



Town of Milton Phosphorus Control Plan

Final Report

April 1, 2021

SUBMITTED TO:

Dan Albrecht
Senior Planner
Chittenden County Regional Planning Commission
110 W Canal Street #202
Winooski, VT 05404
dalbrecht@ccrpcvt.org

&

Town of Milton
43 Bombardier Rd
Milton, VT



SUBMITTED BY:

Andres Torizzo & Kerrie Garvey
Watershed Consulting Associates, LLC
208 Flynn Ave Suite 2H | PO Box 4413
Burlington, VT 05406
(802) 497-2367
www.watershedca.com





Table of Contents

1. Introduction and Project Overview	1
2. PCP TP Reduction Target	2
3. Existing Conditions Assessment	5
3.1. Structural BMPs	5
3.1.1 Desktop Assessment	5
3.1.2 Field Assessments	5
3.2 MRGP Compliance	8
3.2. Non-Structural Practices	11
3.3 Town Ordinances	11
3.4. Existing Conditions Modeling Summary	11
4. Proposed Conditions	11
4.1. Proposed Conditions Review	11
4.2. Proposed Structural BMPs	12
4.3. Non-Structural Practices	14
4.4. MRGP Compliance	15
5. BMP Ranking	20
5.1. Ranking Results	21
6. Modeling Summary	22
7. Implementation Schedule	22
8. Summary	23

List of Appendices:

A - Overview Map of Municipal Developed Lands	G - Proposed Structural BMPs Overview Map
B - Private BMPs Table	H - Proposed Structural BMPs Crediting Table
C - Existing Structural BMPs Overview Map	I - Proposed Condition - REI Crediting Overview Map
D - Existing MRGP Projects - Modeling Assessment Overview Map	J - Proposed Condition - REI Crediting Table
E - Existing MRGP Projects - Crediting Table	K - BMP Ranking Spreadsheet
F - Town Regulations Summary	L – BMP Implementation Schedule

Disclaimer:

This project was supported by the Federal Highway Administration, the Vermont Agency of Transportation, the Chittenden County Regional Planning Commission, and the Town of Milton. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation or the Vermont Agency of Transportation.



1. Introduction and Project Overview

The Town of Milton is a Municipal Separate Storm Sewer System (MS4) permit holder with a significant amount of municipal developed lands (Figure 1; see Appendix A for a larger version of this map) located in Chittenden County within the Lake Champlain Basin. A phosphorus Total Maximum Daily Load (TMDL) was developed for Lake Champlain to reduce export of this nutrient that is harmful in excess to the lake. As a part of compliance with this TMDL and under the National Pollutant Discharge Elimination System (NPDES) MS4 permit, MS4 communities within the Lake Champlain Basin are required to complete a Phosphorus Control Plan (PCP) for municipally owned developed lands within their municipality.

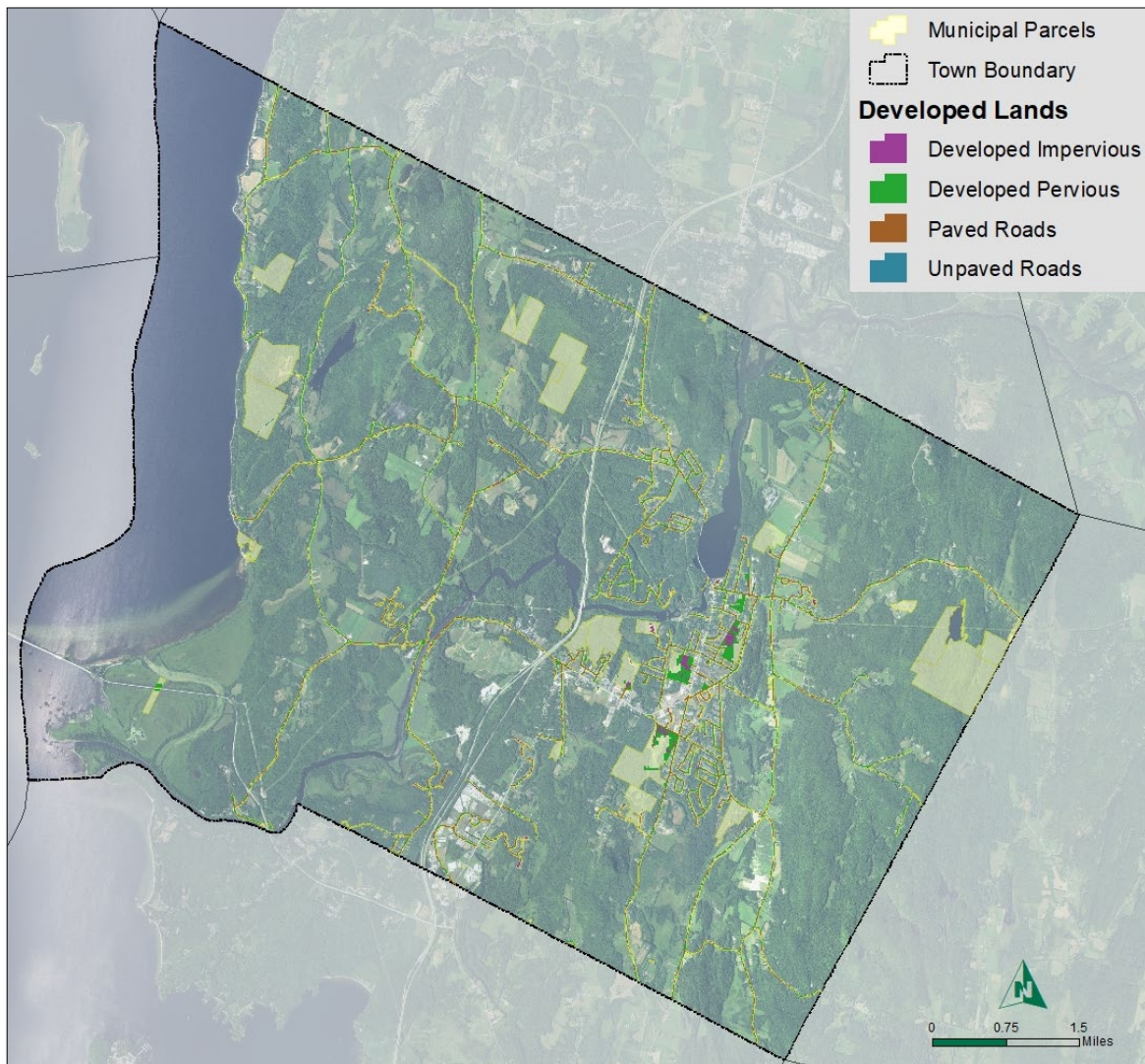


Figure 1. Municipal developed lands in the Town of Milton (673.37 acres).

This PCP provides a plan for the Town to achieve the percent total phosphorus (TP) reduction target for the Malletts Bay Lake Segment (20.5%), Northeast Arm Lake Segment (7.2%), and 3-acre parcels (35.0%). The development of the PCP included an assessment of existing structural and non-structural best management practices (BMPs), Town stormwater ordinances, and proposed structural BMPs. This PCP identifies the suite of practices that will collectively achieve the required TP loading reduction for the Town.



2. PCP TP Reduction Target

Under the NPDES MS4 permit, developed land within municipally owned and controlled areas of Milton must comply with the TP reduction goals of the PCP including:

1. Municipal roads and municipal rights of way,
2. Municipally owned parcels (excluding schools), and
3. Sites subject to the 3-acre requirements for which the Town assumes full legal responsibility.

The Town's developed lands are predominantly paved roadways and municipally owned parcels. The GIS parcel data utilized for the 2019 Milton Stormwater Master Plan (SWMP) served as a reference for the development of the TP reduction target. This dataset was updated by Watershed staff to be consistent with the most recent dataset of municipally owned parcels sourced from the Vermont Open Geodata Portal and confirmed by Town staff. The initial TP reduction target from the 2019 Milton SWMP (71.8 kg/yr) was revised to accurately reflect the appended municipal lands dataset. Two parcels subject to the Vermont 3-acre permit with several proposed structural best management practices (BMPs) where the Town plans to take on management of these practices, Milton Middle School and Milton High School, were identified during the proposed conditions assessment (See Section 4.2 – Proposed Structural BMPs). The baseload for the Town was updated to include these two properties. The revised TP reduction target for the Town of Milton is 79.85 kg/yr. See below for a description of this TP reduction target calculation.

Developed lands within municipal parcels are categorized as phosphorus baseload areas and count towards the Town's calculated phosphorus load (Figure 1). This categorized Developed Lands dataset, based on the 2011 Lake Champlain Basin Impervious cover dataset and the developed lands category from the National Land Cover Dataset, was provided by the VT DEC. Roads were divided into paved and unpaved categories based on the surface type in the Vermont Agency of Transportation (VTrans) road centerline data. A summary of the area per developed land category and the TP loading rate (provided by the VT DEC) for each of the developed land classes can be found below in Table 1. The loading rate was multiplied by the developed lands area to determine the annual TP loading.



Table 1. Acreage, loading rate, and total phosphorus load based on land use class for developed lands within the Town of Milton.

Loading Rate Class	Area (ac)	Loading Rate (kg/ac/yr)	TP Baseload (kg/yr)
Malletts Bay - Malletts Bay - DD			
Unpaved Road	5.60	2.01	11.25
Paved Roads	92.11	0.83	75.99
Developed Pervious	106.34	0.01	1.28
Developed Impervious	18.93	0.83	15.61
Malletts Bay - Lamoille River			
Unpaved Roads	6.58	2.03	13.39
Paved Roads	115.72	1.14	131.69
Developed Pervious	134.81	0.23	30.73
Developed Impervious	22.78	1.14	25.92
Northeast Arm - Northeast Arm - DD			
Unpaved Road	28.15	2.07	58.18
Paved Roads	34.76	1.14	39.76
Developed Pervious	53.14	0.30	15.84
Developed Impervious	3.37	1.14	3.86
3-Acre Parcels - Lamoille River			
Unpaved Road	0.00	2.03	0.00
Paved Roads	0.05	1.14	0.06
Developed Pervious	36.67	0.23	8.36
Developed Impervious	14.38	1.14	16.36
<i>Total</i>	<i>673.37</i>		<i>448.28</i>

Milton has 673.37 acres of municipally owned developed land of which 330.95 acres are developed pervious, 59.45 acres are developed impervious, 242.64 acres are paved roads, and 40.33 acres are unpaved roads. The Town's total TP baseload is 448.28 kg/yr (Table 1).

Municipal paved roads account for more than half of the Town's total phosphorus load, 247.5 kg/yr. The second highest contributor is unpaved roads (82.8 kg/yr), followed by developed impervious surfaces (61.8 kg/yr), and developed pervious, (56.2 kg/yr; Table 1).

The Town is subject to the required TP reduction for municipal lands in the Northeast Arm lake segment (7.20%), the Malletts Bay lake segment (20.50%), and for 3-acre parcels (35.0%). See Figure 2 for an overview map of the lake segment basins within the Town of Milton. Note that the Lamoille River drainage area and the Malletts Bay Direct Drainage (DD) area are both part of the Malletts Bay Lake Segment. These



two values have been summed to calculate the values shown for the Malletts Bay Segment Subtotal. The calculated TP reduction goal for the PCP is 79.85 kg/yr (Table 2).

Table 2. Base Load and P Reduction Target Calculations for the Town of Milton.

Lake Segment	Developed Land Area (acres)	Base Load (kg/year)	Percent Reduction Target	P Reduction Target (kg/year)
Malletts Bay (including Lamoille River and Malletts Bay DD)	502.87	305.87	20.50%	62.70
Northeast Arm	119.41	117.63	7.20%	8.47
3-Acre Parcels	51.10	24.78	35.0%	8.67
Total	673.37	448.28	--	79.85

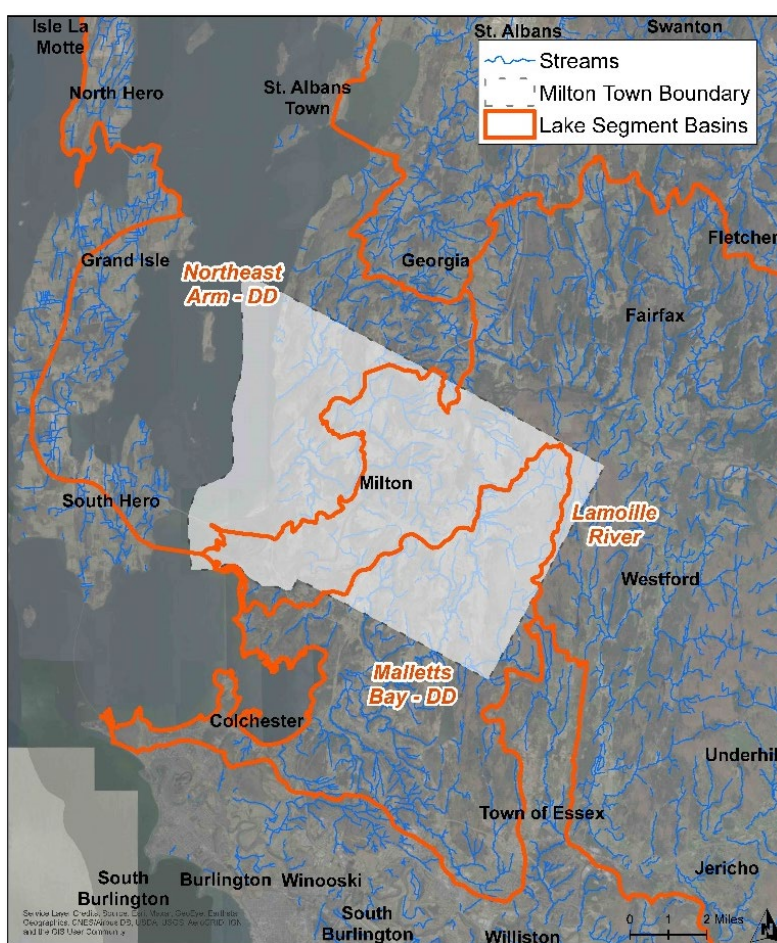


Figure 2. The Town of Milton falls within the Northeast Arm and Malletts Bay (including Malletts Bay DD and Lamoille River) lake segments.



3. Existing Conditions Assessment

3.1. Structural BMPs

Structural BMPs are constructed practices such as gravel wetlands, bioretention areas, and sand filters designed to manage stormwater runoff. To be eligible for credit towards the PCP, BMPs must meet the following set of criteria:

- a. Structures must have been constructed between 2002 and July 1st, 2010. This timeframe is distinguished by when the 2002 Vermont Stormwater Management Manual was adopted, which set minimum standards for stormwater management practices and the end of the Vermont TMDL modeling period in 2010.
- b. BMPs installed after July 1st, 2010 will also receive credit for treating redeveloped or pre-existing impervious cover that did not require a new stormwater permit.
- c. Structures must be on municipally owned land, or, if structures are on private land, the Town must enter a maintenance agreement with the landowner(s) to establish phosphorus crediting eligibility for said structure.

3.1.1 Desktop Assessment

A review was completed of Vermont operational stormwater permits issued within the Town of Milton to identify existing structural BMPs potentially eligible for TP reduction credit. Permits were filtered to meet the criteria described above, and eight privately owned structural BMPs were identified. Currently, due to private ownership, these BMPs are ineligible for crediting. However, if the Town later decides to incorporate maintenance and management of these structures into their MS4 permit, they may be eligible for credit. These eight BMPs are described in Appendix B. These BMPs are not currently included in the TP reduction crediting for the PCP.

All readily available GIS data related to stormwater infrastructure in the Town of Milton was also referred to during this desktop assessment. The limited availability of this GIS data was acknowledged as a data gap in the Town's 2019 SWMP. As described in the SWMP, the Town is actively working to generate and maintain stormwater infrastructure GIS data.

3.1.2 Field Assessments

Seven existing practices were identified in the field including one structural BMP and six road-based practices. A map of their point locations can be found in Appendix C. Listed below are brief descriptions of these practices.



1. Milton Town Library Swale

A grass swale was identified south of the Milton Town Library on Bombardier Road. The feature runs parallel to the southern edge of the Municipal Building parking lot. The swale was determined to be in good condition (Figure 3).



Figure 3. Municipal Building Swale.

2. Beebe Hill Road South

A municipal roads project grant for Beebe Hill Road was identified via the Vermont DEC's Clean Water Project Explorer. A recently installed stone-lined ditch and driveway culvert were identified as practices associated with this grant. The swale was determined to be in good condition (Figure 4).



Figure 4. Beebe Hill Road (South) Stone-Lined Ditch.

3. Beebe Hill Road North

Upgrades to the stretch of Beebe Hill Road that surrounds its passage over Stone Bridge Brook were also documented. This included stone lined ditching, a sediment trap, road crown improvements, bank stabilization, turnout upgrades, and culvert upgrades (Figure 5).



Figure 5. Beebe Hill Road (North).

4. McMullen Road

A number of upgrades were made to a section of McMullen Road just to the west of Malletts Creek. Work included removal of a grader berm, improvements to existing ditching, installation of check dams, stabilization of the existing turnout, storm armoring the bank, and sediment removal from driveway culverts (Figure 6).



Figure 6. McMullen Road.



5. Kingsbury Crossing Ditching Improvements

Several upgrades were made to the ditching along a steep section of Kingsbury Road, east of the intersection with Pleasant Place. Upgrades included the installation of stone-lined ditching and stone aprons at the ends of each ditch (Figure 7).



Figure 7. Kingsbury Road Ditching.

6. Cadreact Road

Various improvements were made to a stretch of Cadreact Road surrounding its crossing over Trout Brook. This was the highest priority project during a 2017 Road Erosion Inventory of the Town. Improvements included installation of new stone-lined ditching, removal of various grader berms, installation of stone aprons at the end of ditches, and gully stabilization (Figure 8).



Figure 8. Cadreact Road.

7. Westford Road

Improvements to a portion of Westford Road near the intersection with Ted Road were also identified. Improvements included stone lining the ditches, lowering the road shoulder, and improving the road crown (Figure 9).



Figure 9. Looking West from Westford / Ted Road Intersection



The crediting assessment considered the seven existing practices within the Town described above. Of these BMPs, six are road-based practices that were implemented following the Road Erosion Inventory (REI) in compliance with the Municipal Roads General Permit (MRGP). The remaining project is a grass treatment swale located at the Town's municipal complex that was completed as part of the Library Expansion. However, as this project required a State stormwater permit and was constructed after July 1, 2010, it is not eligible for credit under the Town's PCP.

3.2 MRGP Compliance

There are six MRGP compliance projects eligible for credit under the PCP consisting of 18 road segments, each of which is 100 meters in length. The linear loading rates for these road segments were calculated using the Vermont Agency of Natural Resources Department of Environmental Conservation's "Standard Operating Procedures for Tracking & Accounting of Stormwater Permit Program: Municipal Roads General Permit (MRGP)" published on June 1, 2020 (Table 3). These rates were applied to each of these segments to determine the P loading per segment. The linear loading rates can be found in Table 3. The six MRGP project locations in the Town are located within the Malletts Bay (Direct Drainage) and Northeast Arm (Direct Drainage) drainage areas. A map of these project locations can be found in Appendix D.

Table 3. Linear loading rates table excerpted from the "Standard Operating Procedures for Tracking & Accounting of Stormwater Permit Programs: Municipal Roads General Permit (MRGP)".

Appendix C. MRGP Linear Loading Rates

Table C-1. MRGP unpaved Class 1-3 phosphorus loading rates (kg/km/yr) for the Lake Champlain basin. Data modified from Tetra Tech (2015). CSO = combined sewer overflow. DD = direct drainage to lake segment. % = road slopes. Data may be updated following completion of all REIs.

Drainage Areas	Hydrologically Connected Segments									Un- connected Segments
	Fully Meets MRGP Standards			Partially Meets MRGP Standards			Does Not Meet MRGP Standards			
	<5%	5-10%	>10%	<5%	5-10%	>10%	<5%	5-10%	>10%	
Burlington Bay - CSO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Burlington Bay - DD	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Isle La Motte - DD	1.054	3.506	6.130	3.162	10.518	18.391	5.271	17.530	30.652	1.005
Lamoille River	0.937	3.118	5.452	2.812	9.354	16.355	4.687	15.589	27.259	0.894
LaPlatte River	0.998	3.318	5.802	2.993	9.954	17.406	4.988	16.590	29.009	0.951
Lewis Creek	0.900	2.995	5.237	2.701	8.984	15.710	4.502	14.974	26.183	0.858
Little Otter Creek	1.246	4.145	7.248	3.739	12.436	21.745	6.232	20.727	36.242	1.188
Main Lake - DD	0.956	3.180	5.560	2.868	9.539	16.680	4.780	15.898	27.799	0.911
Malletts Bay - DD	0.957	3.184	5.568	2.872	9.553	16.703	4.787	15.921	27.839	0.913
Mettawee River	0.986	3.280	5.734	2.958	9.839	17.203	4.930	16.398	28.672	0.940
Missisquoi Bay - DD	1.046	3.481	6.086	3.139	10.442	18.258	5.232	17.403	30.430	0.997
Missisquoi River	1.026	3.412	5.966	3.077	10.235	17.897	5.129	17.059	29.829	0.978
Northeast Arm - DD	1.213	4.035	7.056	3.640	12.105	21.167	6.066	20.175	35.278	1.156

REI data was utilized to determine segment slope and the pre-retrofit MRGP standard compliance level (i.e., Fully Meets, Partially Meets, or Does Not Meet). The post-retrofit condition was assumed to Fully Meet Standards. The percent P reduction was calculated using the change in MRGP standard compliance level. This percent reduction in compliance status was also obtained from the 2010 publication "Standard Operating Procedures for Tracking & Accounting of Stormwater Permit Programs: Municipal Roads General Permit (MRGP)". The percent reductions are included in Table 4 below. For example, if a segment were originally assessed as "Does Not Meet" standards, and through an implemented fix of the segment, was reassessed as "Fully Meets" standards, that segment would receive an 80% reduction in P loading.

**Table 4. Phosphorus reduction efficiencies as determined by change in MRGP compliance.***Table 3. Total phosphorus load reduction efficiencies* based on change in MRGP compliance status.*

To \ From		Pre-Construction Compliance Status	
		Partially Meets	Does Not Meet
Post Construction Compliance Status	Partially Meets	0%	40%
	Fully Meets	40%	80%

* Percent reductions are calculated relative to the loading rate for segments not meeting standards

In total, these six MRGP compliance projects will reduce P loading by 14.2 kg/yr. A summary table is included below (Table 5). The complete calculations for crediting for these six projects can be found in Appendix E.

**Table 5. P reduction summary table for the six MRGP compliance projects.**

Road Name	Road Segment ID	Lake Segment	Road Slope (%)	Road Material	Pre-Construction Standard	Segment P Loading (kg/yr)	Post-Construction Standard	Post-Construction P Reduction (%)	Post-Construction P Reduction (kg/yr)
McMullen Road	38891	Malletts Bay - DD	4.63	Paved Non-Curbed	Does Not Meet	0.45	Fully Meets	80%	0.36
McMullen Road	38892	Malletts Bay - DD	7.43	Paved Non-Curbed	Does Not Meet	0.60	Fully Meets	80%	0.48
McMullen Road	38893	Malletts Bay - DD	11.58	Paved Non-Curbed	Does Not Meet	0.75	Fully Meets	80%	0.60
Kingsbury Crossing	1	Malletts Bay - DD	11.32	Gravel	Does Not Meet	2.78	Fully Meets	80%	2.23
Kingsbury Crossing	6	Malletts Bay - DD	1.34	Gravel	Fully Meets	0.10	Fully Meets	0%	0
Cadreact Brook Rd	27	Northeast Arm - DD	1.88	Gravel	Does Not Meet	0.61	Fully Meets	80%	0.49
Cadreact Brook Rd	28	Northeast Arm - DD	9.57	Gravel	Does Not Meet	2.02	Fully Meets	80%	1.61
Cadreact Brook Rd	29	Northeast Arm - DD	5.58	Gravel	Does Not Meet	2.02	Fully Meets	80%	1.61
Cadreact Brook Rd	30	Northeast Arm - DD	0.70	Gravel	Does Not Meet	0.61	Fully Meets	80%	0.49
Beebe Hill Road S	35	Northeast Arm - DD	9.84	Gravel	Does Not Meet	2.02	Fully Meets	80%	1.61
Beebe Hill Road S	36	Northeast Arm - DD	1.94	Gravel	Does Not Meet	0.48	Fully Meets	80%	0.38
Beebe Hill Road S	37	Northeast Arm - DD	6.08	Gravel	Does Not Meet	2.02	Fully Meets	80%	1.61
Beebe Hill Road N	15	Northeast Arm - DD	0.01	Gravel	Partially Meets	0.36	Fully Meets	40%	0.15
Beebe Hill Road N	16	Northeast Arm - DD	7.95	Gravel	Does Not Meet	2.02	Fully Meets	80%	1.61
Beebe Hill Road N	17	Northeast Arm - DD	4.24	Gravel	Does Not Meet	0.61	Fully Meets	80%	0.49
Westford Rd	72163.1	Malletts Bay - DD	0.85	Paved Non-Curbed	Fully Meets	0.09	Fully Meets	0%	0
Westford Rd	72164.1	Malletts Bay - DD	0.54	Paved Non-Curbed	Fully Meets	0.09	Fully Meets	0%	0
Westford Rd	72165.1	Malletts Bay - DD	8.60	Paved Non-Curbed	Does Not Meet	0.60	Fully Meets	80%	0.48
Total						18.21			14.20



3.2. *Non-Structural Practices*

Non-structural practices such as catch basin cleaning and street sweeping can be eligible for credit under the PCP. The Town's SWMP (last revised May 14, 2019) describes the Town's approach to catchbasin cleaning and street sweeping. The plan notes that the Town owns a vacuum-truck for cleaning catchbasins, culverts, and stormwater ponds (where practical). The plan notes "catch basin maintenance is prioritized based on the percent of sediment buildup in the sump. Catch basins are cleaned when 50% or more of the sump is filled. The Town will inspect at least 33% of its catch basins and outfalls each year, and repair and/or replace them as deemed necessary". In 2018, 46 catchbasins were cleaned. The plan states that the Town partners with neighboring communities to complete annual street sweeping in the spring in the Town core and major intersections. The Town of Milton sweeps approximately eight road lane miles of paved and curbed roads annually, collecting an estimated twelve cubic yards of material.

The Town indicated that catchbasin vactoring has been completed in this manner for at least 20 years. Street sweeping began at approximately at the same time. Per the VT DEC's "Tracking and Accounting of Non-structural Practice" document, TP reduction credit can only be given for an increase in street sweeping during or after the TMDL modeling period. "The base year for fully credit is 2010, based on the end of the modeling period for the Lake Champlain TMDL. Credit is reduced by 10% for each prior to 2010 that the practice commenced or increased." As such, neither practice is eligible for TP reduction credit.

3.3 *Town Ordinances*

TP reductions associated with Town ordinances or regulations to address sub-jurisdictional impervious surfaces could be credited under the PCP. However, the Town does not currently have an ordinance to address sub-jurisdictional impervious surfaces. A summary of the reviewed Town ordinances and regulations can be found in Appendix F.

3.4. *Existing Conditions Modeling Summary*

In total, the Town of Milton's TP reduction target is 79.85 kg/yr. Of this TP reduction target, 14.2 kg/yr can be credited for the existing MRGP compliance projects. This reduction equates to 17.78% of the total reduction target (Table 6).

Table 6. TP reductions from existing BMPs within the Town of Milton are shown below.

Total Reduction Target (kg/yr)	Total Reduction from Existing BMPs (kg/yr)	Total Reduction from Existing BMPs (% of target)
79.85	14.2	17.78%

4. Proposed Conditions

4.1. *Proposed Conditions Review*

An assessment was completed to determine the most cost effective and feasible suite of practices eligible for credit under the PCP. The evaluation considered structural practices including new projects, projects identified in the Milton Stormwater Master Plan (SWMP), and modifications of projects proposed in the Milton SWMP to maximize phosphorus removal and better fit known site conditions and compliance of MRGP road segments identified during the Road Erosion Inventory (REI).



4.2. Proposed Structural BMPs

Sixty-three proposed structural BMPs were identified and modeled for the Town. Figure 10 below shows the location of the proposed practices within the Town. See Appendix G for a larger overview map of these project locations. Generally, soils in Milton have a high infiltration capacity (Hydrologic Soil Group A) and as such most practices are fairly simply designed infiltration-based BMPs such as infiltration basins.

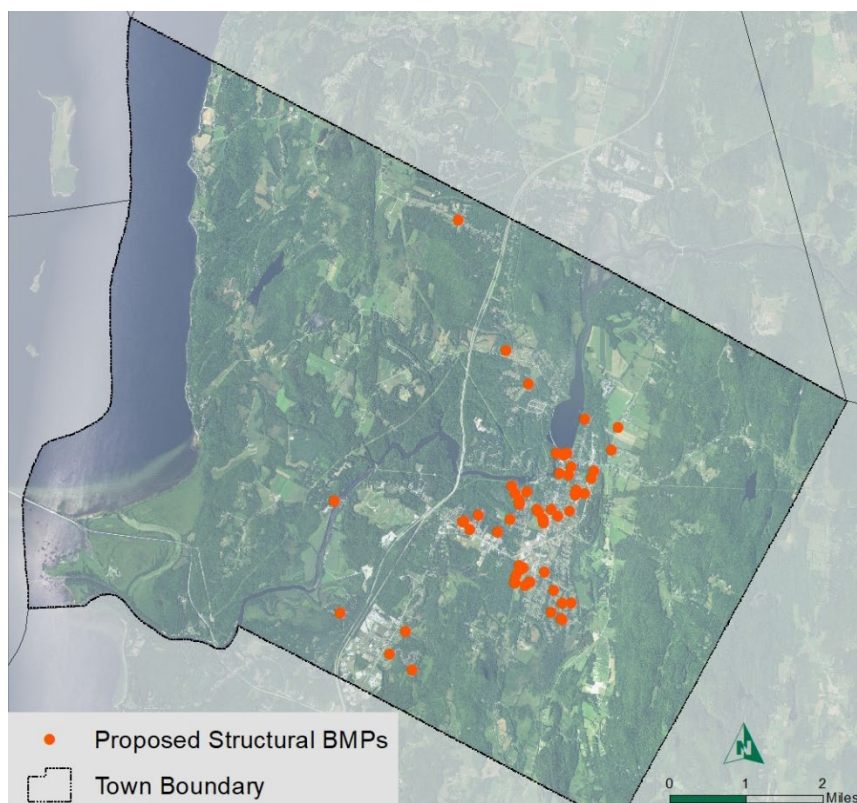


Figure 10. 63 proposed structural BMPs are proposed in the Town of Milton.

Each of the sixty-three practices listed was modeled using the VT DEC's Stormwater Treatment Calculator (STP Calculator) methodology as embedded in the VT DEC BMP Tracking Table (see Appendix H). This modeling involved verification and quantification of the drainage area for each BMP including differentiating impervious and pervious cover within the drainage areas, BMP type, BMP storage volume, and if the BMP is a retrofit of an existing practice. The annual Total Phosphorus (TP) reduction for each practice was then calculated using the performance curves for each of the BMP types (Table 7).

**Table 7. Summary of proposed structural BMPs eligible for PCP credit and their modeled TP reduction (kg/yr).**

Project Name	BMP Type	Total P Reduction (kg/yr)
Allen Brook Dr	Sand filter (w/ underdrain)	0.56
Allen Dr	Infiltration Basin	0.44
Bear Trap Ln	Infiltration Basin	5.19
Bradley St	Bioretention (infiltrating)	0.13
Brandy Ln Parking E	Infiltration Basin	0.10
Brandy Ln Parking	Infiltration Basin	0.73
Checkerberry Sq	Infiltration Basin	1.12
Cherry St	Infiltration Chambers	0.41
Chrisemily Ln N	Infiltration Chambers	3.76
Chrisemily Ln S	Infiltration Basin	0.17
Emile Dr	Infiltration Basin	0.93
Hemlock Rd	Infiltration Chambers	1.11
Howard Dr	Infiltration Trench	0.94
Hunting Ridge Ln Swale	Sand filter (w/ underdrain)	0.28
Ice House Rd	Infiltration Basin	0.96
Kingswood Dr	Sand filter (w/ underdrain)	0.15
Lamoille Terr at Rt 7	Infiltration Chambers	0.45
Lamoille Terr N	Infiltration Basin	0.86
Lamoille Terr S	Infiltration Basin	0.69
Landfill Rd Parking	Infiltration Chambers	0.85
Lena Ct	Infiltration Basin	1.99
Maplewood Ave	Infiltration Basin	1.43
McMullen Rd Dry Wells	Infiltration Chambers	0.21
Milton Elementary 1	Infiltration Basin	0.49
Milton Elementary 2	Infiltration Chambers	6.56
Milton Elementary 3	Bioretention (infiltrating)	0.32
Milton Elementary 4	Bioretention (infiltrating)	0.32
Milton High Parking	Infiltration Chambers	0.18
Milton High Parking N	Bioretention (infiltrating)	0.40
Milton High Parking S	Infiltration Basin	0.78
Moss End Dr	Infiltration Basin	1.16
Municipal Office Parking Lot N	Bioretention (infiltrating)	0.06
Municipal Building Roof W	Bioretention (infiltrating)	0.13
Municipal Parking E	Bioretention (infiltrating)	0.11
Municipal Office Parking Lot S	Bioretention (infiltrating)	0.07
Municipal Roof E	Bioretention (infiltrating)	0.07
Murray Road at Sawyer Ave	Infiltration Basin	0.75
Nancy Dr	Infiltration Basin	0.21
North Rd Culvert	Sand filter (w/ underdrain)	7.95
Park Pl N	Infiltration Basin	0.36
Park Pl SE	Infiltration Basin	0.21
Park Pl SW	Infiltration Basin	0.10
Petty Brook Rd	Sand filter (w/ underdrain)	0.22



Project Name	BMP Type	Total P Reduction (kg/year)
Pinewood Ln E	Infiltration Chambers	0.59
Pinewood Ln W	Infiltration Chambers	0.52
Poor Farm Road	Grass Channel	0.29
Railroad St Ditch N	Grass Channel	0.06
Railroad St Ditch S	Wet pond/ Created Wetland	0.60
River St Park	Bioretention (infiltrating)	0.15
Riverside Dr	Infiltration Basin	0.76
School St	Bioretention (infiltrating)	0.41
Stacy St	Infiltration Chambers	2.50
Tennis Courts	Infiltration Trench	0.39
Tennis Ct E	Infiltration Basin	0.13
Tennis Ct W	Infiltration Basin	0.10
Town Garage E	Infiltration Basin	0.32
Town Garage W	Sand filter (w/ underdrain)	0.16
Town Library	Bioretention (infiltrating)	0.06
Turner Ave	Grass Channel	0.09
Valley View Dr Corner	Infiltration Basin	0.40
Woodcrest Cir	Infiltration Chambers	0.47
WW Treatment Plan N	Infiltration Basin	1.35
WW Treatment Plan S	Infiltration Basin	0.06
Total:		53.36

These 63 practices would reduce TP loading by 53.36 kg/yr, 66.83% of the Town's TP reduction target (Table 8).

Table 8. Modeling summary for the proposed structural BMPs.

Total Reduction Target (kg/yr)	Total Reduction from Proposed BMPs (kg/yr)	Total Reduction from Proposed BMPs (% of target)
79.85	53.36	66.83%

4.3. Non-Structural Practices

At this time, non-structural practices are not recommended in this PCP. Prioritization will be given to structural BMPs and MRGP compliance projects. The Town of Milton has communicated that it does not currently plan to incorporate additional non-structural practices to their existing street sweeping and catch basin cleaning activities. If proposed structural BMPs and MRGP compliance projects prove to be infeasible, this option could be explored further.



4.4. MRGP Compliance

The existing conditions modeling assessment focused on six road-based practices implemented following the Road Erosion Inventory (REI) in compliance with the Municipal Roads General Permit (MRGP). These six MRGP compliance projects will reduce P loading by 14.2 kg/yr.

There are an additional 66 road segments that do not meet MRGP standards as determined by the REI. Each of these segments was assessed to determine potential TP credit for bringing these segments into compliance. The linear loading rates for these road segments were calculated using the Vermont Agency of Natural Resources Department of Environmental Conservation's "Standard Operating Procedures for Tracking & Accounting of Stormwater Permit Programs: Municipal Roads General Permit (MRGP)" published on June 1, 2020. The linear loading rates were applied to each of these segments to determine the P loading per segment for unpaved roads (Table 9 upper) and paved roads (Table 9 lower). The project locations in the Town are located within the Mallettes Bay Direct Drainage, Northeast Arm Direct Drainage, and Lamoille River Drainage Areas, which are highlighted in Table 9.



Table 9. Linear loading rates tables excerpted from the "Standard Operating Procedures for Tracking & Accounting of Stormwater Permit Programs: Municipal Roads General Permit (MRGP)" for unpaved (upper) and paved (lower) roads.

Appendix C. MRGP Linear Loading Rates

Table C-1. MRGP unpaved Class 1-3 phosphorus loading rates (kg/km/yr) for the Lake Champlain basin. Data modified from Tetra Tech (2015). CSO = combined sewer overflow. DD = direct drainage to lake segment. % = road slopes. Data may be updated following completion of all REIs.

Drainage Areas	Hydrologically Connected Segments									Un-connected Segments
	Fully Meets MRGP Standards			Partially Meets MRGP Standards			Does Not Meet MRGP Standards			
	<5%	5-10%	>10%	<5%	5-10%	>10%	<5%	5-10%	>10%	
Burlington Bay - CSO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Burlington Bay - DD	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Isle La Motte - DD	1.054	3.506	6.130	3.162	10.518	18.391	5.271	17.530	30.652	1.005
Lamoille River	0.937	3.118	5.452	2.812	9.354	16.355	4.687	15.589	27.259	0.894
LaPlatte River	0.998	3.318	5.802	2.993	9.954	17.406	4.988	16.590	29.009	0.951
Lewis Creek	0.900	2.995	5.237	2.701	8.984	15.710	4.502	14.974	26.183	0.858
Little Otter Creek	1.246	4.145	7.248	3.739	12.436	21.745	6.232	20.727	36.242	1.188
Main Lake - DD	0.956	3.180	5.560	2.868	9.539	16.680	4.780	15.898	27.799	0.911
Malletts Bay - DD	0.957	3.184	5.568	2.872	9.553	16.703	4.787	15.921	27.839	0.913
Mettawee River	0.986	3.280	5.734	2.958	9.839	17.203	4.930	16.398	28.672	0.940
Missisquoi Bay - DD	1.046	3.481	6.086	3.139	10.442	18.258	5.232	17.403	30.430	0.997
Missisquoi River	1.026	3.412	5.966	3.077	10.235	17.897	5.129	17.059	29.829	0.978
Northeast Arm - DD	1.213	4.035	7.056	3.640	12.105	21.167	6.066	20.175	35.278	1.156

Table C-3. MRGP paved municipal road phosphorus loading rates (kg/km/yr) for the Lake Champlain basin. Data modified from Tetra Tech (2015). CSO = combined sewer overflow. DD = direct drainage to lake segment. % = road slopes. Data may be updated following completion of all REIs.

Drainage Areas	Hydrologically Connected Segments									Un-connected Segments
	Fully Meets MRGP Standards			Partially Meets MRGP Standards			Does Not Meet MRGP Standards			
	<5%	5-10%	>10%	<5%	5-10%	>10%	<5%	5-10%	>10%	
Burlington Bay - CSO	1.555	2.073	2.592	4.665	6.220	7.775	7.775	10.367	12.959	1.230
Burlington Bay - DD	1.122	1.496	1.870	3.365	4.487	5.609	5.609	7.478	9.348	0.887
Isle La Motte - DD	0.786	1.048	1.310	2.357	3.143	3.929	3.929	5.238	6.548	0.621
Lamoille River	0.963	1.284	1.605	2.888	3.851	4.814	4.814	6.418	8.023	0.761
LaPlatte River	1.037	1.382	1.728	3.110	4.146	5.183	5.183	6.911	8.638	0.820
Lewis Creek	0.923	1.231	1.539	2.770	3.693	4.616	4.616	6.155	7.694	0.730
Little Otter Creek	1.126	1.501	1.877	3.378	4.504	5.630	5.630	7.507	9.384	0.890
Main Lake - DD	1.000	1.333	1.667	3.000	4.000	5.000	5.000	6.667	8.333	0.791
Malletts Bay - DD	0.899	1.199	1.499	2.698	3.597	4.496	4.496	5.995	7.493	0.711
Mettawee River	0.949	1.266	1.582	2.848	3.797	4.746	4.746	6.328	7.910	0.751
Missisquoi Bay - DD	1.041	1.387	1.734	3.122	4.162	5.203	5.203	6.937	8.672	0.823
Missisquoi River	1.013	1.350	1.688	3.038	4.051	5.064	5.064	6.752	8.440	0.801
Northeast Arm - DD	0.954	1.272	1.590	2.862	3.815	4.769	4.769	6.359	7.949	0.754

REI data was utilized to determine segment slope and the pre-retrofit MRGP standard compliance level (i.e., Fully Meets, Partially Meets, or Does Not Meet). The post-retrofit condition was assumed to Fully Meet standards. The percent P reduction was calculated using the change in MRGP standard compliance level. This percent reduction in compliance status was also obtained from the 2020 publication "Standard Operating Procedures for Tracking & Accounting of Stormwater Permit Programs: Municipal Roads General Permit (MRGP)". The percent reductions are included in Table 10 below. For example, if a segment were originally assessed as "Does Not Meet" standards and, through an implemented fix of the segment, was reassessed as "Fully Meets" standards, that segment would receive an 80% reduction in P loading.

**Table 10. Phosphorus reduction efficiencies as determined by change in MRGP compliance.**

Total phosphorus load reduction efficiencies based on change in MRGP compliance status.*

To \ From		Pre-Construction Compliance Status	
		Partially Meets	Does Not Meet
Post Construction Compliance Status	Partially Meets	0%	40%
	Fully Meets	40%	80%

* Percent reductions are calculated relative to the loading rate for segments not meeting standards

In total, these 66 MRGP compliance projects will reduce P loading by 15.2 kg/yr, 19.0% of the overall TP reduction target of 79.85 kg/yr. A summary table is included below (Table 11). An overview map of these sites is included as Appendix I. The complete calculations for the crediting of these 66 segments can be found in Appendix J.

**Table 11. P reduction summary table for the proposed MRGP compliance projects.**

Road Name	Road Segment ID	Post-Construction P Reduction (kg/yr)
Beebe Hill Rd	7050_Beebe_Hill_Rd_1	0.48
Beebe Hill Rd	7050_Beebe_Hill_Rd_23	0.49
Beebe Hill Rd	7050_Beebe_Hill_Rd_43	0.15
Beebe Hill Rd	7050_Beebe_Hill_Rd_47	0.15
Bullock Rd	7050_Bullock_Rd_1	0.48
Cadreact Rd	7050_Cadreact_Rd_10	0.15
Cadreact Rd	7050_Cadreact_Rd_24	0.15
Cadreact Rd	7050_Cadreact_Rd_25	0.15
Cadreact Rd	7050_Cadreact_Rd_31	0.48
Cadreact Rd	7050_Cadreact_Rd_33	0.48
Cadreact Rd	7050_Cadreact_Rd_8	0.15
Cary Dr	7050_CARY_DR_9055.1	0.38
Cherry St	7050_CHERRY_ST_10588.1	0.15
Cherry St	7050_CHERRY_ST_10593.1	0.12
Devino Rd	7050_Devino_Rd_1	0.11
Devino Rd	7050_Devino_Rd_8	0.37
Duffy Rd	7050_DUFFY_RD_17053.1	0.14
Duffy Rd	7050_DUFFY_RD_17069.1	0.60
Duffy Rd	7050_DUFFY_RD_17070.1	0.18
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_1	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_11	0.13
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_12	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_13	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_14	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_15	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_17	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_18	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_19	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_20	0.05
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_24	0.37
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_25	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_3	1.61
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_31	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_32	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_4	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_5	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_6	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_7	0.15
Eagle Mountain Harbor Rd	7050_Eagle_Mountain_Harbor_Rd_8	0.01
East Rd	7050_EAST_RD_19006.1	0.14



Road Name	Road Segment ID	Post-Construction P Reduction (kg/yr)
East Rd	7050_EAST_RD_19007.1	0.14
Forbes Rd	7050_FORBES_RD_22010.1	0.06
Hardscrabble Rd	7050_HARDSCRABBLE_RD_26380.1	0.60
Hardscrabble Rd	7050_Hardscrabble_Rd_3	0.11
Henry Rd	7050_Henry_Rd_1	0.15
Howard Dr	7050_Howard_Dr_1	0.15
Hunting Rdg Ln	7050_HUNTING_RDG_LN_29816.1	0.14
Hunting Rdg Ln	7050_HUNTING_RDG_LN_29817.1	0.14
Hunting Rdg Ln	7050_HUNTING_RDG_LN_29820.1	0.14
Hunting Rdg Ln	7050_HUNTING_RDG_LN_29821.1	0.14
John Rowley Rd	7050_John_Rowley_Rd_5	0.37
Lake Rd	7050_LAKE_RD_33135.1	0.38
Main St	7050_MAIN_ST_36890.1	0.15
Maplewood Av	7050_MAPLEWOOD_AV_38019.1	0.39
Marrs Hollow Rd	7050_MARRS_HOLLOW_RD_38373.1	0.10
Mcmullen Rd	7050_MCMULLEN_RD_38895.1	0.14
Middle Rd	7050_MIDDLE_RD_39841.1	0.36
Milton Falls Ct	7050_MILTON_FALLS_CT_40503.1	0.15
Milton Falls Ct	7050_MILTON_FALLS_CT_40504.1	0.15
Reynolds Rd	7050_Reynolds_Rd_1	0.38
Ritchie Av	7050_RITCHIE_AV_53975.1	0.19
Sawmill Rd	7050_Sawmill_Rd_2	0.22
Stonebridge Rd	7050_STONEBRIDGE_RD_63746.1	0.15
Sunset Av	7050_Sunset_Av_4	0.11
Westford Rd	7050_WESTFORD_RD_72136.1	0.14
Westford Rd	7050_WESTFORD_RD_72137.1	0.14
Total:		15.20

These 66 MRGP compliance practices would reduce TP loading by 15.20 kg/yr, 19.0% of the Town's TP reduction target (Table 12).

Table 12. Modeling summary for the proposed MRGP projects.

Total Reduction Target (kg/yr)	Total Reduction from Proposed BMPs (kg/yr)	Total Reduction from Proposed BMPs (% of target)
79.85	15.20	19.0%



5.BMP Ranking

A prioritization matrix was utilized in order to quantitatively rank the sixty-three proposed structural BMPs. Considerations that factored into the ranking of projects included:

- Total Phosphorus (TP) removed
- Stormwater volume managed
- Stormwater volume infiltrated
- Ease of operation and maintenance (O&M)
- Permitting restrictions
- Impervious cover managed
- Project efficiency (\$/lbs. of P removed)
- BMP design status (i.e., final design, preliminary design, or planned)
- Ancillary benefits

Each of the factors noted in Appendix K (worksheet 1) were scored, and scores were totaled for each of the criteria. The projects were assigned a rank from 1 to 63 with those projects receiving the highest scores assigned the highest rank (note that some projects had tied scores). The full ranking table is included as Appendix K (worksheet 2).



5.1. Ranking Results

The sixty-three proposed structural BMPs were ranked using the methodology described above and in Appendix K. The BMPs in order of rank are summarized below in Table 12. Note that when scores were tied, the cost per pound of TP removed was used as a tiebreaker.

Table 12. BMP Ranking summary table.

BMP Name	Score	Rank
Chrisemily Ln N	29	1
Bear Trap Ln	28	2
North Rd Culvert	28	3
Maplewood Ave	27	4
Milton Elementary 2	27	5
Tennis Courts	27	6
Ice House Rd	27	7
Riverside Dr	26	8
Lena Ct	26	9
Moss End Dr	26	10
Checkerbery Sq	26	11
WW Treatment Plan N	25	12
Milton High Parking S	25	13
Stacy St	25	14
Landfill Rd Parking	25	15
Hemlock Rd	24	16
Howard Dr	24	17
Lamoille Terr S	23	18
Tennis Ct E	23	19
Brandy Ln Parking	22	20
Milton High Parking N	22	21
Park Pl N	22	22
Lamoille Terr N	22	23
Murray Road at Sawyer Ave	22	24
Pinewood Ln E	22	25
Tennis Ct W	22	26
Milton Elementary 1	21	27
Municipal Parking E	21	28
Pinewood Ln W	21	29
Lamoille Terr at Rt 7	21	30
Cherry St	21	31
Milton Elementary 4	20	32

BMP Name	Score	Rank
Emile Dr	20	33
Chrisemily Ln S	20	34
Park Pl SE	19	35
Nancy Dr	19	36
School St	19	37
Municipal Roof E	19	38
Woodcrest Cir	19	39
Milton High Parking	18	40
Valley View Dr Corner	18	41
Municipal Building Roof W	18	42
Municipal Office Parking Lot S	18	43
Bradley St	18	44
Town Library	18	45
Milton Elementary 3	17	46
Allen Dr	17	47
Poor Farm Road	17	48
Town Garage E	17	49
Municipal Office Parking Lot N	17	50
Hunting Ridge Ln Swale	16	51
Allen Brook Dr	16	52
Park Pl SW	13	53
McMullen Rd Dry Wells	13	54
River St Park	11	55
Turner Ave	11	56
Railroad St Ditch N	11	57
Kingswood Dr	11	58
WW Treatment Plan S	11	59
Brandy Ln Parking S	10	60
Petty Brook Rd	9	61
Town Garage W	9	62
Railroad St Ditch S	4	63



6. Modeling Summary

The Town of Milton has a TP reduction target of 79.85 kg/yr. The table below (Table 13) summarizes the crediting for existing and proposed practices in the Town. In total, 82.76 kg/yr can be credited for these practices, 103.6% of the TP reduction target.

Table 13. TP reductions from existing and proposed practices within the Town of Milton

Scenario	TP Reduction Target	Existing MRGP Compliance Projects	Proposed MRGP Compliance Projects	Proposed Structural BMPs	Proposed and Existing Projects
TP Reduction (kg/yr)	79.85	14.2	15.2	53.36	82.76
% of TP Reduction Target	—	17.78%	19.04%	66.83%	103.6%

The final suite of practices included in the PCP for TP reduction credit includes:

- Six existing MRGP compliance projects (18 road segments),
- Sixty-three proposed structural BMPs, and
- Sixty-six proposed MRGP compliance projects.

7. Implementation Schedule

The PCP implementation schedule was created for the Town to ensure that the PCP will be fully implemented prior to the June 17, 2036 deadline. It is important to ensure that the developed schedule is feasible for the Town to implement while complying with MS4 permit requirements.

The schedule was divided into six phases, five of which are 3 years in length and the final is one year in length. This phased approach was used to ensure that the Town has the necessary time to obtain required permits, assess any environmental concerns, complete final designs, obtain or budget for construction funding, and schedule construction activities. No projects were scheduled for the final phase, Phase 6, which will ensure that any project delays do not impact permit compliance. The BMP Ranking and input from the Town were utilized in scheduling implementation of these projects. Related projects (i.e., multiple bioretention practices at the Municipal complex) were scheduled in the same phase so that they can be coordinated. Three of the projects (Allen Dr, Allen Brook Dr, and Ice House Rd) are already in the design stages. Additionally, nine other projects were placed early in the schedule as the Town plans to complete them in the near term:

- Bear Trap Rd project
- North Rd Culvert
- Lamoille Terrace
- Emile Dr
- Chrisemily Ln S
- Chrisemily Ln N
- Stacy St
- Petty Brook Rd
- Checkerberry Rd



See Table 14 below for a summary of the number of projects scheduled per phase and the preliminary estimated implementation cost of those projects. Please refer to Appendix L for the full implementation schedule.

Table 14. Number of projects and estimated project cost per implementation phase.

Phase	Year	Total Estimated Cost*	Number of Projects
Phase 1	2021	\$487,065	9
	2022		
	2023		
Phase 2	2024	\$339,299	11
	2025		
	2026		
Phase 3	2027	\$241,662	15
	2028		
	2029		
Phase 4	2030	\$277,103	13
	2031		
	2032		
Phase 5	2033	\$295,739	15
	2034		
	2035		
Phase 6	2036		

**Future cost estimates do not account for future inflation. Costs are preliminary and based on limited site investigation.*

8. Summary

Modeling results show that an annual TP reduction of 14.2 kg could be credited for the six existing MRGP compliance projects. This reduction meets 17.8% of the Town's total target reduction of 79.85 kg/yr.

Modeling results also show that an annual TP reduction of 82.76 kg could be credited for proposed structural BMPs and both existing and proposed MRGP compliance projects. This reduction for the full suite of projects meets 103.6% of the Town's total target reduction of 79.85 kg/yr.

Although these practices exceed the required TP reduction for the PCP, they offer a factor of safety for the Town in the event that one or more of the proposed practices is unable to be completed due to unforeseen circumstances. These additional BMPs will also allow the Town to meet other water quality goals.