5% Slope = Unsuitable (Score: 0 points; discarded from further analysis)

Road Right-of-Way Width

- ≥ 50 ft = Ideal (Score: 2 points)
- 46-50 ft = Potential (Score: 1 point)
- < 46 ft = Unsuitable (Score: 0 points; discarded from further analysis)

Secondary Consideration:
Hydrologic Soil Group (indication of infiltration potential)

- A/B (highest infiltration potential) = Ideal (Score: 2 points)
- B/C (moderate infiltration potential) = Potential (Score: 1 point)
- C/D (lowest infiltration potential) = Unsuitable (Score: 0 points; **not** discarded from further analysis)

The scores from each of the three criteria were added, and a score was assigned for each road segment with higher scores indicating a greater potential for GSI suitability. Those sites with greater potential were noted for assessment in the field.

Using this data, 43 potential locations for stormwater BMPs were identified in the Town. Point locations were generated for each site and an overview map was created displaying these points, their ID numbers, site names, and approximate locations. WCA generated a spreadsheet including a more complete site description including general site notes and preliminary BMP thoughts. The ID numbers are included in both the table and map so that projects can be easily located.

Of note – there is currently only one parcel in Wallingford with greater than 3 acres of impervious cover (the True Temper factory site). This site currently has a Multi-Sector General Permit (MSGP) governing its stormwater runoff. There is no operational permit for this site. Given that it has a valid stormwater permit, and may be required to obtain an operational permit under the Lake Champlain TMDL '3-acre' impervious cover parcel rule, this site was not evaluated further for retrofit opportunities.

Results of this effort can be seen in Attachment 3a.1 – Initial Project Locations Map and 3a.2 – Sites List.

The Task 3a Summary Memo describes this work.

3.2 Field Assessment (Task 3b)

Watershed used the results of Task 3a – Desktop Assessment to target field assessment sites. Each of these sites was visited and the feasibility of implementing stormwater management practices at each site was evaluated in the context of the site. Factors considered include probable or known ownership, location of utilities (if applicable and where evident), soil conditions observed including the potential for season high groundwater, parking or traffic use patterns (particularly for streetscape features), feasibility for construction (particularly with respect to steep slopes or other constraints), ease of hydrologic connections, or other potential factors.

The potential management practice type(s), based on field assessment, was also noted for future consideration.

All information was recorded in the field using the custom developed app prepared during Task 3a. Additional information was derived or inferred from baselayers customized during that same Task.

Additional potential sites were added in the field, though given the relatively thorough desktop assessment process, only four additional sites were added. Unpaved road-related sites were not assessed during this process. The assessment and selection for unpaved road-related sites will be discussed under Task 6 – Proposed Best Management Practices – 30% Concept Design.

Results of this effort can be seen in Attachment 3b.1 – Field Assessed Site Locations Map and 3b.2 – Field Assessment Sheets.

4 Prioritization (Task 4)

Each field assessed site was assigned a characteristic based on either observations made in the field or assessments based on review of desktop data. Each characteristic has a related score. It is important to note that we chose to use two different ranking matrices for these sites. One matrix is designed to effectively rank potential retrofits that are potentially larger and associated with drainage infrastructure outfalls or other larger drainage areas. The second matrix is tailored to smaller projects, primarily those within the road right-of-way. We chose to pursue this method as past experience has taught us that one ranking matrix will often unfairly bias the results in favor of larger, more impactful (but also much more expensive) projects, while the smaller road right-of-way projects, which typically have smaller individual impacts in terms of pollutant load reductions, tended to fall lower in the rankings. The two tables describe the rankings and their associated scores. Please note that scores have been normalized as a percent of total score as each matrix has a different possible total score. Please also note – the category 'Proximity to Water' was changed to 'Hydrologic Connectivity' in the final ranking table as this more accurately reflects what this criteria was meant to characterize (i.e. not necessarily the physical distance from water but rather how easily pollutants might pass from a source area to a water resource).

Table 3: Preliminary ranking criteria to prioritize larger, potentially more impactful projects.

Criteria	Description	Score
Drainage Area Size	L - Large	25
	M - Medium	10
	S - Small	5
Pollutant Load Reduction Potential	H - High	25
	M - Medium	10
	L - Low	5
Impervious Area %	H - High	25
	M - Medium	10
	L - Low	5
Proximity to Water	H – High (closer to water)	25
	M - Medium	10
	L – Low (farther from water)	5
Hydrologic Soil Group	A - High infiltration potential	25
	B - Moderate infiltration potential	10
	C/D - Low or no infiltration potential	0
Land Owner	Municipality Owned (Parcels or Road ROW)	25
	Participatory Private / VTrans	10
	Unknown Private	0
	Non-Participatory Private	-25
Parcel with ≥3 acres of impervious cover, no permit or expired permit	Yes	15
	No	0

Table 1: Preliminary ranking criteria to identify smaller, less complicated or less expensive projects.

Criteria	Description	Score
Cost Projection	H - High (>$50K)	5
	M - Medium ($10-50K)	15
	L - Low (<$10K)	35
Additional Design Required	Min - Minimal	25
	Med - Medium	10
	Complex	5
Land Owner	Municipality Owned (Parcels or Road ROW)	25
	Participatory Private / VTrans	10
	Unknown Private	0
	Non-Participatory Private	-25
Pollutant Load Reduction Potential	H - High	25
	M - Medium	10
	L - Low	5
Hydrologic Soil Group	A - High infiltration potential	25
	B - Moderate infiltration potential	10
	C/D - Low or no infiltration potential	0
Proximity to Water	H – High (closer to water)	25
	M - Medium	10
	L – Low (farther from water)	5
Impervious Area %	H - High	25
	M - Medium	10
	L - Low	5

4.1 Results:

Rows in blue represent projects associated with road rights-of-way. Rows in orange rows represent project associated with drainage infrastructure or have larger drainage areas.

Based on these criteria, the Top 10 sites in Wallingford are:

Table 5: Top 10 proposed best management practice sites in Wallingford.

Site	% of Total Score
Railroad_Ditch	82%
Florence_Ave_ROW_A	81%
Railroad_St_Drainage	76%
N_Main_St_ROW_C	73%
N_Main_St_ROW_B	73%
Railroad_St_ROW_A	73%
Bill_Fox_Rd_ROW_A	68%
Family Dollar Yard	67%
Elm_St_ROW_A	62%
Fire Department	61%

The Top 20 sites in Wallingford are:

Table 6: Top 20 proposed best management sites in Wallingford.

Site	% of Total Score
River_St_ROW_A	59%
Rt_140_ROW_A	59%
Macs_Mkt	58%
Depot_St_ROW_A	57%
School_Entrance	55%
School_Playground	55%
Deerfield_Dr_ROW_A	51%
Village_St_ROW_A	51%
School_St_ROW_A	51%
Sugar_Hill_Rd_ROW_B	49%

A map of these sites can be seen in Attachment 4.1 – Prioritized Sites Map. All ranking results can be seen in Attachment 4.2 – Prioritized Sites Table. These are provided as Excel spreadsheets. A PDF of all ranked results can be seen in Attachment 4.3 – All Sites Table. Please note that no effort was made to 'break' ties.

5 Stakeholder Outreach (Task 5)

A stakeholder outreach process was conducted to determine the final design sites for 30% concept design. During a project team meeting held with the Town of Wallingford and the Rutland Natural Resources Conservation District (NRCD) to discuss the results of the prioritization process, Watershed stated that, depending on the complexity of design associated with the sites identified in Task 4 previously, that it was feasible to create 3-4 30% designs for these sites. That would leave 4-5 30% design sites for the road-erosion-related sites. The group felt that this was feasible.

Watershed presented the prioritized sites to the group. The group generally felt that the following sites, in the listed order, are worth pursuing:

1. Railroad Street Drainage (to potentially include the Fire Department site drainage area)
2. Wallingford Elementary School (Entrance and Playground combined)
3. Florence Avenue ROW A
4. North Main Street ROW C and B
5. Elm Street ROW A

6. Family Dollar Yard

Railroad Ditch:

The top site from Task 4 was the Railroad Ditch. The stakeholders felt that given the right-of-way issues inherent with the railroad's owners, as well as the relatively constrained nature of the site, that this site was not worth pursuing further at this time, though it remains a potentially impactful and viable site for future retrofitting.

No further outreach was conducted for this site.

Florence Avenue ROW A:

The stakeholders felt that this site has merit, if attention is paid to the berm at the top of the bank of the tributary. Lowering this berm could potentially cause flooding along Florence Avenue as the bridge on Railroad Street over the tributary has become blocked with debris in the past, resulting in tailwater conditions. While the Town acknowledged that the bridge likely needs upgrading, the group felt that maintaining the berm as part of any retrofit would be wise. Watershed agreed that any outlet from the retrofit would make use of a pipe overflow versus a weir-style overflow to minimize berm disruption and local flooding.

Railroad Street Drainage:

The group felt that this would be good site as it captures a relatively large drainage area, with an additional drainage area that could be connected to it. However this area is on private property, near to the River Corridor, within a flood-prone area, and may be considered wetlands, though it is not mapped as such. Despite these constraints, the group felt that it was worth pursuing. Watershed agreed to further screen the site with the appropriate authorities at the State level to see if a retrofit is possible here.

An on-site visit was conducted with Zapata Courage of the VT DEC Wetlands program and Joshua Carvajal of the Stream Alteration division. The potential to install a gravel wetland at the site was discussed at the existing outfall. Ms. Courage felt that, while this is far from an ideal site, that it might be permissible if the footprint of the gravel wetland was kept as close to the outfall as possible. Mr. Carvajal did not have any concerns at this site. David Rosa, VT DEC Floodplain Manager also visited the site with Shannon Pytlik, River Corridor Manager (not on the same day as with Ms. Courage and Mr. Carvajal). Mr. Rosa felt that the site would not be feasible or be eligible for Ecosystem Restoration Program (ERP) funding as it is in the floodplain.

Though there may be some potential to obtain funding other than ERP implementation grants, Watershed does not recommend this site for further design given the VT DEC's concerns over natural resource constraints, as well as the site's proximity to the railroad right-of-way.

During this same review process, the VT DEC looked at the site labeled Fire Department. Watershed explained that the potential retrofit for this site could be a system of sub-surface chambers to filter stormwater. Though Ms. Courage and Mr. Carvajal believed this site to be preferable to the Railroad Street

drainage site, Mr. Rosa and Ms. Pytlik were not supportive of it as it is in the floodplain and river corridor, making it unlikely to garner funding or support from ERP. Likewise, we would not recommend pursuing further design or implementation at this site.

The e-mail correspondence related to these sites can be seen in Attachment 5.1 – VT DEC Correspondence.

North Main Street ROW C and B:

The group felt that these sites were worth pursuing, with the caveat that this ROW is controlled by VTrans and may not be suitable for infiltration-based practices. Additionally, the road subbase in that area may prove challenging to work around. Watershed agreed to reach out to VTrans regarding the potential to install streetscape bioretention practices in this area and will include them in final designs if suitable.

Watershed reached out to VTrans via Jennifer Callahan, Stormwater Technician for VTrans, who referred Watershed to Dexter Puls, Stormwater Technician for VTrans for further follow-up. Watershed proposed a modified catch basin filter system, similar to one that has been used by the City of Dover, New Hampshire in partnership with the University of New Hampshire Stormwater Center as a simple, non-infiltration-based retrofit in urban environments. The basic concept design for this can be seen in Attachment 5.2 – Media Box Filter. This reduces concerns associated with infiltration under road subbase as well as issues related to high seasonal ground water. The box filter is also load rated for use under roads.

Mr. Puls referred Watershed to Rob Faley, District Transportation Administrator for the Southwest Region, who posed several questions related to the media box filter. This correspondence can be seen in Attachment 5.3 – VTrans Correspondence.

Railroad Street ROW A:

The group felt that this was a good site, but that ROW issues with the railroad might be difficult to work around. This site was not chosen for further design.

Bill Fox Road ROW A:

The group felt that this was a good site, but that it might be better served during the road-erosion-related inventory and prioritization. It will be added to that scope of work and revisited later.

Family Dollar Yard:

The group felt that this was one of the best sites identified, but it isn't without constraints. Chief among those is the possibility that the site (the open space adjacent to Route 7 in front of the Family Dollar parking lot) may be predominantly ledge. This could be expensive to work around. Additionally, the site is owned by a property management company (JM and MM Mulkin, based in Derby, VT but with an owner that lives out of state) that leases the site to Family Dollar. Watershed agreed to follow up with the property management company and Family Dollar.

Initial outreach to JM and MM Mulkin was conducted on 3-28-18. Jim Mulkin was receptive to the project, but stated that he could not commit the property to any use. He indicated that Family Dollar would have to make that decision. Outreach was conducted to the local manager of the Family Dollar by Sandi Switzer on 3-28-18. The local manager referred her to Family Dollar's corporate access number. Watershed called Family Dollar corporate on 3-29-18 and was able to speak with Richard Hillesheim, with Family Dollar Corporate's Real Estate Division. Mr. Hillesheim stated that, as long as the property owner (Mr. Mulkin) was OK with the project moving forward and that the project scope would not interfere in any with Family Dollar's access to or use of the property, then it could proceed. Mr. Mulkin was informed of this information via a phone call and gave his consent, which was later confirmed via e-mail. This can be seen as Attachment 5.4 – Family Dollar Correspondence.

An on-site investigation was conducted with Phil Baker of the Town of Wallingford on 5-9-18. Mr. Baker was able to dig two holes to a depth of approximately 6.5' – 7.0'. The first test pit, near the intersection of Maple Street and Route 7, revealed a layer of approximately 40" of fill soil (gravelly sandy loam), followed by a layer of gravelly cobble from a depth of 40" to the bottom of the test pit at ~78". Mr. Baker indicated that the layer from 40" - ~78" was indicative of native material in his experience in the area. Evidence of groundwater was found at ~78" depth.

The second test pit was dug a similar distance from Route 7 as the first but farther away from Maple Street, nearer to an obvious bedrock outcrop. This test pit displayed a similar soil profile (fill soil to approximately 45" depth, followed by gravelly cobble to a depth of ~78"). Evidence of groundwater was not found, but bedrock was encountered at ~78" depth.

Generally, there was little evidence of poor quality fill soils (road material, trash, demolition debris) across the site. Though bedrock and groundwater are of concern here, they both occur at a depth that would not exclude the possibility of installing sub-surface chambers with an underdrain. This type of practice would also alleviate concerns with changing the site characteristics that would interfere with Family Dollar's operations or Mr. Mulkin's rental operation.

Elm Street ROW A:

The group felt that this was a good site for a smaller streetscape bioretention practice, though of lower priority than other sites. It will be pursued for design only if other, higher priority sites don't work out.

Fire Department:

The group felt that, though this site could treat a large amount of runoff, property issues might constrain this site and preclude it from developing. The Fire Department building is on property owned by the railroad and is leased by the Department. Developing anything within that corridor was seen as being too unlikely to pursue further.

This was later confirmed by VT DEC (see description for the Railroad Street Drainage area).

Of the Top 20 sites, one group of sites stood out.

School Entrance and Playground:

The group felt that this site was worth pursuing, given the quasi-public ownership of the parcel (the parcel is owned and controlled by the school district). The town public works director did caution that the open space at the entrance to the school was actually where the old high school stood. When that structure was demolished, the walls and foundation were collapsed into themselves, so much of that area is likely to be filled with rubble from that demolition. Despite this potential constraint, Watershed agreed to move forward with outreach to the school district.

Watershed provided Town Administrator Sandi Switzer with an e-mail introducing the potential project and concept for a system of sub-surface chambers that she could send to Gary Marcy, Director of Operations for the school. The e-mail was sent on 3-27 and included photos of the potential system, along with a map showing approximately where the practice would be installed.

Watershed met with Mr. Marcy on site to discuss the potential practice type and location. Mr. Marcy indicated that if the practice could be moved lower on the property, to the approximate area of the school's baseball field, that the school would be more amenable to pursuing design and implementation. This site is actually more conducive to stormwater management as it could possibly capture a significant portion of the school's parking lot (with additional catch basin infrastructure and piping installed, as well as potentially some curbing or re-grading), as well as the school's rooftop runoff if the roof drain pipes can be routed to a sub-surface practice. There may be challenges associated with the ballfield site as well, as that area may contain several old concrete tanks that may need to be excavated.

None of the other Top 20 sites were deemed suitable to pursue for additional levels of design.

Based on this outreach and the feedback received we recommended that the following sites proceed to 30% design:

- Family Dollar
- Wallingford School
- Florence Avenue
- North Main Street ROW B and C

These sites were ultimately chosen for 30% concept design under Task 6.

Results of the stakeholder outreach process are summarized in the Task 5 Summary Memo. Correspondence with VT DEC regarding sites in or near the river corridor and floodplain can be seen in Attachment 5.1 – VT DEC Correspondence. Typical design plans for the media box filter can be seen in Attachment 5.2 – Media Box Filter. Correspondence with VTrans can be seen in 5.3 – VTrans Correspondence while correspondence regarding the Family Dollar site can be seen in Attachment 5.4 – Family Dollar Correspondence.

6 Proposed Best Management Practices – 30% Concept Designs (Task 6)

Watershed developed four 30% Concept Designs for non-road specific projects and five concepts for road-erosion based projects. These can be seen in Attachment 6.1 - 30% Concept Plans – Non-Road Sites and 6.2 - Road Erosion Sites – Solutions. We are also including Attachment 6.3 - Batch Import – Wallingford and 6.4 - BMP Template for P Estimation – Non MS4 for Ecosystem Restoration Program (ERP) reporting purposes. We're also including 6.5 - Road Erosion Solutions – Quick Reference Manual to assist with road erosion solutions.

6.1 30% Concept Designs – Non-Road Sites

The four projects selected for 30% Concept Design are:

- Family Dollar– Sub-surface chambers
- Wallingford School – Sub-surface chambers
- Florence Avenue – Bioretention Swale
- North Main Street ROW B and C – Media Box Filter

Each section below describes each project in more detail.

6.1.1 Family Dollar

Description:

A system of sub-surface chambers will be installed in the front yard of the Wallingford Family Dollar. The property is owned by James Mulkin, who has expressed his support of the project to the concept design phase. The Family Dollar Corporation has also expressed their support, as long as the chamber system does not interfere with their daily operations. The chambers will have to be installed so as to avoid the ledge outcrop on the site. The concept calls for laying the chambers out in such a way as to stagger each of the rows. The system will be sized to treat the full Water Quality volume (WQv) from the majority of Wallingford's developed downtown area. During geotechnical assessment, groundwater was found at a depth of approximately 6.0-6.5'. The chambers will be located above that elevation and will be underdrained using an 8" perforated underdrain pipe, located below a 2' layer of sand that will act as a filter for pollutants. No runoff will be infiltrated. Runoff events larger than the WQv storm will bypass the system via an overflow and be routed to the same ditch they currently flow to. No change will be made to runoff routing for storms larger than the WQv storm.

Figure 2: The potential site where sub-surface chambers could be installed as a filtration practice is show in this photo. Only the green space in front of the parking area would be developed for stormwater management.

Impervious Treated (ac)	Total Drainage Area (ac)	Total Phosphorus Removed Annually (lbs.)	Total Solids Removed (lbs.)	Cost per Pound P removed ($)
16.5	156.6	8.36	4169	$26,250

Cost:

Table 7: Cost projection for the proposed 30% concept design at the Family Dollar site.

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
653.55	Project Demarcation Fencing	LF	575	$ 1.17	$ 672.75
652.10	EPSC Plan	LS	1	$ 1,000.00	$ 1,000.00
649.51	Geotextile for silt fence	SY	125	$ 4.13	$ 516.25
	Construction Staking	HR	8	$ 100.00	$ 800.00
				Subtotal:	$ 3,989.00
Chambers - Costs					
	Chambers, Excavation, and Stone	CY	17000	$ 7.00	$ 119,000.00
203.26	Channel Excavation of Rock (Contingency)	CY	25	$ 140.00	$ 3,500.00
604.20	Concrete Catch Basin	EACH	1	$ 3,387.59	$ 3,387.59
629.54	Crushed Stone Bedding	TON	665	$ 34.04	$ 22,636.60
601.0915	18" CPEP	LF	55	$ 64.04	$ 3,522.20
601.2625	30" CPEP(SL)	LF	20	$ 47.78	$ 955.60
605.11	8 Inch Underdrain Pipe	LF	200	$ 27.04	$ 5,408.00
651.35	Topsoil	CY	120	$30.96	$ 3,715.20
651.15	Seed	LBS	50	$7.66	$ 383.00
				Subtotal:	$ 162,508.19
Subtotal:					$ 166,497.19
	Construction Oversight**	HR	32	$ 125.00	$ 4,000.00
	Construction Contingency - 10%**				$ 16,649.72
	Incidentals to Construction - 5%**				$ 8,324.86
	Minor Additional Design Items - 5%**				$ 8,324.86
	Final Design	HR	40	$ 125.00	$ 5,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	8	$ 125.00	$ 1,000.00
Total (Rounded)					**$ 210,000.00**

6.1.2 Wallingford School

Description:

The system will consist of a series of 5x15 Storm Tech MC-4500 sub-surface infiltration chambers designed to fully infiltrate the Water Quality volume (WQv) from a 22.75 acre drainage area, 20.04% of which (or 4.55 acres) is impervious. This drainage area includes the school's main parking lot and rooftop (provided the roof drain pipes can be tied to the system – plans are inconclusive on this matter). Larger storms will bypass the system via an overflow pipe to the Roaring Brook. Geotechnical assessment at the site found a favorable infiltration rate of approximately 1.3" per hour. Conversations with the Town Road Foreman, who has extensive knowledge of this particular site, indicates that there may be some buried debris on the site below the ball field (old concrete tanks or other debris from the high school demolition). This may complicate excavation for the chambers to some degree.

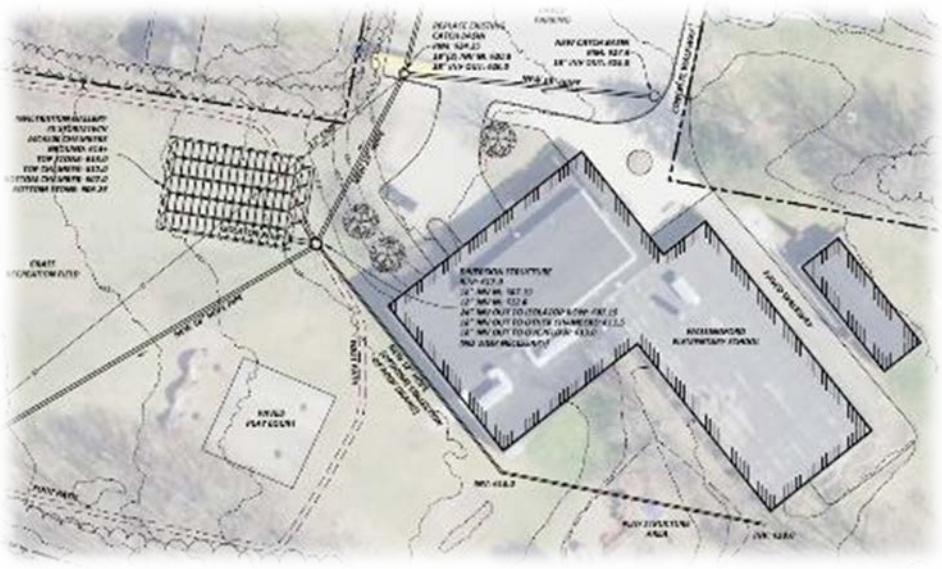


Figure 3: Vignette from the 30% concept design for the Wallingford School infiltration chamber system. The system would take drainage from the entire school area, including some of the road and residential neighborhood adjacent to the school.

Figure 4: Vignette from the 30% concept design for the Wallingford School infiltration chamber system. The system would take drainage from the entire school area, including some of the road and residential neighborhood adjacent to the school.

In order to route runoff to this site, a new diversion structure will need to be installed on School street. This will route the WQv to the chambers. Larger storms should bypass via this overflow. However, the chambers will also have an overflow to Roaring Brook to prevent surcharging of catch basins in the

school's parking lot. An additional two catch basins should be installed in the school's parking lot to capture parking lot runoff.

The school has been notified of this concept and is generally favorable.

Impervious Treated (ac)	Total Drainage Area (ac)	Total Phosphorus Removed Annually (lbs.)	Total Solids Removed (lbs.)	Cost per Pound P removed ($)
4.55	22.75	9.4	10,016	$14,350

Cost:

Table 8: Cost projection for the proposed 30% concept design at the Wallingford School.

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
653.55	Project Demarcation Fencing	LF	400	$ 1.17	$ 468.00
652.10	EPSC Plan	LS	1	$ 1,000.00	$ 1,000.00
649.51	Geotextile for silt fence	SY	60	$ 4.13	$ 247.80
	Construction Staking	HR	8	$ 125.00	$ 1,000.00
				Subtotal:	$ 3,715.80
Chambers - Costs					
	Chambers, Excavation, and Stone	CY	5200	$ 5.50	$ 28,600.00
604.20	Concrete Catch Basin	EACH	3	$ 3,387.59	$ 10,162.77
601.0915	18" CPEP	LF	675	$ 64.04	$ 43,227.00
601.0905	12" CPEP	LF	330	$ 39.24	$ 12,949.20
651.35	Topsoil	CY	100	$30.96	$ 3,096.00
651.15	Seed	LBS	50	$7.66	$ 383.00
				Subtotal:	$ 98,417.97
Subtotal:					$ 102,133.77
	Construction Oversight**	HR	24	$ 125.00	$ 3,000.00
	Construction Contingency - 10%**				$ 10,213.38
	Incidentals to Construction - 5%**				$ 5,106.69
	Minor Additional Design Items - 5%**				$ 5,106.69
	Final Design	HR	40	$ 125.00	$ 5,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	8	$ 125.00	$ 1,000.00
Total (Rounded)					**$ 132,000.00**

6.1.3 Florence Avenue

Description:

Between the road edge and the berm separating the road right-of-way from Roaring Brook, an infiltration swale could be dug to allow for runoff from Florence Avenue and several surrounding residences to drain and infiltrate into soil. The right-of-way is publicly owned. The improvement would consist of excavating the ROW to specifications, amending 18-24" of soil with bioretention media, and replanting with grass seed. The swale would be sloped such that the bottom would allow for up to 1.75' of ponding prior to overflow. An overflow pipe would be installed through the existing berm to allow for runoff bypass to the Brook. This would allow the berm to continue to provide some measure of local flood control, though it should be noted that the primary reason that localized flooding occurs in this location is the undersized stream crossing bridge located downstream of Florence Avenue.

Figure 5: Florence Avenue right-of-way greenspace where the infiltration swale would be installed. The swale would essentially formalize and improve the existing ROW.

Figure 6: Florence Avenue right-of-way greenspace where the infiltration swale would be installed. The swale would essentially formalize and improve the existing ROW.

Impervious Treated (ac)	Total Drainage Area (ac)	Total Phosphorus Removed Annually (lbs.)	Total Solids Removed (lbs.)	Cost per Pound P removed ($)
0.69	1.08	1.34	629.81	$5,970

Cost:

Table 9: Cost projection for the proposed 30% concept design along the Florence Avenue right-of-way.

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 500.00	$ 500.00
653.55	Project Demarcation Fencing	LF	150	$ 1.17	$ 175.50
653.20	Temporary Erosion Matting	SY	250	$ 2.20	$ 550.00
649.51	Geotextile for silt fence	SY	20	$ 4.13	$ 82.60
	Construction Staking	HR	4	$ 125.00	$ 500.00
				Subtotal:	$ 1,808.10
Gravel Wetland					
203.15	Common Excavation	CY	100	$9.86	$ 986.00
651.35	Topsoil (Bioretention Media)	CY	35	$30.96	$ 1,083.60
651.15	Seed	LBS	25	$7.66	$ 191.50
601.0915	18" CPEP Outlet Works	LF	15	$64.04	$ 960.60
				Subtotal:	$ 3,221.70
Subtotal:					$ 5,029.80
	Construction Oversight**	HR	8	$ 125.00	$ 1,000.00
	Construction Contingency - 10%**				$ 502.98
	Minor Additional Design Items - 5%**				$ 251.49
	Final Design	HR	8	$ 125.00	$ 1,000.00
	Permit Review and Applications (exclusive of permit fees)	HR	4	$ 100.00	$ 400.00
Total (Rounded)					**$ 8,000.00**

6.1.4 North Main Street ROW B and C

Description:

Initially a series of above-ground stormwater BMPs were envisioned for the North Main Street area in Wallingford. However, concern over parking, plowing, and traffic flow made it such that these practices were ultimately deemed infeasible. Instead, research was conducted into sub-surface filters that could be relatively easily retrofit to existing catch basins to provide filtration of runoff and limited detention prior to discharge back to the closed stormwater system. Many manufacturers offer such filters, but the University of New Hampshire's Stormwater Center has developed a non-proprietary filter configuration that has been successfully used in the City of Dover, New Hampshire. The filter consists of a normal catch basin grated inlet to a concrete chamber with an overflow weir equipped with a trash rack to remove large debris and other floatables. The runoff passes over the weir or through a series of weep holes in the weir wall into a second larger chamber partially filled with a layer of stone and a sand-based filter media. Runoff is filtered through this media and drains from the fully enclosed structure by a series of small weep holes drilled in the overflow pipe. Larger storms bypass the system via the riser that feeds into the

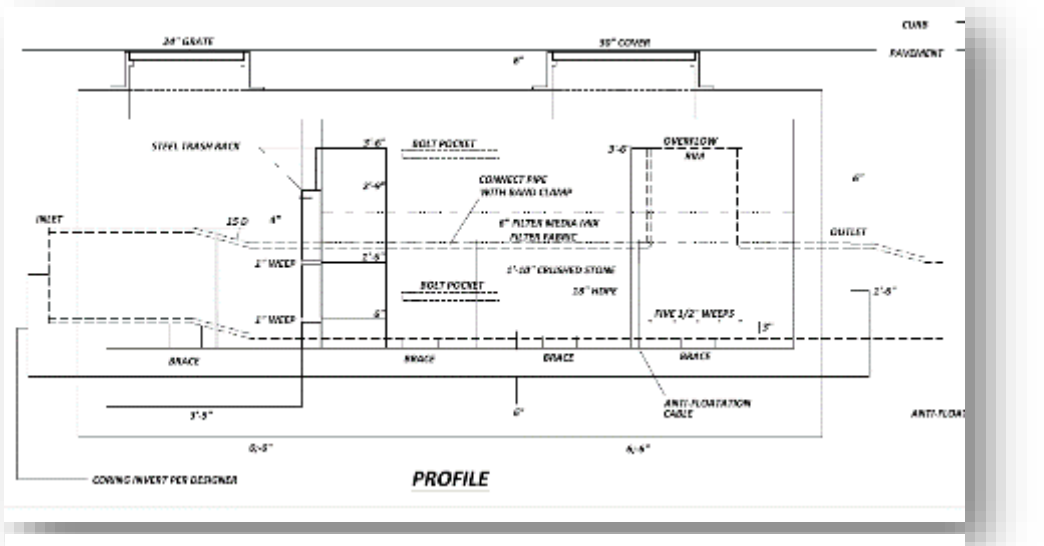


Figure 7: Vignette of the modified media box filter originally developed by the University of New Hampshire Stormwater Center and modified for installation in an 'online' configuration by Watershed Consulting Associates, LLC and Lakeside Environmental Group.

Figure 8: Vignette of the modified media box filter originally developed by the University of New Hampshire Stormwater Center and modified for installation in an 'online' configuration by Watershed Consulting Associates, LLC and Lakeside Environmental Group.

overflow pipe. Each three-piece unit (as originally designed) is designed to treat up to 0.5 acres of impervious cover. An additional segment can be added for each additional 0.25 acres of impervious cover. This practice was chosen as it non-proprietary, is easily serviced, has easily replaceable filter media, and can be installed in the road right of way without impacting traffic, plowing, parking, or adding infiltrated runoff to the road subbase, which was a particular concern expressed by VTrans for this location. VTrans has been appraised of this design and is generally favorable of the concept, though they noted that they aren't necessarily in favor of the increased operation and maintenance that will come with these practices.

The benefits and costs associated with this practice are presented cumulatively below. Please note that phosphorus removal rates are derived from WinSLAMM-based washoff model for the drainage area, along with a research-derived rate for sub-surface filters at the UNH Stormwater Center (from their 2012 Biennial Report).

Impervious Treated (ac)	Total Drainage Area (ac)	Total Phosphorus Removed Annually (lbs.)	Total Solids Removed (lbs.)	Cost per Pound P removed ($)
2.88	9.06	0.75	1,410	$112,000

Cost:

Table 10: Cost projection for the 30% concept design for the North Main Street ROW B and C site.

VTrans Code	Description	Unit	Quantity	Unit Price	Amount
Site Preparation					
	Mobilization	LS	1	$ 1,000.00	$ 1,000.00
653.55	Project Demarcation Fencing	LF	250	$ 1.17	$ 292.50
652.10	EPSC Plan	LS	1	$ 1,000.00	$ 1,000.00
	Construction Staking	HR	8	$ 125.00	$ 1,000.00
				Subtotal:	$ 3,292.50
Chambers - Costs					
N/A	Filters - All	LS	1	$ 36,000.00	$ 36,000.00
604.20	Concrete Catch Basin (optional)	EACH	2	$ 3,387.59	$ 6,775.18
204.20	Trench Excavation of Earth	CY	300	$ 14.05	$ 4,215.00
406.25	Bituminous Concrete Pavement	TON	40	$ 127.86	$ 5,114.40
629.54	Crushed Stone Bedding	TON	38	$ 34.04	$ 1,293.52
301.26	Subbase of Gravel, Fine Graded	CY	5	$ 40.03	$ 200.15
618.15	Bituminous Concrete Sidewalk	TON	5	$ 135.59	$ 677.95
601.0915	18" CPEP	LF	100	$ 64.04	$ 6,404.00
				Subtotal:	$ 60,680.20
Subtotal:					$ 63,972.70
	Construction Oversight**	HR	24	$ 125.00	$ 3,000.00
	Construction Contingency - 10%**				$ 6,397.27
	Incidentals to Construction - 5%**				$ 3,198.64
	Minor Additional Design Items - 5%**				$ 3,198.64
	Final Design	HR	25	$ 125.00	$ 3,125.00
	Permit Review and Applications (exclusive of permit fees)	HR	6	$ 125.00	$ 750.00
Total (Rounded)					**$ 84,000.00**

6.2 30% Concept Design – Unpaved Road-Related

After speaking with the Town of Wallingford, in particular Phil Baker, the Town Road Foreman, a number of sites were investigated throughout the town that have been previously identified as particularly problematic with respect to erosion of non-paved road to surface waters. It is important to note that this work was not meant to replace a road erosion assessment that was conducted during the summer of 2018 by the Rutland Regional Planning Commission under guidelines set forth by the Municipal Roads General Permit (MRGP). This assessment was for the entirety of the town whereas the road segments assessed in this master plan were only for previously identified problem spots. This was done intentionally to focus on areas of concern and to not overlap with work being performed under a different, but related, scope.

Watershed started with an initial list of roads to investigate in general, including

- West Hill Road
- Tifft Road
- Hartsboro Rd
- Town Highway 47
- Ice Bed Road
- Home Stone Road
- Willow Heights Road
- Sugar Hill Road

These roads account for approximately 12.8 miles of road within Wallingford.

Of these roads, it was found that:

- Ice Bed Road had no water-quality related erosion issues of appreciable severity
- Home Stone Road had no water-quality related erosion issues of appreciable severity
- Willow Heights Road was a paved road which, while hydrologically connected to the Otter Creek, fell outside the purview of the scope of work to assess unpaved roads within Wallingford
- Sugar Hill Road had two visible road/stream crossings but the road and ditches were, generally, in good shape and didn't seem to be of particular priority

Given this, the following roads were evaluated according to their relative priority:

- West Hill Road
- Tifft Road
- Hartsboro Road
- Town Highway 47

The most severe erosion issues were found on five different segments of West Hill Road. This road also presented the most feasible context for solution development. Tifft Road is generally very constrained and solutions, beyond road crowning and some ditch armoring, are limited. Town Highway 47 presents a similar problem in that the road is an old 'dugway' with the road and stream pinned tightly to each other. There are few, if any, solutions beyond some road crowning and ditch armoring that could alleviate erosion to the stream. Ideally, TH 47 would be abandoned. Hartsboro Road presented good opportunities for solution implementation, but generally the severity of erosion was much less than that seen on West Hill Road. For these reasons we chose to focus our solution development on West Hill Road. They are presented below in order of relative priority. Please note that West Hill Road 4 was selected as the top priority, with each subsequent segment of lesser priority. None of these road segments would meet MRGP standards in their existing condition.

Please note that for costs the following conditions apply:

- Material costs, where known or applicable, are taken from VTrans 5-year averages for materials as placed (trucking and machine time for placement included).
- Optional practices were *not* included in the overall cost estimate.
- For any unknown cost items (such as road re-crowning or grader berm removal), 30% was added to the overall materials total to account for these costs in an attempt to provide an estimate to accomplish the work.

6.2.1 *West Hill Road 4:*

This segment near 1799 West Hill Road is 1,115' long and has long sections of eroded ditches flowing to a small tributary. Nearly 50% of this overall segment needs to be re-crowned (though it is important to note that the assessment occurred in the fall of the year), and around 50% of the ditching needs to be stabilized in some fashion. In addition, there are undersized culverts along this road segment. In order to bring the segment into compliance with MRGP requirements there are a number of best management practices (BMPs) that should be installed. See the Attachment 6.2 – Road Erosion Solutions for a description of the specific practices and materials estimate. Costs are outlined below.

Figure 9: West Hill Road 4. This road segment needs to be re-crowned.

- Stone armoring of ditches:
  - ~115 CY Type 1 Stone: $5,050 ($43.91/CY)
  - ~30 CY 2-4" Stone: $1,325 ($43.91/CY)
- New Culverts and Rock Aprons:
  - 145' new 18" plastic culvert: $9,285 ($64.04/LF)
  - Type 1 Stone (inlet/outlet): $625 ($43.91/CY)

- Type Stone (rock aprons): $700 ($43.91/CY)
- Grader Berm Removal:
  - 200’ linear feet: Cost Unknown
- Re-Crowning of Road:
  - ~1,115 linear feet Cost Unknown
- Optional Stone Check Dams:
  - Stone Check Dam (each) $22 ($43.91/CY)

- **Total Cost (approximate): $22,000 (total materials plus 30% labor costs for unknowns)**

6.2.2 *West Hill Road 5:*

This segment, which is just downhill of 2048 West Hill Road, is approximately 415' long and has an eroded, steep ditch on the uphill side of the road that flows directly to a small tributary. The ditch needs re-shaping and armoring with stone. Additionally, a section of grader berm needs to be removed and a new road crossing culvert could be installed to take water from the uphill ditch into an open field area on the opposite side of the road before the ditch meets the tributary. Some re-crowning of the road is necessary. See the Attachment 6.2 – Road Erosion Solutions for a description of the specific practices and materials estimate.

Figure 10: West Hill Road 5. The turnout at the bottom of the road is eroding directly into the tributary.

- Stone armoring of ditches:
  - ~50 CY Type 1 Stone: $2,200 ($43.91/CY)
  - ~14 CY 2-4” Stone: $615 ($43.91/CY)
- New Culverts and Rock Aprons:
  - 35’ new 18” plastic culvert: $2,250 ($64.04/LF)
  - Type 1 Stone (inlet/outlet): $175 ($43.91/CY)
  - Type Stone (rock aprons): $220 ($43.91/CY)
- Grader Berm Removal:
  - 150’ linear feet: Cost Unknown
- Re-Crowning of Road:
  - ~415 linear feet Cost Unknown
- Optional Stone Check Dams:
  - Stone Check Dam (each) $22 ($43.91/CY)
  - Stone Chute and Spreader: $500 ($43.91/CY)

- **Total Cost (approximate): $7,800 (total materials plus 30% labor costs for unknowns)**

6.2.3 *West Hill Road 3:*

This segment of road, downhill from 1348 West Hill Road, is approximately 545' long with a 450' long section of ditch on the uphill side of the road that is eroded and needs to be re-shaped and armored. One existing culvert may need to be replaced, or at least dug out of the sediment that is blocking the inlet and outlet, and there is an opportunity to install three road crossing culverts to rock aprons to divert runoff and sediment away from the tributary at the bottom of the hill. There is a 320' section of the road that has a grader berm that should be removed. The road segment also needs to be re-crowned. See the Attachment 6.2 – Road Erosion Solutions for a description of the specific practices and materials estimate.

- Stone armoring of ditches:
  - ~60 CY Type 1 Stone: $2,600 ($43.91/CY)
  - ~14 CY 2-4" Stone: $615 ($43.91/CY)
- New Culverts and Rock Aprons:
  - 90' new 18" plastic culvert: $5,765 ($64.04/LF)
  - Type 1 Stone (inlet/outlet): $615 ($43.91/CY)
  - Type Stone (rock aprons): $615 ($43.91/CY)
- Grader Berm Removal:
  - 320' linear feet: Cost Unknown
- Re-Crowning of Road:
  - ~545 linear feet Cost Unknown
- Optional Stone Check Dams:
  - Stone Check Dam (each) $22 ($43.91/CY)

- **Total Cost (approximate): $13,000 (total materials plus 30% labor costs for unknowns)**

6.2.4 *West Hill Road 2:*

This road segment, uphill of 1107 West Hill Road and downhill of Hounds Hill Road, is approximately 440' long and has a 375' length of eroded ditch on the uphill side of the road that flows directly to a tributary. This section of road is heavily impacted by the steep, private Hounds Hill Road. This driveway flows to West Hill Road and contributes a significant amount of runoff and sediment. There is an opportunity to install a road crossing culvert to accept flow from Hounds Hill Road and direct it to a field on the downhill side of the road, which will help alleviate erosion to the tributary. Generally, the road did not have a grader berm and was not in need of re-crowning. See the Attachment 6.2 – Road Erosion Solutions for a description of the specific practices and materials estimate.

Figure 11: West Hill Road 3. Grader berm needs removing and the ditch is eroding.

- Stone armoring of ditches:
  - ~45 CY Type 1 Stone: $1,975 ($43.91/CY)
  - ~14 CY 2-4" Stone: $615 ($43.91/CY)
- New Culverts and Rock Aprons:
  - 35' new 18" plastic culvert: $2,250 ($64.04/LF)
  - Type 1 Stone (inlet/outlet): $220 ($43.91/CY)

  - Type Stone (rock aprons): $310 ($43.91/CY)
- Optional Stone Check Dams:
  - Stone Check Dam (each) $22 ($43.91/CY)

- **Total Cost (approximate): $7,150 (total materials plus 30% labor costs for unknowns)**

6.2.5 *West Hill Road 1:*

This road segment, located downhill of 518 West Hill road, is approximately 580' long and has ditches on both sides of the road that are steep and eroded that lead directly to a small tributary. The road segment should be re-crowned, though there was no evidence of a grader berm. There are two opportunities to install a road crossing culvert to a rock apron, though driveways on the receiving side of the road will be a complicating factor. Additionally, the stream crossing culvert at the bottom of the road segment appears to be undersized and in poor condition. At minimum a culvert that matches the stream's bankfull width should be installed. A hydraulic or bankfull width assessment of the culvert was not done as part of this scope of work. See the Attachment 6.2 – Road Erosion Solutions for a description of the specific practices and materials estimate.

Figure 12: West Hill Road 1. Misaligned and undersized culvert at bottom of road segment.

- Stone armoring of ditches:
  - ~120 CY Type 1 Stone: $5,270 ($43.91/CY)
  - ~35 CY 2-4" Stone: $1,550 ($43.91/CY)

- New Culverts and Rock Aprons:
  - 70' new 18" plastic culvert: $4,500 ($64.04/LF)
  - Type 1 Stone (inlet/outlet): $350 ($43.91/CY)
  - Type Stone (rock aprons): $475 ($43.91/CY)
- Re-Crowning of Road:
  - ~580 linear feet Cost Unknown
- Optional Stone Check Dams:
  - Stone Check Dam (each) $22 ($43.91/CY)
  - Stone Level Spreaders $500 each (2X)

- **Total Cost (approximate): $16,000 (total materials plus 30% labor costs for unknowns)**

As all of these projects are located on West Hill, the cost of doing them together could potentially decrease the overall project cost due to economies of motion with respect to mobilization/demobilization of equipment and other resources.

The total cost projection to accomplish all five of these projects together is $65,950.

Annotated solutions maps can be seen in Attachment 6.2 – Road Erosion Solutions – Solutions.

6.2.6 Next Steps

We would recommend that these priority sites be visited by the road foreman for inspection and fine-tuning of material estimates, as well as estimation of labor costs. These fine-tuned material costs and labor cost estimates could then be put together in a Better Roads Grant for FY2019 to fund implementation of these solutions.

7 Summary and Recommendations:

The results of the Town of Wallingford Stormwater Master Planning process have identified and refined designs for a number of potential sites that could have an impact on water quality on water bodies throughout the Town. The following is a summary of the steps necessary to bring each of these projects to full implementation.

7.1 Implementation – Next Steps

Under Projects to Implement there are two sub-categories - 30% Concept Design – Non-Road Sites and 30% Concept Designs – Unpaved Road-Related Sites.

7.1.1 30% Concept Design Sites – Non-Road Sites

The 30% design sites should now proceed to full 100% design and implementation, once final stakeholder buy-in has been accomplished if and where necessary. In accordance with VT DEC Design Terminology and Guidance, this scope of work will entail updating the designs to 60% concept by further involving stakeholders (where necessary), refining permitting requirements and updating applications, updating cost estimates for all aspects of construction, and updating of plans to show additional specifications or details beyond the 30% level. Once accomplished, design can proceed to the 90% and then 100% level which comprises plan sets of sufficient quality for regulatory agency review and contractor construction, bidding documents (general conditions, supplementary conditions, specifications, and schedule, with bid form, definitions, and proposed agreement at the 100% level), and final cost projections with reduced contingency to reflect the level of design.

7.1.1.1 Family Dollar

This project primarily requires additional outreach to both the property owner and the business operator (Family Dollar) to formalize an agreement to either obtain an access easement or fee simple purchase of the property in order to install the sub-surface practice. As this potential retrofit would treat the majority of runoff from the developed core of Wallingford and have a substantial impact on water quality in the Otter Creek, this project is worth pursuing. An additional grant should be sought for final design to the 100% construction plan level. The Ecosystem Restoration Program (ERP) would be the most likely source for this funding as the project has already been identified as a priority as part of this stormwater master plan.

7.1.1.2 Wallingford School

This is a worthwhile project to pursue as it would treat nearly all of the school's runoff, as well as a substantial portion of runoff from the roadway and adjacent residential development area. The school has already expressed their willingness to participate and as a publicly owned piece of land, access and use negotiations should be easier than for private property. The largest remaining question for this site is the exact location of the school's roof drain outlet pipe, which was not definitively located in the field, nor was it found on plans provided by the school. This would be resolved during the final design process. This site would be a good site to pursue under a subsequent ERP final design grant. It is important to note that this project could also qualify for funding under the forthcoming so-called 'green schools' grant program in development by the State. This grant program has yet to be fully defined but may include provisions for conducting final design and implementation of stormwater retrofits at schools.

7.1.1.3 Florence Avenue Right of Way A

The intent of this practice was to provide the town with a simple, easily replicated infiltration practice that could be installed in the road right-of-way wherever space is available. As such, it was intended that the simplicity of the design would lend itself to implementation by the town road crew (or for a relatively small construction fee by a qualified subcontractor). There is also a program sponsored by the State that specifically funds organizations like the Vermont Youth Conservation Corps (VYCC) in constructing smaller, simpler practices like this for towns or other organizations. This practice is an ideal project for this program and should be submitted for implementation to VYCC.

7.1.1.4 North Main Street ROW B and C

The media box filter represents a potentially very important type of practice to implement in Vermont. Many of Vermont's road and highways are hydrologically connected and lack open space in which to install stormwater retrofit practices. The media box filter as designed represents an excellent opportunity to pursue a non-proprietary, easily maintained, replicable, and flexible stormwater management solution for transportation corridors. The modifications made to the original UNH Stormwater Center design allow the filter to be installed either on- or offline (online in order to bypass flows from upstream catch basins through the filter, thereby reducing the space needed and construction complexity).

7.1.2 *Road Erosion Projects*

Each of the priority sites should be initially visited by the Town of Wallingford Road Foreman to fine-tune solution selection and cost-estimation for materials and labor as all costs given here are taken from VTrans estimation documents. The preliminary cost estimates are as follows:

Site	Priority	Cost
West Hill Road 4	1 of 5	$22,000
West Hill Road 5	2 of 5	$7,800
West Hill Road 3	3 of 5	$13,000
West Hill Road 2	4 of 5	$7,150
West Hill Road 1	5 of 5	$16,000
TOTAL		**~$65,950**

These projects would all potentially be eligible for a Better Roads Category A grant. However, a town-wide erosion inventory may be required prior the program accepting the grant application as an erosion inventory and implementation plan in accordance with the pending Municipal Roads General Permit is required. This work is currently being performed by the Rutland County RPC.

7.2 *Additional Projects to Pursue*

7.2.1 *Other Best Management Practices (Structural):*

There are a number of other sites in the Town of Wallingford that could be pursued for additional assessment, design, and potential implementation.

7.2.1.1 *Railroad Street ROW A*

We would recommend conducting additional investigation into this site in order to develop a similar design to Florence Avenue ROW A. This could be done relatively simply.

7.2.1.2 *Bill Fox Road ROW A*

This site is an unpaved road segment that could easily be repaired by re-crowning the road and improving the adjacent ditch through armoring or check dams. This work could easily be investigated and performed by the town's road crew.

7.2.1.3 Main Street Drainage A and Main Street Drainage B

Both of these drainage systems outlet to private property. The drainage channels then continue under the railroad tracks to a parcel of public land, most of which is in the floodplain as determined during a site visit with Josh Carvajal. There may also be wetlands concerns as determined during this same site visit by Zapata Courage. However, there may be some opportunity here still. Both officials expressed their belief that, with additional investigation and delineation, a solution might be found that would both treat stormwater and not interfere with natural resources. In addition, the private property owner at the outlet of South Main Street Drainage B expressed his interest in partnering with the town on developing a solution at his site, though he indicated that property acquisition might be part of the deal.

7.2.1.4 Elm Street ROW A

This site is similar to both Florence Avenue ROW A and Railroad Street ROW A in that a relatively small, simple roadside practice could be developed here and implemented by the town with a minimum of additional design.

7.2.1.5 Additional Top 20 Sites (excluding Mac's Market)

Seven of the ten proposed sites in the Top 20 list are road-related sites. A separate scope of work could be developed that would look at these sites in more depth, in particular with respect to actual right-of-way boundaries, soil quality, available space, and utility or other feature conflict, to determine and design a suite of final practices for implementation.

7.2.1.6 Mac's Market

The Mac's Market gas station, located in the Village of East Wallingford, is a small but busy convenience store located directly on the banks of the Mill River. Though privately owned and highly constrained by available space, could be a good site to consider for further design efforts as its high use potentially make it a hot spot for pollution to the River. Initial outreach should be conducted before entering into any agreement for a design scope of work to gauge landowner interest.

7.2.2 *Other Best Management Practices (non-structural):*

7.2.2.1 *Adopt Town-specific Stormwater Bylaws*

Many towns in Vermont are working to adopt Town-specific stormwater bylaws, whether as part of an MS4 permit or as an initiative to preserve water quality and protect infrastructure within their jurisdiction. These bylaws are meant to complement the VT DEC stormwater regulations for 'sub-jurisdictional' development (essentially any development that would not be covered under a State stormwater permit).

In order to encourage the adoption of such practices, the Vermont League of Cities and Towns (VLCT) has created a set of model bylaws addressing site development during all phases of construction: pre-, during, and post-construction stormwater management practices designed to minimize soil disturbance, reduce or eliminate sediment-laden runoff, and manage site-specific stormwater after construction has finished. These bylaws are intended to be modified by each municipality to fit their desired goals.

To support adoption of these bylaws, the VLCT has also prepared a manual and sizing tool titled the Vermont Green Stormwater Infrastructure Simplified Sizing Tool for Small Projects. Debuted in October, 2015, this manual and tool are specifically aimed at small, sub-jurisdictional sites in Vermont.

Adopting bylaws and encouraging the use of the simplified small sites sizing tool in Wallingford could have a net benefit for the Town in terms of reduction of load on existing stormwater infrastructure and pollutant removal enhancement - ensuring compliance with the Lake Champlain TMDL. Jurisdictional stormwater regulations may not guarantee that cleanup goals are met – and not meeting those goals could lead to stricter regulations across a broader array of sites. Enacting a Town-specific program now could prevent further regulations in the future. A model for this program and tools for implementation can be found as part of Attachment 2.3 – Related Documents (part of the Task 2 Data Library).

7.2.2.2 *Adopt and Promote Usage of the VT DEC's Guide to Stormwater Management for Homeowners and Small Businesses*

This guide is specifically aimed at sub-jurisdictional stormwater management practices that are easy for residents and small businesses to adopt. It contains helpful explanations of each practice, along with illustrations for each, and other resources to use when considering implementing stormwater management on small properties. Encouraging the adoption of the guidelines laid out in this manual could

have an appreciable cumulative impact on water quality in the Town of Wallingford. That document can be found here: https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/2018-06-14%20VT_Guide_to_Stormwater_for_Homeowners.pdf

7.2.2.3 *Enact Town-wide Illicit Discharge Detection and Elimination (IDDE) Program*

The Town of Wallingford was the beneficiary of a grant through the VT DEC that investigated the presence of illicit discharges in and around the Town. Several potential illicit discharges were found and most were considered resolved. However, one potential discharge of potentially detergent-laden water from #56 Church Street, was not definitively eliminated (at least according to the report submitted to the VT DEC on March 31, 2014). It was noted in that report that the Town was actively pursuing the owner to compel them to inspect the house's plumbing and eliminate the discharge. It is not known from this report if this work was finalized.

Currently, the Town does not have its own IDDE program. As many illicit discharges are the result of broken sanitary or stormwater infrastructure (sagging or broken pipes, leaks in old clay-tile pipe joints, etc.), it is recommended that that Town adopt a town-specific IDDE program that conducts an annual dry weather outfall survey to look for water flowing during periods of no precipitation. This could lead to the regular detection of illicit discharges, dumping, or other issues. Now that the Town possesses updated stormwater system mapping information, as well as sanitary sewer mapping information, this process could be economical.