DUFRESNE GROUP
CONSULTING ENGINEERS

dufresnegroup.com
info@dufresnegroup.com

January 22, 2020

Town of Marlboro
PO Box E
Marlboro, VT 05344

Re: Village Wastewater Study, Marlboro, VT
DG 4180006

Dear Marlboro Selectboard Members:

This letter report has been developed to summarize our preliminary evaluation for a potential community wastewater system in Marlboro Village. Our work included compiling data on existing wastewater flows, evaluating site conditions and constraints on the Town-owned parcel, evaluating wastewater collection and treatment alternatives, and developing construction cost estimates.

The Town of Marlboro, through proactive planning, identified the need to evaluate alternatives for a community wastewater system in the Village. This need is not immediate as there are no known deficiencies or septic failures as of the date of this report. The community wastewater system is a potential future need that the Town is planning for with this study. There are a few buildings within the study area that have no space for replacement on-site septic, if the existing septic systems were to fail. Two of these buildings include the Town Office/Post Office and the Meeting House (Church). Additionally, the Town House does not have an existing septic system.

1. Existing Wastewater Flows

1.1. Study Area

The study area includes the “Designated Village Center” as shown in Figure 1.1. The Designated Village Center was approved by the Vermont Agency of Commerce and Community Development in June 2014. The study area consists of thirteen parcels with the following existing uses:

- Residential – 9 parcels
- Commercial – 3 parcels
- Vacant – 1 parcel

The vacant parcel is undeveloped and owned by the Town. This undeveloped parcel is the focus of the site evaluation for potential wastewater treatment system alternatives.

The study area is solely for the purpose of defining the geographic limits of the evaluation and does not represent the extent of any potential future water or wastewater system.

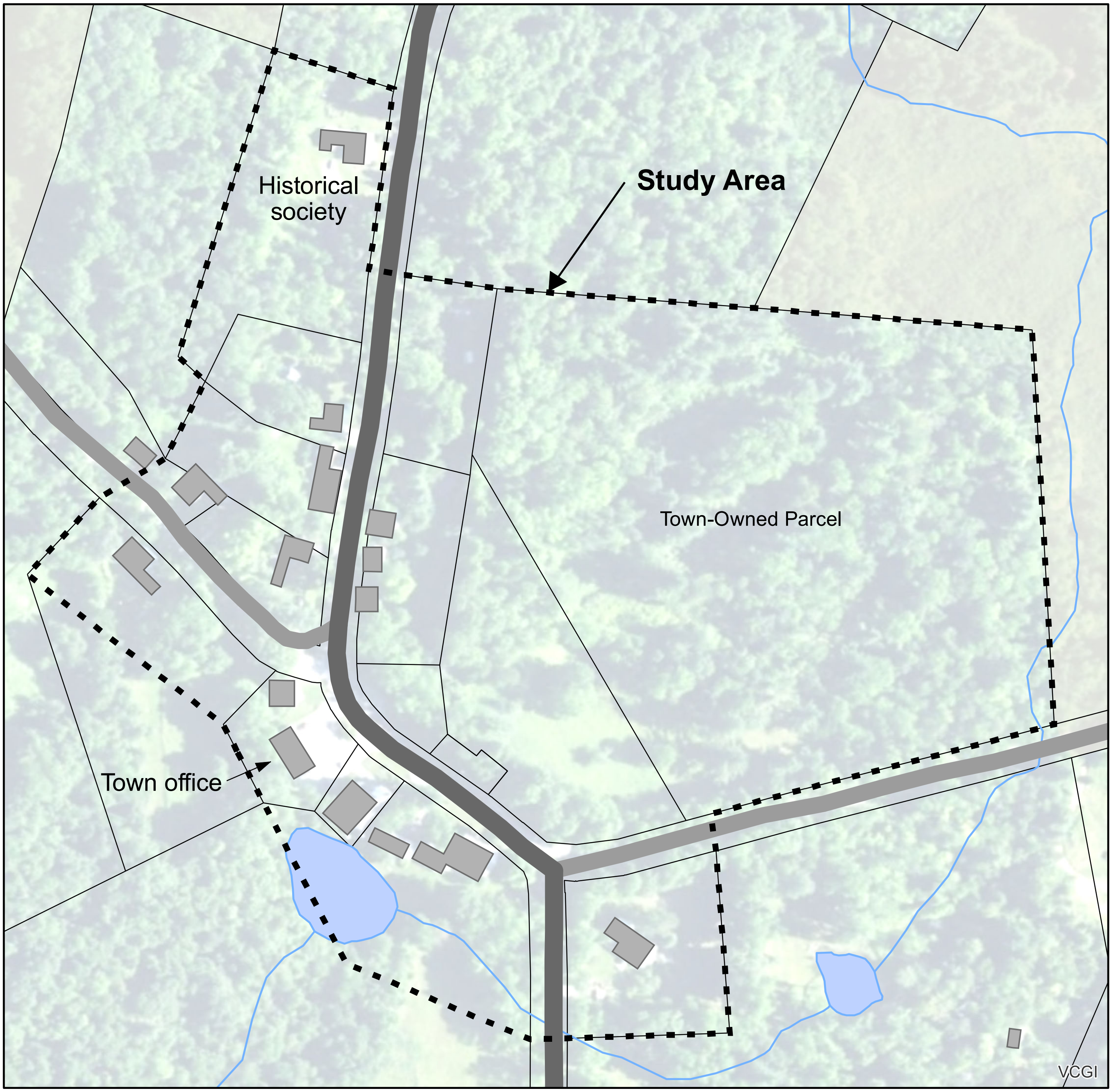


Figure 1.1 - Study Area

Designated village center

Parcel lines, 2015

Building Footprint

Stream

Lake/Pond

Road

N

Notes:
1. Map by Windham Regional Commission, Brattleboro, Vt., May 2019 and modified by Dufresne Group, December 2019.
2. Contour lines were derived from Vermont lidar data.
3. Parcel lines are from GIS data developed by Cartographic Technologies, Inc. (CTI), Brattleboro, Vt., and are current to 2015.
4. Building footprints were developed by Microsoft's Bing Maps team. for nationwide coverage. At this scale errors are known to exist.

200 100 0 200 400 600 Feet

Information for this study was obtained through several sources, as follows:

- Town of Marlboro Land Records
- Property Owner Survey (provided by the Town)
- Windham Regional Commission (Mapping)
- Vermont Center for Geographic Information (VCGI)
- Wastewater Systems and Potable Water Supply Permit Database

1.2. Estimating Existing Wastewater Flows

Since properties with on-site septic systems and private wells do not typically have meters to record water usage, it is difficult to determine the actual water, and therefore wastewater, usage characteristics and trends in the study area. The wastewater flows can be roughly estimated using the current use and size of the existing buildings. The Vermont Wastewater and Potable Water Supply Rule (WW Rule) includes three tables of design demands (theoretical wastewater flows) for use in estimating the wastewater flows for permitting purposes.

In order to estimate existing water usage in the study area, the building use and size information from the property owner surveys and wastewater permits was used, along with the design flow tables from the WW Rule. For properties where a survey was not completed and no wastewater permit exists, the current use was assumed based on local knowledge and similarly sized properties. Since the Town House does not currently have wastewater facilities, an estimated flow was included based on an assumed number of assembly seats. Table 1.1 summarizes the estimated wastewater flows for each property in the study area. The buildings located at 13 Town Hill Road (Town House) and 510 South Road (Town Office) are on the same parcel.

Table 1.1: Estimated Wastewater Flows

Property	Type	Use	Estimated Flow (gpd)	Source
364 South Road	Residential	2-bedroom house	280	Survey
399 South Road	Residential	House (bedrooms unknown)	420	Assumed
432 South Road	Residential	1-bedroom house	280	Survey
448 South Road	Residential	3-bedroom house	420	Town Files
461 South Road	Residential	Vacant	420	Assumed
466 South Road	Residential	3-bedroom house	490	Survey
510 South Road	Commercial	Offices	210	WW Permit
524 South Road	Commercial	Assembly	600	Town
550 South Road	Commercial	Lodging / House	1410	Assumed
595 South Road	Residential	4-bedroom house	490	Town
13 Town Hill Road	Commercial	Assembly	200	Assumed
56 Town Hill Road	Residential	3-bedroom house	420	Survey
83 Town Hill Road	Residential	4-bedroom house	490	Survey

Note: The existing flow for 13 Town Hill Rd (Town House) is zero as there are no existing wastewater facilities. An estimated flow has been assigned assuming the Town House would connect to a future community wastewater system.

Based on the reported and assumed existing uses and sizes of properties within the study area, the estimated average day wastewater flows are as follows:

- Residential Average Day Usage: 3,710 gallons per day (gpd)
- Commercial Average Day Usage: 2,420 gpd
- Total Estimated Average Day Usage: 6,130 gpd

The estimated existing wastewater flows of 6,130 gpd triggers permitting under the Regional Wastewater Program. The flow limit for the Regional Wastewater Program is 6,500 gpd. If estimated future flows are re-evaluated during final design and increase to 6,500 gpd or greater, the permitting jurisdiction would move to the Indirect Discharge Program. The concepts for wastewater collection and disposal would be the same under the Indirect Discharge Permit; however, the leach fields would need to be doubled to meet the requirement of dual-alternating fields under the Indirect Discharge Permit. This would have a significant cost impact and should be avoided if possible.

2. Site Evaluation

The Town owns a 10-acre parcel on the northern end of the study area. The process of evaluating a site for septic suitability includes a desktop review of several factors, including:

- Environmental Constraints
- Physical Constraints
- Topography
- Soils Mapping

After the desktop review narrows down the options for wastewater treatment sites, field investigations are performed to confirm soil types, ledge/groundwater depths, topography and isolation distances.

The site evaluation not only defines the location for a wastewater treatment system, but also the type of wastewater treatment system. The typical options for soil-based wastewater treatment systems include in-ground, at-grade and mound.

- In-Ground (Conventional): This type of treatment system consists of a septic tank and subsurface leach field. The leach filed is constructed of trenches with pipe surrounded by stone. Wastewater flows from the building into the septic tank where the solids settle out. The effluent (liquid waste) continues through a pipe to the subsurface infiltration field where it filters through the stone and is treated by microbes in the soil below the trench.
- Mound: A mound system is similar to a conventional system, with modifications to address restrictions such as high water table or shallow bedrock. Mound sand is placed over the existing surface to raise the height of the leach field over the water table or ledge. The leach field is constructed over the sand, using the same trench detail as a conventional system. Wastewater flows from the building into the septic tank. The effluent continues into a chamber where it is dosed or pumped into the mound and filters through the sand into the native soil.

- At-Grade: An at-grade system is in between an in-ground and mound. An at-grade system is used where the required vertical separation from the water table falls at existing grade. The leach field is constructed on the existing surface, with no sand required under the field.

2.1. Environmental & Physical Constraints

The environmental constraints on this parcel are shown in Figure 2.1. The parcel contains a Class 2 wetland in the northeast corner. There also appears to be a drainage channel running diagonally through the parcel from the southwest corner to the wetland in the northeast corner. This channel is partially fed from the overflow of the pond behind the Meeting House, via a culvert under South Road. There is also a short stream segment in the southwestern corner of the parcel. Based on the existing environmental constraints, locations for wastewater treatment appear to be in the northwest corner and southern half of the parcel.

The parcel is located within the drainage area to headwaters for the Whetstone Brook. There are local concerns regarding water quality impacts to the headwaters from a potential community wastewater disposal system. If a system is properly designed, installed and maintained, it will not negatively affect water quality of the nearby headwaters.

The Town-owned parcel is undeveloped and does not appear to be directly adjacent to any significant development. There are three residential properties that abut this parcel with most of the development occurring more than 100 feet from the parcel boundary. Table 2.1 summarizes the features present in and around the Town-owned parcel and approximate distances from the parcel boundary, as well as the required minimum separation distances from the features to a leach field.

Table 2.1: Horizontal Isolation Distances for Features

Feature	Approximate Distance from Nearest Feature to Parcel Boundary[1]	Minimum Horizontal Separation Distance from Feature to Leach Field[2]
Building/Foundation	30’	20’-75’
Drainage Swales	In Parcel	25’-75’
Potable Water Piping/Tanks	>100’	25’-100’
Private Water Source	>150’	150’
Public Water Source	>240’	150’-1000’
Property Lines	N/A	25’
Roads/Drives/Parking Lots	55’	10’
Slopes >30%	>25’	25’
Stormwater Practices	N/A	50’
Surface Water	In Parcel	50’
Trees	In Parcel	10’

Notes:

1. Distances are approximately measured from the feature to the parcel boundary. Any potential wastewater disposal system will be at least 25 feet inside the parcel boundary.
2. Minimum horizontal separation distance from features to leach field varies based on a variety of factors. Refer to Table 9-5 and 9-6 of the WW Rule.

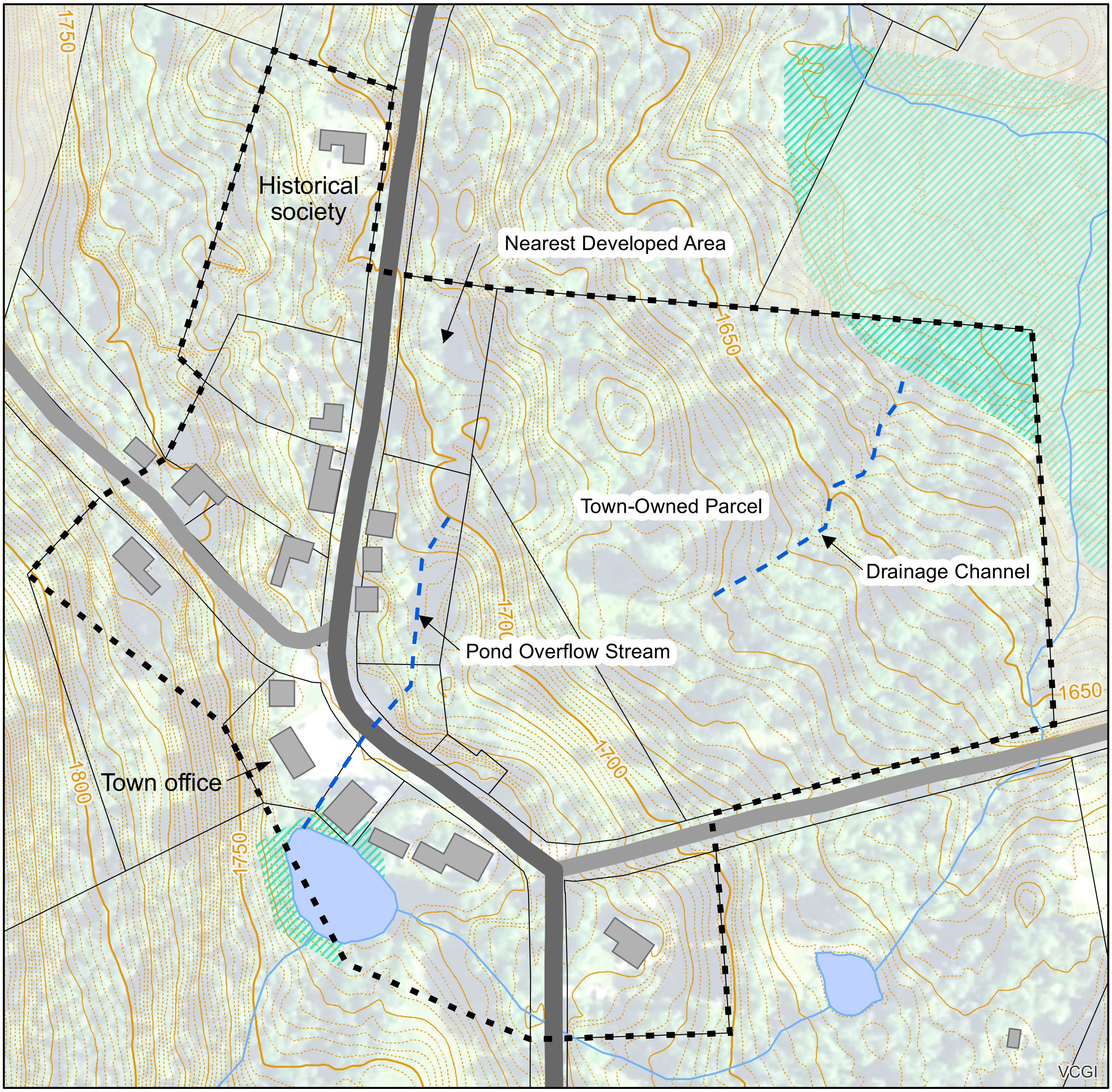


Figure 2.1 - Site Constraints

- Designated village center
- Parcel lines, 2015
- 50-foot contour
- 10-foot contour
- 2-foot contour
- Vermont significant wetland

N

Notes:
1. Map by Windham Regional Commission, Brattleboro, Vt., May 2019 and modified by Dufresne Group, December 2019.
2. Contour lines were derived from Vermont lidar data.
3. Parcel lines are from GIS data developed by Cartographic Technologies, Inc. (CTI), Brattleboro, Vt., and are current to 2015.
4. Building footprints were developed by Microsoft's Bing Maps team. for nationwide coverage. At this scale errors are known to exist.
5. The wetlands shown are those included in the Vermont Significant Wetlands Inventory.

200 100 0 200 400 600 Feet

2.2. Topography

The parcel slopes down from an approximate elevation of 1700 ft in the southwest corner to 1620 ft in the northeast corner, as shown in Figure 2.1 with the Vermont LIDAR contours. The average slope across the parcel is approximately 10%, although there appear to be areas throughout the parcel with slopes exceeding 20%. The parcel is located mostly downgradient from the other parcels in the study area.

An inground septic system requires a slope of less than 20%. At-grade and mound systems can be installed on slopes greater than 20%. In this case, the slope of the site does not rule out any type of treatment system.

2.3. Soils Mapping

The Natural Resources Conservation Services (NRCS) soils mapping shows four different soil types on the Town-owned parcel. A summary of the soils mapping is shown in Table 2.2.

Table 2.2: NRCS Soils Mapping Summary

Soil ID	Soil Name	VT Onsite Waste Disposal Group	Soil Septic Suitability Rating
21C	Marlow Fine Sandy Loam, 8-15% slopes	IIh	Moderate
22C	Marlow Fine Sandy Loam, 8-15% slopes, very stony	IIh	Moderate
25C	Westbury Fine Sandy Loam, 8-15% slopes	IIId	Marginal
26B	Westbury Fine Sandy Loam, 3-8% slopes, very stony	IIIc	Marginal

NRCS soil septic suitability ratings are shown in Figure 2.2. Soil ratings are developed by the NRCS based on soil probes, soil classifications and mapping. These soil ratings consider the severity of restrictions in the soil, such as ledge, water table, slope, percolation, and filtration. There are four general ratings: well suited, moderately suited, marginally suited and not suited.

The soils on this parcel range from moderately suited to marginally suited. A rating of moderately suited means that there are limitations in the soil that may require a system other than an in-ground system. A rating of marginally suited means that there are significant limitations in the soil that will usually require a mound system.

2.4. Field Investigations

In order to confirm the soil types and restrictions, test pits were performed in six locations on the Town-owned parcel in August 2019. The observed soils are summarized in Figure 2.3. Table 2.2 summarizes the water table depth, ledge depth and ground slope in each test pit.

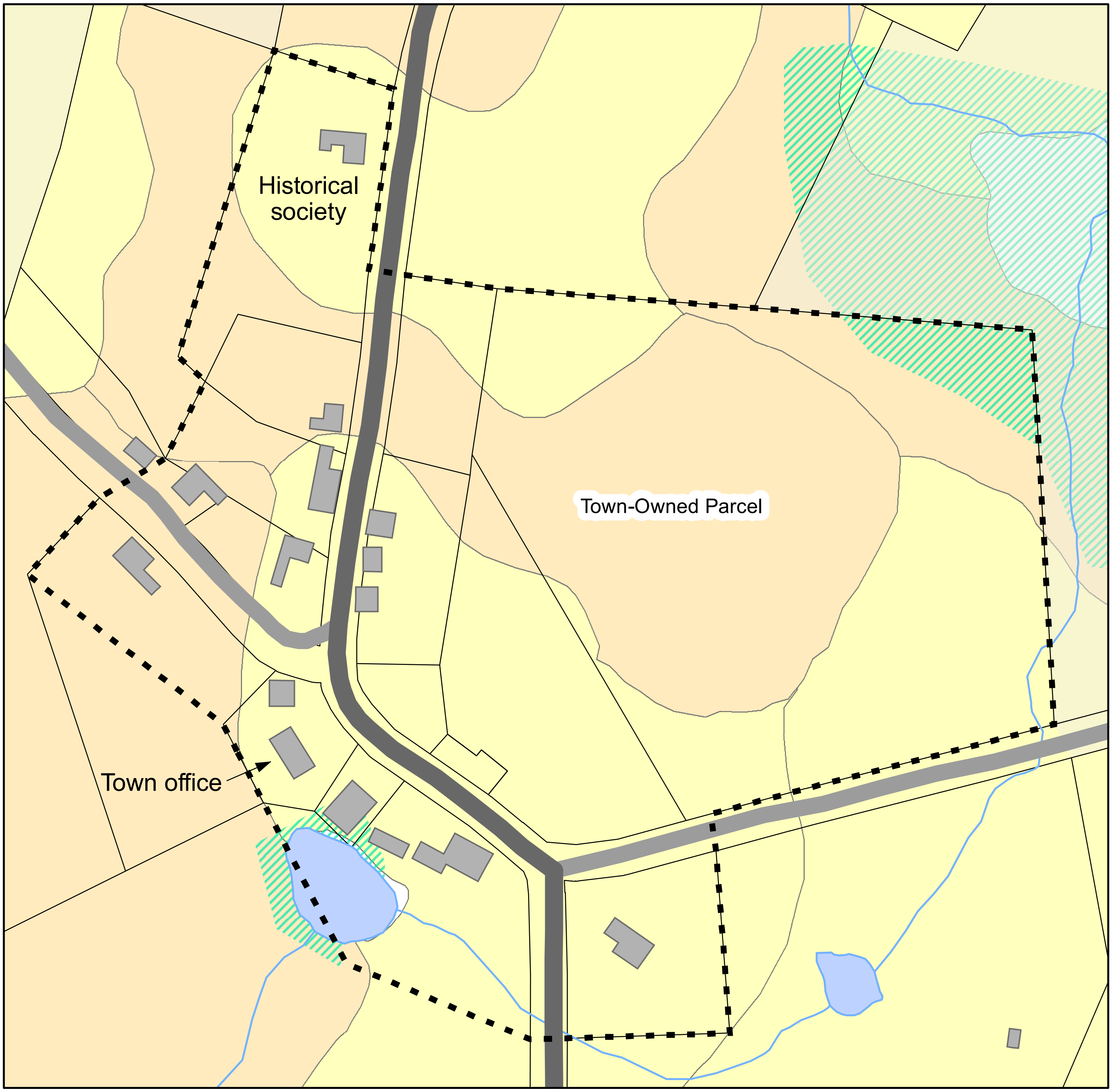


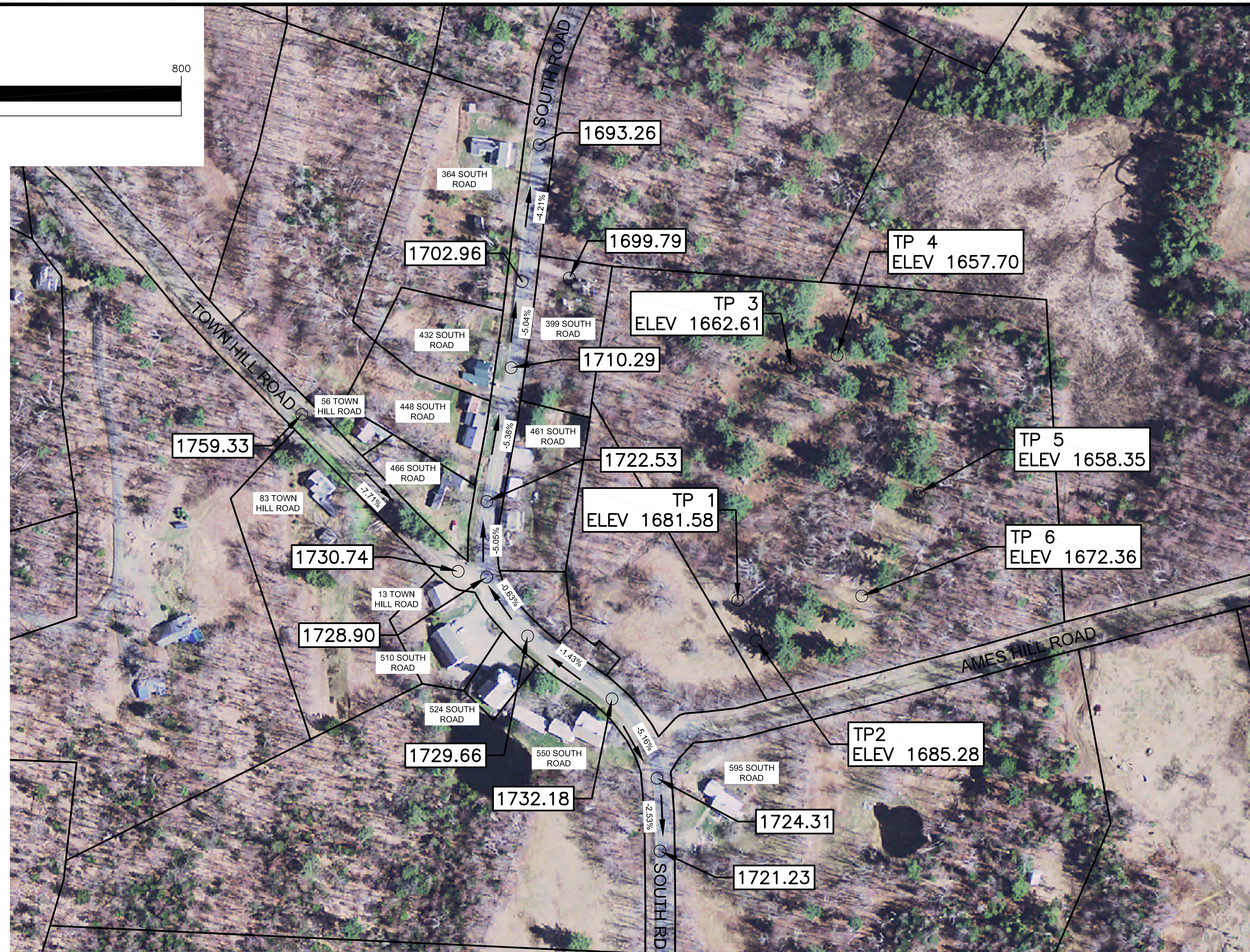
Figure 2.2 - NRCS Soils Mapping

Notes:
1. Map by Windham Regional Commission, Brattleboro, Vt., May 2019 and modified by Dufresne Group, December 2019.
2. Contour lines were derived from Vermont lidar data.
3. Parcel lines are from GIS data developed by Cartographic Technologies, Inc. (CTI), Brattleboro, Vt., and are current to 2015.
4. Building footprints were developed by Microsoft's Bing Maps team. for nationwide coverage. At this scale errors are known to exist.
5. The wetlands shown are those included in the Vermont Significant Wetlands Inventory.

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)



Test Pit #1				
Depth	Muncel Color	Color	Desc	Notes
0-10"	10 YR 3/3	Dark Brown	Silt Loam	
10-32"	2.5Y 4/3	Olive Brown	Silt Loam	
32-72"	2.5Y 4/3	Olive Brown	Silt Loam w/stone	Very Firm
ESHWT @ 18", distinct concentrations observed, seeps @ 65"				
Roots to 24"				
NLTD				
Existing Slope – 18%				

Test Pit #2				
Depth	Muncel Color	Color	Desc	Notes
0-8"	10 YR 3/3	Dark Brown	Silt Loam	
8-29"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
29-44"	2.5Y 6/4	Light Yellowish Brown	Fine Loamy Sand	Very Firm
44-77"	2.5Y 4/3	Olive Brown	Fine Loamy Sand w/3" stone	Less Firm
ESHWT @ 29", distinct concentrations observed				
Roots to 34"				
NLTD				
Existing Slope – 14%				

Test Pit #3				
Depth	Muncel Color	Color	Desc	Notes
0-10"	10 YR 3/3	Dark Brown	Silt Loam	
10-16"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
16-29"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
29-70"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/2-3" stone	Very Firm
ESHWT @ 29", distinct concentrations observed, very firm (5" thick)				
Roots to 14"				
NLTD				
Existing Slope – 14%				

Test Pit #4				
Depth	Muncel Color	Color	Desc	Notes
0-6"	10 YR 3/3	Dark Brown	Silt Loam	
6-20"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
20-26"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
26-65"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/6"+ stone	Very Firm
ESHWT @ 26", distinct concentrations observed, very firm				
Roots to 18"				
NLTD				
Existing Slope – 15%				

Test Pit #5				
Depth	Muncel Color	Color	Desc	Notes
0-12"	10 YR 3/3	Dark Brown	Silt Loam	
12-26"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
16-31"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
31-65"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/4-6" stone	Very Firm
ESHWT @ 26", distinct concentrations observed, very firm				
Roots to 26"				
NLTD				
Existing Slope – 15%				

Test Pit #6				
Depth	Muncel Color	Color	Desc	Notes
0-12"	10 YR 3/3	Dark Brown	Silt Loam	
12-20"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
20-35"	10YR 5/4	Yellowish Brown	Medium Loamy Sand	
35-67"	2.5Y 4/3	Olive Brown	Fine Loamy Sand	Very Moist
ESHWT @ 19", distinct concentrations observed				
Roots to 22"				
NLTD				
Existing Slope – 2.5%				

DUFRESNE GROUP
CONSULTING ENGINEERS

Suite 200, 56 Main Street
Springfield, Vermont 05156
Tel: (802) 674-2904 Fax: (802) 674-2913
E-mail: info@dufresnegroup.com
Home page: www.dufresnegroup.com

Project #	3190006
Project Mgr.	C.M.HASKINS
Design	B.L.BAKER
Drawn	B.L.BAKER
Checked by	N.R.JOHNSON
Date	DEC. 6, 2019
Scale	AS SHOWN
Approved by	C.M.HASKINS

VILLAGE COMMUNITY WASTEWATER STUDY

TEST PITS AND ELEVATION DATA

MARLBORO, VERMONT

FIG 2.3

DWG. NO. Marlboro WW SP01.dwg

SHEET 1 OF 1

FILE: M:\CADD Files\Marlboro VT\Marlboro WW SP01.dwg Dec 04, 2019 – 12:30pm

Table 2.2: Soil Test Pit Summary

Test Pit #	Soil Type	Ground Elevation (ft)	Ground Slope	ESHWT[1]	Ledge[2]
1	Silt Loam	1681.58	18%	18”	NLTD
2	Fine Loamy Sand	1685.28	14%	29”	NLTD
3	Fine Loamy Sand	1662.61	14%	29”	NLTD
4	Fine Loamy Sand	1657.70	15%	26”	NLTD
5	Fine Loamy Sand	1658.35	15%	26”	NLTD
6	Fine/Medium Loamy Sand	1672.36	2.5%	19”	NLTD

Notes:

1. ESHWT = Estimated depth to Seasonally High Water Table (measured from ground elevation)
2. NLTD = No Ledge to Depth. Test pits range from 65”-77” in depth. Refer to figure 2.3 for individual test pit depth.

The NRCS soils mapping shows four different soil types on this parcel, with two different septic soil suitability ratings. However, the soil type was found to be similar across all test pits.

The water table in all test pits is shallow, which was expected due to the nearby wetland and the drainage channel running diagonally across the parcel. The WW Rule requires a minimum of 3 feet from the bottom of the wastewater treatment system to seasonally high water table. Based on the test pit results, the only option for a soil-based treatment system is a mound system.

In addition to site investigations for wastewater treatment, field investigations were also made for wastewater collection. Elevations were obtained throughout the study area to determine where wastewater collection can flow by gravity to treatment and where pumping facilities may be required. The elevations were recorded along South Road and Town Hill Road and are shown in Figure 2.3 along with estimated ground slopes between the points. Based on these elevations, it appears that there is the potential for wastewater from all properties in the study area to be collected and flow to the potential disposal site(s) by gravity.

3. Alternatives Evaluation

The WW Rule requires a minimum vertical separation of 3 feet from the seasonally high water table to the bottom of the infiltration trenches in the wastewater disposal system. As seen in the test pits, the seasonally high water table throughout the Town-owned parcel is 18”-29” below existing grade. Therefore, a mound system is required to raise the infiltration trenches to the required 3 feet above seasonally high water table.

Since the type of wastewater disposal system needs to be a mound system, the alternatives will look at various configurations of collection and treatment utilizing a mound system. When sizing a mound system, the WW Rule dictates a maximum application rate of 1.0 gallons per square foot per day, regardless of existing soils. This translates into a percolation rate of 9 minutes per inch. This rate was used to size all the alternative mound systems in this report.

The elevation data shows a high point in front of the Whetstone Inn. This means that gravity flow from 595 South Road to the northwest along South Road is unlikely. The two remaining options are to utilize a residential pump station to pump wastewater from 595 South Road northwest to a gravity collection system or construct two separate wastewater disposal fields to allow for gravity flow from all properties in the study area. The two proposed disposal field locations are on the north and south ends of the Town-owned parcel.

Based on the evaluations above, three alternatives were developed. These alternatives vary in methods of collection, pretreatment and sizing of mound systems. These alternatives are based on preliminary flow estimates and site evaluations. Details such as sewer flows and site-specific design details need to be confirmed during final design.

3.1. Alternative 1

The concept for Alternative 1 is shown in Figure 3.1 and involves two separate gravity collection systems and two separate wastewater disposal systems. The study area is split at the high point in front of the Whetstone Inn. The wastewater from the Whetstone Inn and 595 South Road is conveyed via a gravity collection system to the southern disposal system, where it enters into a 4,000-gallon septic tank and then into a dosing chamber before flowing by gravity into a 36 ft by 95 ft mound disposal system. The proposed southern disposal system is sized for 1,900 gallons per day.

The wastewater from other 11 parcels is conveyed via a gravity collection system to the proposed northern disposal system, which is sized for 4,230 gallons per day. Wastewater enters into a 9,000-gallon septic tank and then into a dosing chamber before entering into a 44 ft by 178 ft mound disposal system.

The southern collection system consists of approximately 470 linear feet of 6” SDR35 PVC gravity sewer main with two sewer services. The northern collection system consists of approximately 1,350 linear feet of 6” SDR35 PVC gravity sewer main with eleven sewer services.

Alternative 1 does not require any electricity as all flow is by gravity and no pretreatment is required. The estimated total project cost for Alternative 1 is shown in Table 3.1.

3.2. Alternative 2

The collection system concept for Alternative 2 is the same as Alternative 1. The treatment systems differ from Alternative 1 as Alternative 2 incorporates the addition of pretreatment systems prior to both wastewater disposal fields. The pretreatment systems replace the dosing chambers in the two treatment systems and allow for the leach field sizes to be reduced. Alternative 2 is shown in Figure 3.2.

With the addition of pretreatment, the southern leach field is reduced to 20 ft by 79 ft and the northern leach field is reduced to 28 ft by 134 ft. The septic tank sizing and collection system remains the same as in Alternative 1 for both the northern and southern systems.

Test Pit #3				
Depth	Muncel Color	Color	Desc	Notes
0-10"	10 YR 3/3	Dark Brown	Silt Loam	
10-16"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
16-29"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
29-70"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/2-3" stone	Very Firm
ESHWT @ 29", distinct concentrations observed, very firm (5" thick)				
Roots to 14"				
NLTD				
Existing Slope – 14%				

Test Pit #4				
Depth	Muncel Color	Color	Desc	Notes
0-6"	10 YR 3/3	Dark Brown	Silt Loam	
6-20"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
20-26"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
26-65"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/6"+ stone	Very Firm
ESHWT @ 26", distinct concentrations observed, very firm				
Roots to 18"				
NLTD				
Existing Slope – 15%				

Test Pit #5				
Depth	Muncel Color	Color	Desc	Notes
0-12"	10 YR 3/3	Dark Brown	Silt Loam	
12-26"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
16-31"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
31-65"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/4-6" stone	Very Firm
ESHWT @ 26", distinct concentrations observed, very firm				
Roots to 26"				
NLTD				
Existing Slope – 15%				

Test Pit #6				
Depth	Muncel Color	Color	Desc	Notes
0-12"	10 YR 3/3	Dark Brown	Silt Loam	
12-20"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
20-35"	10YR 5/4	Yellowish Brown	Medium Loamy Sand	
35-67"	2.5Y 4/3	Olive Brown	Fine Loamy Sand	Very Moist
ESHWT @ 19", distinct concentrations observed				
Roots to 22"				
NLTD				
Existing Slope – 2.5%				

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

DUFRESNE GROUP
CONSULTING ENGINEERS

Suite 200, 56 Main Street
Springfield, Vermont 05156
Tel: (802) 674-2904 Fax: (802) 674-2913
E-mail: info@dufresnegroup.com
Home page: www.dufresnegroup.com

Project #	3190006
Project Mgr.	C.M.HASKINS
Design	B.L.BAKER
Drawn	B.L.BAKER
Checked by	N.R.JOHNSON
Date	JAN. 22, 2020
Scale	AS SHOWN
Approved by	C.M.HASKINS

VILLAGE COMMUNITY WASTEWATER STUDY

WASTEWATER COLLECTION & DISPOSAL SYSTEM ALTERNATIVE 1

MARLBORO, VERMONT

FIG 3.1

DWG. NO. Marlboro WW SP01.dwg

SHEET 1 OF 1

FILE: M:\CADD Files\Marlboro VT\Marlboro WW SP01.dwg Jan 22, 2020 – 5:14pm

Table 3.1: Total Project Cost Estimate – Alternative 1

Item Description	Estimated Cost
Northern Wastewater Collection System	$210,000
Northern Wastewater Disposal System	$110,000
Southern Wastewater Collection System	$75,000
Southern Wastewater Disposal System	$60,000
Miscellaneous Work	$70,000
Construction Subtotal	**$525,000**
Contingency (20%)	$105,000
Engineering	$105,000
Legal/Fiscal/Administrative	$5,000
Total Project Cost	**$740,000**

Notes:

1. Construction costs are based on construction in 2020. These estimated costs should be increased to reflect inflation when budgeting for construction in future years.
2. Construction cost estimates are based on conceptual designs without the benefit of final design documents. Actual construction costs may vary substantially.
3. The construction cost estimates for the wastewater collection systems include furnishing and installing approximately 1,820 linear feet of 6” SDR 35 PVC pipe and precast concrete manholes with appurtenances; excavation, backfill and compaction; select backfill materials; and pavement and grass restoration.
4. The wastewater disposal system cost estimates include furnishing and installing a septic tank, dosing chamber, PVC piping from septic tank to leach field, mound sand, stone, and piping in leach field; excavation, backfill and compaction; select backfill materials; and grass restoration.
5. The construction cost estimate for miscellaneous work includes additional work necessary to complete the installation of the wastewater collection and disposal systems.
6. Engineering costs for final design and construction phase engineering are based on the State of Vermont Fee Allowance Table for similarly sized projects.
7. Legal, fiscal and administrative costs are estimated by the engineer based on similarly sized projects and should be confirmed by the Town of Marlboro prior to budgeting.

Test Pit #3

Depth	Muncel Color	Color	Desc	Notes
0-10"	10 YR 3/3	Dark Brown	Silt Loam	
10-16"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
16-29"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
29-70"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/2-3" stone	Very Firm
ESHWT @ 29", distinct concentrations observed, very firm (5" thick)				
Roots to 14"				
NLTD				
Existing Slope – 14%				

Test Pit #4

Depth	Muncel Color	Color	Desc	Notes
0-6"	10 YR 3/3	Dark Brown	Silt Loam	
6-20"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
20-26"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
26-65"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/6"+ stone	Very Firm
ESHWT @ 26", distinct concentrations observed, very firm				
Roots to 18"				
NLTD				
Existing Slope – 15%				

Test Pit #5

Depth	Muncel Color	Color	Desc	Notes
0-12"	10 YR 3/3	Dark Brown	Silt Loam	
12-26"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
16-31"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
31-65"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/4-6" stone	Very Firm
ESHWT @ 26", distinct concentrations observed, very firm				
Roots to 26"				
NLTD				
Existing Slope – 15%				

Test Pit #6

Depth	Muncel Color	Color	Desc	Notes
0-12"	10 YR 3/3	Dark Brown	Silt Loam	
12-20"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
20-35"	10YR 5/4	Yellowish Brown	Medium Loamy Sand	
35-67"	2.5Y 4/3	Olive Brown	Fine Loamy Sand	Very Moist
ESHWT @ 19", distinct concentrations observed				
Roots to 22"				
NLTD				
Existing Slope – 2.5%				

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

DUFRESNE GROUP
CONSULTING ENGINEERS
Suite 200, 56 Main Street
Springfield, Vermont 05156
Tel: (802) 674-2904 Fax: (802) 674-2913
E-mail: info@dufresnegroup.com
Home page: www.dufresnegroup.com

Project #	3190006
Project Mgr.	C.M.HASKINS
Design	B.L.BAKER
Drawn	B.L.BAKER
Checked by	N.R.JOHNSON
Date	JAN. 22, 2020
Scale	AS SHOWN
Approved by	C.M.HASKINS

VILLAGE COMMUNITY WASTEWATER STUDY

WASTEWATER COLLECTION & DISPOSAL SYSTEM ALTERNATIVE 2

MARLBORO, VERMONT

FIG 3.2

DWG. NO. Marlboro WW SP01.dwg

SHEET 1 OF 1

FILE: M:\CADD Files\Marlboro VT\Marlboro WW SP01.dwg Jan 22, 2020 – 5:15pm

There are multiple pretreatment options. All pretreatment options should be further evaluated in the final design phase to ensure that the best option is being utilized. For the purposes of this study, two options have been considered. These options include a packed bed filter and a peat fiber or coconut fiber biofilter, as described below:

A. Packed Bed Filter

- This unit utilizes a textile treatment media that is micro-dosed at regular intervals using low horsepower pumps. The treatment media is housed in an 8 ft wide by 16 ft long by 3.5 ft deep buried plastic tank. Effluent is applied at the top of the media and filters down through the media for treatment of biochemical oxygen demand (BOD5), total suspended solids and nitrogen. The Orenco unit is approved by the State of Vermont for on-site wastewater pretreatment.
- Example and costs are based on Orenco AdvanTex® AX100.
- Electricity is required for this unit.
- Each treatment system (north and south) would require two filter units, for a total of four filter units. Additionally, each treatment system would require a recirculation tank, dose tank and pump chamber.

B. Peat Fiber or Coconut Fiber Biofilter

- This type of unit utilizes natural fibers, such as peat or coconut, as a treatment media. These systems can typically operate without power, as long as the hydraulics from the septic tank are sufficient to pressurize the treatment unit. These biofilters utilize the same process as the packed bed filter, with effluent entering at the top of the media and filtering down through the media for treatment.
- Examples are based on Anua Puraflo® (peat fiber) and Premier Tech Ecoflo® (coconut fiber). Cost estimates are based on Anua Puraflow®, which appears to have the higher material cost of the two.
- These pretreatment units do not require electricity, as long as hydraulics are sufficient to pressurize the units by gravity flow. It is anticipated that the hydraulics at both treatment locations will be sufficient.
- The biofilter pretreatment units may require a grease trap for the Whetstone Inn to remove grease prior to the pretreatment unit. If the grease trap is installed on the service line for the building, a 1,000 or 1,500-gallon grease trap would be sufficient. A larger grease trap would be required if it were located at the treatment system. It is recommended that the grease trap be placed on the service line to reduce costs.

Alternative 2A requires electricity for the two pretreatment systems and Alternative 2B does not require electricity. The pretreatment systems may require an annual inspection or maintenance contract with the installer to ensure proper operation. The estimated total project costs for Alternatives 2A and 2B are shown in Table 3.2.

Table 3.2: Total Project Cost Estimate – Alternatives 2A and 2B

Item Description	**Alternative 2A Estimated Cost**	**Alternative 2B Estimated Cost**
Northern Wastewater Collection System	$210,000	$210,000
Northern Wastewater Disposal System	$400,000	$150,000
Southern Wastewater Collection System	$75,000	$75,000
Southern Wastewater Disposal System	$375,000	$100,000
Miscellaneous Work	$160,000	$85,000
Construction Subtotal	**$1,220,000**	**$620,000**
Contingency (20%)	$245,000	$125,000
Engineering	$245,000	$125,000
Legal/Fiscal/Administrative	$10,000	$5,000
Total Project Cost	**$1,720,000**	**$875,000**

Notes:

1. Construction costs are based on construction in 2020. These estimated costs should be increased to reflect inflation when budgeting for construction in future years.
2. Construction cost estimates are based on conceptual designs without the benefit of final design documents. Actual construction costs may vary substantially.
3. The construction cost estimates for the wastewater collection systems include furnishing and installing approximately 1,820 linear feet of 6” SDR 35 PVC pipe and precast concrete manholes with appurtenances; excavation, backfill and compaction; select backfill materials; and pavement and grass restoration.
4. The construction cost estimates for the wastewater disposal systems include furnishing and installing a septic tank, pretreatment system (Orenco AdvanTex AX100 for Alternative 2A and Anua Puraflow for Alternative 2B), PVC piping from septic tank to leach field, mound sand, stone, piping in leach field, electrical services, conduit and wiring; excavation, backfill and compaction; select backfill materials; and pavement and grass restoration.
5. The construction cost estimate for miscellaneous work includes additional work necessary to complete the installation of the wastewater collection and disposal systems.
6. Engineering costs for final design and construction phase engineering are based on the State of Vermont Fee Allowance Table for similarly sized projects.
7. Legal, fiscal and administrative costs are estimated by the engineer based on similarly sized projects and should be confirmed by the Town of Marlboro prior to budgeting.

3.3. Alternative 3

Alternative 3 is based on a single wastewater disposal field as shown in Figure 3.3. The single wastewater disposal field is located in the northwest corner of the Town-owned parcel. Gravity collection from all properties within the proposed service area is possible, with the exception of 595 South Road. The gravity collection system would follow the same alignment as the northern system in Alternatives 1 and 2; however, it extends further south to the Whetstone Inn. Wastewater flows are conveyed north along South Road to a single wastewater disposal field on the northern side of the Town-owned parcel.

Test Pit #3				
Depth	Muncel Color	Color	Desc	Notes
0-10"	10 YR 3/3	Dark Brown	Silt Loam	
10-16"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
16-29"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
29-70"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/2-3" stone	Very Firm
ESHWT @ 29", distinct concentrations observed, very firm (5" thick)				
Roots to 14"				
NLTD				
Existing Slope – 14%				

Test Pit #4				
Depth	Muncel Color	Color	Desc	Notes
0-6"	10 YR 3/3	Dark Brown	Silt Loam	
6-20"	10YR 5/6	Yellowish Brown	Fine Loamy Sand	
20-26"	10YR 5/4	Yellowish Brown	Fine Loamy Sand	
26-65"	2.5Y 6/3	Light Yellowish Brown	Fine Loamy Sand w/6"+ stone	Very Firm
ESHWT @ 26", distinct concentrations observed, very firm				
Roots to 18"				
NLTD				
Existing Slope – 15%				

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

DUFRESNE GROUP
CONSULTING ENGINEERS

Suite 200, 56 Main Street
Springfield, Vermont 05156
Tel: (802) 674-2904 Fax: (802) 674-2913
E-mail: info@dufresnegroup.com
Home page: www.dufresnegroup.com

Project #	3190006
Project Mgr.	C.M.HASKINS
Design	B.L.BAKER
Drawn	B.L.BAKER
Checked by	N.R.JOHNSON
Date	JAN. 22, 2020
Scale	AS SHOWN
Approved by	C.M.HASKINS

VILLAGE COMMUNITY WASTEWATER STUDY

WASTEWATER COLLECTION & DISPOSAL SYSTEM ALTERNATIVE 3

MARLBORO, VERMONT

FIG 3.3

DWG. NO. Marlboro WW SP01.dwg

SHEET 1 OF 1

FILE: M:\CADD Files\Marlboro VT\Marlboro WW SP01.dwg Jan 22, 2020 – 5:19pm

Due to topography at the intersection of South Road and Ames Hill Road, 595 South Road requires a residential pump station to pump into the gravity collection system. This includes a 1,000-gallon tank with duplex submersible pumps. The tank is buried with a hatch on the top for access. The pump station can be located anywhere on the property that allows for gravity flow from the house. It is recommended that the tank be located in the approximate location of the existing septic tank to avoid re-piping of the existing sewer service or internal plumbing.

The ownership and maintenance of the residential pump station can be decided locally. There is no regulatory requirement for it to be owned by one or the other. If the Town chooses to own and maintain the pump station, it is recommended that an easement be obtained from the property owner to allow access if the pump station is located outside of the public right-of-way, which is likely. It is also important to note that while 595 South Road was included in the study area, it is a larger parcel and may not have a need for a connection to a community wastewater disposal area. If there is no need to connect this property, that would eliminate the cost and maintenance of the pump station and force main. For the purposes of this study, Alternative 3 will include the pump station and force main in order to provide for comparison of the three alternatives.

Wastewater enters two 6,000-gallon septic tanks, connected in parallel, and then flows into a dosing chamber. From the dosing chamber, wastewater enters a 60 ft by 192 ft mound system.

The wastewater collection system consists of one residential pump station serving one sewer service with approximately 175 linear feet of 1.5” SDR21 PVC sewer force main and 1,490 linear feet of 6” SDR35 PVC gravity sewer main with twelve sewer services.

Alternative 3 requires electricity for the residential pump station, which can be wired from the house or from a new electrical service. The estimated total project costs for Alternative 3 is shown in Table 3.3.

3.4. Typical Design Details

The mound systems for all three alternatives will have a typical construction layout, consisting of a septic tank, dosing chamber (or pretreatment chamber) and leach field. The leach field details include 1.5-inch PVC pipe for pressure distribution with perforations and 12” of stone under the pipes. Based on the water table, the mound systems will require approximately 14” of sand under the infiltration trenches. The width of the infiltration trenches is 48”. The length of the infiltration trenches and overall field size varies for each alternative. The septic tank, dosing chamber, and pretreatment chamber sizing also varies for each alternative. A summary of the sizing for each alternative is provided in Table 3.4.

Table 3.3: Total Project Cost Estimate – Alternative 3

Item Description	Estimated Cost
Pump Station and Force Main	$235,000
Gravity Wastewater Collection System	$55,000
Wastewater Disposal System	$150,000
Miscellaneous Work & Cleanup	$70,000
Construction Subtotal	**$510,000**
Contingency (20%)	$100,000
Engineering	$105,000
Legal/Fiscal/Administrative	$5,000
Total Project Cost	**$720,000**

Notes:

1. Construction costs are based on construction in 2020. These estimated costs should be increased to reflect inflation when budgeting for construction in future years.
2. Construction cost estimates are based on conceptual designs without the benefit of final design documents. Actual construction costs may vary substantially.
3. The construction cost estimate for the pump station and force main includes furnishing and installing a package pump station with a concrete tank and electrical control panel, and approximately 175 linear feet of 1.5” SDR21 PVC force main; excavation, backfill and compaction; select backfill materials; and pavement and grass restoration.
4. The construction cost estimates for the gravity wastewater collection systems include furnishing and installing approximately 1,490 linear feet of 6” SDR 35 PVC pipe and precast concrete manholes with appurtenances; excavation, backfill and compaction; select backfill materials; and pavement and grass restoration.
5. The construction cost estimate for the wastewater disposal system includes furnishing and installing a septic tank, dosing chamber, electrical service, conduit, wiring, PVC piping from septic tank to leach field, mound sand, stone, and piping in leach field; excavation, backfill and compaction; select backfill materials; and pavement and grass restoration.
6. The construction cost estimate for miscellaneous work includes additional work necessary to complete the installation of the wastewater collection and disposal systems.
7. Engineering costs are based on the State of Vermont Fee Allowance Table for similarly sized projects.
8. Legal, fiscal and administrative costs are estimated by the engineer based on similarly sized projects and should be confirmed by the Town of Marlboro prior to budgeting.

Table 3.4: Summary of Mound System Alternatives

Component	**Component Capacity/Size**		
	Alternative 1	**Alternative 2 (A&B)**	**Alternative 3**
Design Capacity	N: 4,230 gpd S: 1,900 gpd	N: 4,230 gpd S: 1,900 gpd	6,130 gpd
Septic Tank	N: 9,000 gallons S: 4,000 gallons	N: 9,000 gallons S: 4,000 gallons	6,000 gallons (x2)
Dosing Chamber	N: 1,100 gallons S: 480 gallons	N/A	1,500 gallons
Pretreatment System	N/A	N: 4,230 gpd S: 1,830 gpd	N/A
Grease Trap	N/A	1,000-1,500 gallons	N/A
Leach Field: Capacity	N: 4,230 gpd S: 1,900 gpd	N: 2,115 gpd S: 950 gpd	6,130 gpd
Leach Field: # of Trenches	N: 6 S: 5	N: 4 S: 3	8
Leach Field: Length	N: 178 ft S: 92 ft	N: 134 ft S: 78 ft	190 ft
Leach Field: Overall Field Size	N: 44 ft x 178 ft S: 36 ft x 95 ft	N: 28 ft x 134 ft S: 20 ft x 79 ft	60 ft x 192 ft

4. Summary, Conclusions and Recommendations

The purpose of this study is to identify and evaluate feasible alternatives for wastewater collection and disposal in Marlboro Village for long-term planning. Based on the data collected during this study, wastewater disposal is feasible on the Town-owned parcel. Three alternatives were developed and evaluated. Table 4.1 provides a summary of the alternatives evaluated. In all three alternatives, the treatment system is a mound system due to the high water table.

Table 4.1: Summary of Alternatives Evaluation

Alternative		Total Project Cost Estimate	Operation and Maintenance
1	Gravity Collection to Two Mound Systems	$740,000	Low
2A	Gravity Collection to Two Mound Systems w/ Pretreatment (requiring electricity)	$1,720,000	High
2B	Gravity Collection to Two Mound Systems w/ Pretreatment	$875,000	Moderate
3	Pressure and Gravity Collection to One Mound System	$720,000	Low

Notes:

1. The cost estimates were presented previously in Tables 3.1, 3.2 and 3.3.
2. Operation and maintenance rankings compare the three alternatives in terms of possible operation and maintenance requirements for the collection and treatment systems.

Alternative 2A is significantly more expensive than the other alternatives due to the cost of the pretreatment systems and need for an electrical service. Additionally, the pretreatment systems require more maintenance than the other alternatives. Based on the cost and maintenance requirements, Alternative 2A is not recommended.

The total project cost estimate for Alternative 2B is based on the Anua brand pretreatment units. The Premier Tech brand units may have a lower cost, which would bring the total estimate down closer to Alternatives 1 and 3, but still slightly above. Alternative 2B also requires more maintenance than the remaining two alternatives. Alternative 2B is recommended if space becomes an issue on the Town-owned parcel. This may occur if there are other planned uses for this land in the future, or if there are additional constraints identified during final design.

Alternatives 1 and 3 are approximately the same cost and have similar operation and maintenance requirements. One advantage of Alternative 1 is that if the total future flow exceeds 6,500 gpd, the flows would be split between two treatment systems. An Indirect Discharge Permit would not be required under Alternative 1 unless flow to one of the treatment areas exceeds 6,500 gpd. Under Alternative 3, there is no flexibility to avoid an Indirect Discharge Permit if the total future flow exceeds 6,500 gpd.

It is important to note that these alternatives and cost estimates are based on estimated existing wastewater flows, including assumptions for some of the properties. The estimated flows do not include an allowance for growth. It is recommended that the estimated flows be re-evaluated during final design to confirm current uses and flows, and to potentially include an allowance for future growth.

If the estimated flows exceed 6,500 gallons per day, the construction cost of Alternatives 1 and 3 would increase by $90,000 to $100,000. There would also be an increase in contingency and engineering costs. Based on the cost impacts of permitting under the Indirect Discharge Permit, it is recommended that the design flows to each treatment system remain under 6,500 gallons per day. This may require reduction of the service area if flows are found to be greater than 6,500 gallons per day to a single treatment system upon confirmation of uses and the addition of a potential growth allowance.

Both alternatives allow for some level of phasing; however, Alternative 1 provides more flexibility with phasing by only constructing one treatment system at a time. The collection system piping can be installed in phases. For example, if the Town Office needs a replacement wastewater disposal system, the northern treatment system and the piping from there to the Town Office can be constructed, but the piping up Town Hill Road does not need to be constructed at the same time, nor does the southern treatment and collection system. The phasing opportunity in Alternative 3 is limited to phasing the collection system.

Based on the phasing flexibility and the likelihood of avoiding the Indirect Discharge Permit in the case of higher flows, Alternative 1 is the recommended alternative. Alternative 1 includes two gravity collection systems and two wastewater treatment systems, for an estimated total project cost of $740,000.

The following is a summary of the study recommendations and next steps:

1. Continue to plan for future wastewater needs in the Village by adding Alternative 1 to the Town's long-range plan.
2. Prohibit development, or strategically plan for minimal development, on the Town-owned parcel in order to protect and maintain the undeveloped areas for wastewater disposal.
3. Re-evaluate the wastewater flows when final design is initiated to confirm current uses.
4. Consider adding a growth allowance to the estimated wastewater flow provide a factor of safety for potential increases in number of residential bedrooms or commercial uses.
5. Adjust the service area, if necessary, to keep the daily flows below 6,500 gallons per day to each treatment system to avoid additional costs under the Indirect Discharge Program.
6. Consider phasing the construction based on the needs of the Village.
7. When planning for final design, consider applying for a planning loan from the Vermont Clean Water State Revolving Fund.
8. When planning for construction, consider applying for a construction loan from the Vermont Clean Water State Revolving Fund and/or USDA Rural Development.

If you have any questions, please do not hesitate to contact us.

Sincerely,
DUFRESNE GROUP
CHaskins
Christina M. Haskins, PE
Vice President