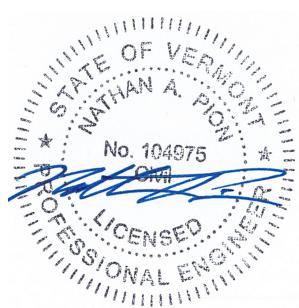


TOWN OF HIGHGATE, VERMONT

Water Feasibility Study

**December 2025
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Table of Contents

1. INTRODUCTION	1
1.1 Location	1
1.2 Population Trends	1
1.3 Community Engagement.....	1
1.4 Scope of Services.....	2
2. EXISITING CONDITIONS	3
2.1 Location Map	3
2.2 History.....	3
2.3 Highgate Center Description	3
2.4 Existing Water	4
2.5 Existing Wastewater.....	4
2.6 Environmental Resources Present.....	5
3. NEED FOR PROJECT	7
3.1 Health, Sanitation, and Security.....	7
3.2 Service Area	7
3.3 Future Growth Needs	7
3.4 Water Demands.....	8
4. SOURCE ALTERNATIVES	11
4.1 Introduction	11
4.2 Highgate Airport Extension.....	11
4.3 Highgate Elementary School Well.....	12
4.4 Highgate Sports Arena Well.....	14
4.5 New Source Development.....	15
4.6 Summary of Construction Costs	17
4.7 Source Recommendation.....	18
5. DISTRIBUTION ALTERNATIVES.....	19
5.1 Introduction	19
5.2 Distribution Preliminary Design Criteria	19
5.3 Distribution System Alternative	20
5.4 Storage Preliminary Design Criteria.....	21
5.5 Distribution System Recommendation.....	21
6. FEASIBILITY ANALYSIS / NEXT STEPS	23
6.1 General	23
6.2 Full Service Area	23
6.3 Gore Road (Only)	27
6.4 Gore Road & Route 78 East.....	29
6.5 Funding Options	30
6.6 Project Schedule	31
6.7 Permit Requirements.....	32
6.8 Next Steps	34

Appendices

- Appendix A – Figures
- Appendix B – Environmental Resources
- Appendix C – Cost Estimates
- Appendix D – O&M Costs
- Appendix E – Long Range Plan Template
- Appendix F – Source Protection Criteria
- Appendix G – O&M Manual Template
- Appendix H – New Community System Checklist
- Appendix I – Community Wastewater PER

Figures

- Figure 1 – Project Location Map
- Figure 2 – Existing Wells
- Figure 3 – Alternative #1 – Airport Water Extension
- Figure 4 – Alternative #2 & #3 – Elementary School & Sports Arena Wells
- Figure 5 – Alternative #4 – Potential Well Sites
- Figure 6 – Proposed Water Distribution System
- Figure 7 – Ground Elevations
- Figure 8 – Proposed Project

1. INTRODUCTION

1.1 Location

The Town of Highgate is located in Franklin County, in the northwest corner of the State of Vermont, approximately 10 miles north of the City of St. Albans. The Highgate Center Village area (Highgate Center) is located at the intersection of Vermont Routes 78 and 207. This feasibility study evaluates alternatives to establish a municipal public water system that would serve Highgate Center and facilitate development in the Village Growth Center, shown in **Figure 1** of **Appendix A**. The Village Growth Center is centered at the intersection of Route 78, St. Armand Road, and Gore Road.

1.2 Population Trends

According to the U.S. Census Bureau, the population for the Town of Highgate was 3,535 in 2010 and 3,472 in 2020, representing a 1.8% decrease in population. The 2023 American Community Survey (ACS) 5-Year Estimate reports a population of 3,510, indicating that Highgate's population has remained generally stable between 2010 and 2023. The 2013 "Vermont Population Projections 2010 – 2030" issued by the Vermont Agency of Commerce and Community Development projected the 2030 Highgate population to range between 3,656 to 4,011 residents based on a 2-6% growth rate.

While Highgate is not experiencing significant population growth, it continues to maintain a steady residential base. The median household income (MHI) is \$78,897 from the 2023 ACS 5-year estimate.

Table 1.1
Town of Highgate Population Trends

	2010 ¹	2020 ⁽¹⁾	2023 ⁽²⁾	2030 ⁽³⁾
Highgate	3,535	3,472	3,510	3,656

Notes:

1. Census Data
2. ACS 2023 5-year
3. Vermont Agency of Commerce and Community Developments, "Vermont Population Projections 2010-2030", 2013.

1.3 Community Engagement

The Town of Highgate has conducted extensive community engagement regarding the development of both municipal water and wastewater systems within Highgate Center. Prior efforts and engagement have included the following reports and activities:

- [Highgate Library & Community Center Feasibility Study](#) (December 21, 2017)
- Community Survey (2018)
- [Implementation Plan for Highgate Town Center](#) (January 2019)
- Highgate Village Core Wastewater and Water Feasibility Study (February 26, 2020)
- Establishment of the Village Core Master Plan Committee (2021)
- [Community Wastewater Preliminary Engineering Report](#) (December 2021)

- [Village Core Master Plan](#) (2024)

The Town has conducted previous property owner outreach as part of the Community Wastewater Preliminary Engineering Report (PER) dated December 2021. Those results can be found in Appendix F of the Community Wastewater PER in Appendix I of this Report for reference. The Town received an overall 15% response rate. Questions #9, 11, 13, and 33-41 specifically focus on the water supply.

Additionally, the Town typically engages the community in the project planning process in the following ways:

Public meetings: The Town holds public meetings to present information about proposed projects and receives input from community members. Project information is typically presented as part of the regularly scheduled selectboard meetings or planning commission meetings, though special meetings may be called, if required.

Informational materials: The Town provides informational materials, such as brochures, fact sheets, and newsletters to educate the community about the need for projects, project impacts on the community, and funding and revenue strategies being considered.

Online resources: The Town also provides online resources, such as updates on the Town website and social media pages, to keep the community informed about projects and provide opportunities for feedback.

Bond vote: The Town would need to conduct a public bond vote for the authorization of any proposed debt incurred. This provides an additional opportunity for public outreach and feedback.

Throughout the planning process, the Town typically works to develop an understanding of the community's needs and concerns and incorporates this feedback into the project plan. By engaging with the community, the Town can build support for the project, ensuring that it meets the needs of the community, and creates a sense of shared ownership over the project's success.

1.4 Scope of Services

The scope of this water system feasibility study is to evaluate whether a municipal water system is feasible in Highgate Center. The Town has until April 1, 2026 to develop a plan to develop a municipal water system to support the Cathedral Square Senior Housing Project. Preparation of the feasibility study includes the following tasks:

- Review of Existing Information
- Development of Alternatives
- Opinion of Probable Construction Costs
- Report

2. EXISITING CONDITIONS

2.1 Location Map

The proposed study area location is provided on **Figure 1** – Project Location Map in **Appendix A**. This map depicts the Highgate Center Village Area and Village Growth Center Concept Area for reference and comparison.

- **Highgate Center Village Center** (Study Area) – This area is the largest of the four village centers within Highgate (the four village areas are Highgate Center, Highgate Falls, Highgate Springs, and East Highgate) and contains all of the municipal buildings, as well as the Highgate Elementary School and Sports Arena.
- **Village Growth Center Concept Area** – The Village Growth Center Concept Area was identified in the Town Plan and includes parcels close to Highgate Center that may be suitable for future growth and connection to a municipal water system.

2.2 History

The Town of Highgate, chartered in 1763, developed as a rural agricultural community, with early industries centered on sawmills, gristmills, and tanneries powered by local streams and river falls. By the late 19th and early 20th centuries, Highgate was connected to regional trade networks via the Central Vermont Railway, supporting small dairy and farm operations that continue to define much of the town's landscape.

The community has remained predominantly agricultural but also serves as a bedroom community for nearby economic centers such as St. Albans and Swanton. Modern development has focused around Route 78 and Highgate Center, with recent planning initiatives emphasizing village revitalization, mixed-income housing, and infrastructure improvements such as sidewalks and municipal water and wastewater service. Since its founding, Highgate has relied on private wells and septic systems, reflecting its rural character and dispersed settlement pattern. However, the combination of aging onsite systems, limited lot sizes in Highgate Center, and renewed emphasis on compact, walkable growth have driven the Town's recent efforts to develop municipal wastewater and water infrastructure.

2.3 Highgate Center Description

Currently, the Highgate Center does not have a municipal water system. However, plans are currently underway for the development of a municipal sewer system. All residential and commercial development is served by individual or shared wells and septic systems. The need for municipal water and wastewater infrastructure in Highgate was first formally identified in the Highgate Town Plan 2015-2020, which noted long-standing reliance on private wells and septic systems, limited lot sizes in the Highgate Center Village, and recurring wastewater management challenges that constrained redevelopment. These priorities were reaffirmed in the Highgate Town Plan 2023–2031, which established the extension of municipal utilities as a core strategy for revitalizing the village core and supporting compact growth.

As outlined in previous engineering studies and reports, the Town of Highgate has a desire to promote future growth in Highgate Center, as well as areas north and west of Highgate Center for industrial growth. In order to facilitate this growth, the Town has narrowed its focus on developing a municipal water system to serve Highgate Center and additional parcels identified in the Village Growth Center Area.

2.4 Existing Water

Highgate Center is currently served almost entirely by individual, privately owned wells. Due to the combination of small lot sizes and onsite water and wastewater systems, many of the wellhead protection areas overlap with septic system disposal setbacks, creating elevated risks of groundwater contamination and associated public health concerns.

As shown in **Figure 2 of Appendix A**, existing wells are densely clustered within the village core, while properties on the outskirts of the study area have larger lot sizes that allow adequate separation between wells and septic systems. According to the Vermont ANR Atlas database, there are approximately 205 existing wells within the study area. The oldest well permit dates to 1967, with 15% of wells permitted before 1980, 30% between 1980 and 1995, 35% between 1995 and 2010, and the remaining 20% issued between 2010 and 2025.

The average well depth across all wells is approximately 250 feet. Analysis of well depth by age indicates no correlation between depth and construction year, suggesting that groundwater conditions and drilling practices have remained consistent over time. Of the 205 wells, approximately 82% are drilled into bedrock and 18% into gravel. The average bedrock well depth is 286 feet, while gravel wells average 98 feet in depth.

The average reported well yield is 18 gallons per minute (gpm), with yields statistically consistent across decades of construction. However, approximately two-thirds of wells produce yields below 18 gpm, indicating that a small number of high yield wells elevate the overall average. No significant difference in yield was observed between gravel and bedrock wells. Geographically, high yield wells are generally located in the eastern portion of the study area, though this may reflect the greater number of wells in that subarea rather than distinct hydrogeologic conditions.

The Vermont Department of Environmental Conservation (VT DEC) and Vermont Department of Health (VDH) have water quality data on file that suggests there is elevated arsenic levels in multiple wells within the project area. Maps and raw water quality results are provided in Appendix B. The maximum contaminant level (MCL) for arsenic is 10 parts per billion (ppb).

2.5 Existing Wastewater

Historically, Highgate Center has relied almost entirely on individual, privately owned onsite septic systems for wastewater disposal. This decentralized approach, while suitable for rural areas with large lot sizes, presents significant challenges in Highgate Center due to dense village development, small lots, and limited soil suitability for replacement systems.

In December 2021, the Town of Highgate completed a Community Wastewater Preliminary Engineering Report (PER), which evaluated alternatives for providing municipal wastewater collection and treatment within the village area. Following the recommendations of that study, the Town pursued and secured funding to design and construct a municipal wastewater treatment system, (“Public Sewage System”). The proposed facility is to be located on the Wright property along Lamkin Street, strategically sited to serve the Highgate Center Village Core and adjacent residential and commercial properties. The anticipated service area for the new system is shown on the map entitled “Town of Highgate Wastewater Service Area”, as shown in Figure 10 in the Figures of the Town of Highgate Community Wastewater Preliminary Engineering Report EPA-PC-395.

According to the Town’s draft Sewer Ordinance, existing septic systems within the designated service area may continue to operate after the Public Sewage System is constructed, provided

they are located outside the 500-year floodplain and remain in compliance with performance standards. New onsite systems within the service area will only be permitted if they do not encroach on another property's wellhead protection area and do not require a variance from the Vermont Department of Environmental Conservation (DEC) Wastewater and Potable Water Supply Rules. The ordinance also establishes conditions for mandatory connection to the new system when necessary to protect public health and safety, as well as requirements for new connections, ensuring consistent operation and regulatory compliance once the system is in place.

2.6 Environmental Resources Present

A preliminary review of the State of Vermont Agency of Natural Resources (ANR) Atlas showed the following environmental resources within the Highgate Center Study Area:

- Groundwater Water Quality: There is water quality data on file with the Drinking Water & Groundwater Protection Division (DWGWPD) and Vermont Department of Health (VDH) that suggest there is elevated arsenic levels in multiple wells within Highgate Center. More information is provided in Appendix B from Allison Murphy, former DWGWPD Engineer, during the Wastewater Preliminary Engineering Report in 2021.
- Class II Wetlands: There are a few large segments of Class II wetlands northeast and northwest of Highgate Center, primarily within wooded areas that have not been developed. The two larger wetland complexes are on the outer edge of the Study Area.
- Urban Soils Background Area: The Highgate Center Village area is located entirely within the Urban Soils Background Area. The Urban Soils Background Area encompasses a ½ square mile of the Study Area.
- Hazardous Waste Sites: There are five hazardous waste sites located within the Study Area, all within the Highgate Center core area. The hazardous waste sites include petroleum contamination from underground storage tanks and spills, a former landfill site that is now a Brownfield due to arsenic and lead contamination, and high levels of metals at a former municipal building. A brief list is provided below for hazardous waste sites centered around Route 78 and St. Armand/Gore Road:
 - Highgate Municipal Building (Site No. 20184796)
 - Highgate Village Mobil (Site No. 890317)
 - Machia Estate (Site No. 20174707)
 - Former Highgate Highway Town Garage (Site No. 20174716)
 - Valero formerly M & R Beverage (Site No. 982371)
- Landfills: In addition to the landfill located at the former Highgate Town Garage, there are three additional former landfills within the Study Area. All three of these are generally located southwest of Highgate Center.
- Primary Agricultural Soils: There are primary agricultural soils in the Highgate Center area, which may be impacted by the development of a new municipal water system.
- Flood Hazard Area: The study area is bound to the south by the Missisquoi River, which includes a flood hazard area.
- Rare, Endangered, Threatened Species: A Rare, Threatened, and Endangered Animal is identified along Gore Road from Route 78 almost all the way to the Canadian border. Any work along Gore Road will need to be coordinated with the VT Dept. of Fish and Wildlife.
- Archaeological Sensitivity: Charles Knight, Ph.D, at the University of Vermont, issued a "Desk Review of the proposed Highgate Wastewater Feasibility Study" in August 2020. The water feasibility study is within the same area as the wastewater feasibility study. Per the 2020 Archeological Report, "The proposed area is located adjacent to the limits of the Highgate Falls Prehistoric Archaeological District.....consists of 18 pre-Contact Native

American archaeological sites identified along the banks of the Missisquoi River....” The conclusion was a Phase I site identification survey needed to be conducted. Any proposed construction related to a water system will likely require a Phase I site identification survey.

Maps of the environmental resources present have been included in **Appendix B**. A full Environmental Report will be required if the project moves forward into preliminary engineering and final design.

3. NEED FOR PROJECT

3.1 Health, Sanitation, and Security

The close spacing of existing homes and the extensive use of private wells and individual septic systems present an ongoing potential risk to groundwater quality and public sanitation. Many properties in the village core rely on small lots that do not provide enough separation between drinking water sources and wastewater disposal areas. Review of wellhead protection zones and permitted wastewater system locations shows a significant degree of overlap, creating a measurable risk for cross contamination.

This condition increases the potential for bacterial or nutrient contamination of groundwater. Even properly maintained systems may allow migration of contaminants when wells and leach fields are located too close together or when multiple systems operate within a limited area. In these conditions, one failed septic system can affect several nearby wells, posing both health and regulatory challenges for the community.

The establishment of a managed public water and wastewater system would improve the long-term sanitary conditions in Highgate Center. Centralized service would reduce the number of individual disposal systems, limit potential sources of contamination, and ensure consistent monitoring of both water quality and treatment performance. In addition, a community system provides greater security and resilience by protecting residents from the financial and health impacts associated with private system failure or groundwater pollution.

As discussed in Section 2, the VT DEC and VDH have data suggesting elevated arsenic levels in multiple wells within Highgate Center. More information is available in Appendix B.

3.2 Service Area

The potential service area for the proposed Highgate Center public water system encompasses the Village Center Area boundary as well as adjacent parcels within the Village Zoning District along St. Armand Road, as illustrated on **Figure 1 in Appendix A**. In addition, several properties identified within the Village Growth Center Concept Area have been recognized as suitable for future development and could be served by a municipal water system as the community grows.

3.3 Future Growth Needs

Future growth within the Town of Highgate is expected to be concentrated in and around Highgate Center, consistent with the community's Village Center Designation and goals outlined in the Town Plan 2023–2031. The Town has established a clear planning framework that encourages compact, walkable development in the village core while preserving the surrounding agricultural and forest lands.

Population forecasts prepared by the Northwest Regional Planning Commission as part of the *Highgate Village Core Wastewater and Water Feasibility Study* (2020) project modest but steady population increases over the coming decades. Based on regional trends, Highgate's population is estimated to rise to between 3,650 and 4,000 residents by 2030, representing roughly a 4 to 14 percent increase over 2010 levels. The analysis also projects a need for approximately 60 to 120 additional housing units by 2030, most of which are expected to occur within or adjacent to Highgate Center as infrastructure capacity improves.

A primary driver of near-term growth is the planned Cathedral Square senior housing development, with 30 units of mixed income housing for residents aged 55 and older, proposed within the Designated Village Center. The project, undertaken in partnership with the Town of Highgate, represents a major investment in housing in the village core. The development will require identification of reliable water supply and wastewater treatment capacity as part of the project's approval process.

Beyond Cathedral Square, the Village Growth Center Concept Area, as identified in the Village Master Plan (February 2024), provides additional opportunity for future infill and mixed-use development, including residential expansion, small-scale commercial uses, and community facilities once municipal water and wastewater service becomes available. Incremental growth is also anticipated along St. Armand Road, Gore Road, and Route 78, particularly where improved utility and transportation infrastructure, such as new sidewalks, will enhance accessibility and development feasibility.

The Highgate Airport and Industrial Park area has also been identified as a potential focus for commercial growth, supported by recent investments in water and sewer extensions funded through the 2025 federal and state infrastructure grants. While the village area is expected to absorb much of the future residential demand, other areas of Highgate may also emerge as local growth centers, including the airport district and portions of the Route 78 corridor. These areas present opportunities for coordinated planning and shared investment in water and wastewater infrastructure where service extensions or system interconnections are practical. Collectively, the range of planned and potential developments indicates a gradual increase in housing, employment, and public service needs over the coming decades.

3.4 Water Demands

Initial Year (2025) Water Average Day Demand

The Community Wastewater Preliminary Engineering Report (Otter Creek Engineering, June 2021) estimated an average daily water demand of approximately 44,581 gallons per day (gpd) for the initial Highgate Center service area (Refer to Table 3 in Community Wastewater PER included in Appendix I). The 44,581 gpd includes the following:

- Village Center Designation
- Highgate Elementary School
- St. Armand Road (North of Village to Rail Trail)
 - 23 Single Family Homes (SFHs)
 - 4 Farms
- Gore Road
 - 16 SFHs
 - 2 Businesses
- Route 78 (East of Village to Rail Trail)
 - 7 SFHs
 - 1 Farm
- Lamkin Road (East of Village to Rail Trail)
 - 18-25 SFHs

This planning figure was derived using standard Vermont DEC design flow assumptions and the estimated number of potential service connections within the core village including homes, small businesses, and municipal buildings. The 44,581 gpd value therefore represents a planning-level

estimate of the average daily demand for the initial phase of service, sufficient to meet the needs of existing users and limited near-term growth, but not the entire future build-out of the village or town. A breakdown of the “Existing Uses in Potential Service Area” can be found in Table 3 of the Community Wastewater PER in Appendix I. The total number of equivalent residential users (ERUs) for the initial design year (2025) is 212. An ERU is a standard measure for calculating user fees for services by equating the total usage based on an average single-family homes usage, which is equivalent to 210 gpd.

Per the Water Supply Rules, in the absence of site specific data, a maximum day demand peaking factor of 2.0 shall be used to calculate the maximum day demand. Based on an average day demand of 45,000 gpd, the maximum day demand would equate to 90,000 gpd.

Design Year (2045) Water Average Day Demand

Population and housing forecasts prepared by the Northwest Regional Planning Commission (NRPC) in the *Highgate Village Core Wastewater and Water Feasibility Study* (2020) project that the Town of Highgate’s population will increase to between 3,650 and 4,000 residents by 2030, representing a 4 to 14 percent rise over 2010 levels. The analysis also estimates a need for 60 to 120 new housing units by 2030, most of which are anticipated to be located within or near Highgate Center, where planned municipal water and wastewater service will support compact, village-scale development.

Per the Water Supply Rules, water treatment plants, water system sources, and pump stations shall be designed for maximum day demand at the design year, recommended at 20 years. Water distribution mains and transmission lines shall be designed for 50 years projected growth. While storage tanks are not specifically stated, they typically have an expected useful life more in line with water distribution mains. However, due to future growth uncertainty, we only projected the storage tank volume out to 20 years. For this exercise, we considered all water infrastructure with a 20-year project growth.

There are two (2) major developments proposed within or adjacent to the Highgate Center Village Center; Cathedral Square and Cassidy Meadows. The Cathedral Square Development is a 30-unit affordable housing development for older adults (55+), consisting of one- and two-bedroom apartments. A total gallons of water per day needed for the Cathedral Square Development was not found. But based on 30 units, with two-bedrooms, the estimated total demand will be approximately 6,075 gpd. This assumes that each unit will demand approximately 202.5 gpd, based on 225 gpd with a 0.9 reduction. The Cassidy Meadows Development (Act 250 Case # 6F0619) proposes 34 residential units with a mix of carriage units, duplex and triplex unit buildings. The total gallons of water per day needed for the project is estimated to be 5,473 gpd.

The Highgate Village Core Wastewater and Water Feasibility: Planning Analysis projects a population growth of 2-6% from 2020 to 2030. However, past data has failed to achieve these growth projections. To be conservative, a 0.5% and 2% per year increase in water demand is estimated for the design year estimates. This equates to one (1) new single family home of 210 gpd per year. This is in addition to the Cathedral Square and Cassidy Meadows Development, because those projects are currently under preliminary development.

Table 3.1
Water ADD
Design Year (2045)

	Design Year (2045) @ 0.5% Growth (gpd)	Design Year (2045) @ 2% Growth (gpd)
Initial Year ADD	45,000	45,000
Cathedral Square	6,075	6,075
Cassidy Meadows	5,473	5,473
Future Demand	4,720 ⁽¹⁾⁽²⁾	21,868 ⁽²⁾⁽³⁾
Total	61,268	78,416
USE⁽⁵⁾	65,000 gpd	

Notes:

1. 0.5% annual increase of Initial Year ADD for 20 years.
2. Equivalent to 22 new Single Family Homes (SFHs) constructed over 20 years. ~1 new SFH/year.
3. 2.0% annual increase of Initial Year ADD for 20 years.
4. Equivalent to 104 new SFHs constructed over 20 years. ~5 new SFH/year.
5. For future planning purposes.

4. SOURCE ALTERNATIVES

4.1 Introduction

To identify a reliable and sustainable public water source for Highgate Center, several supply alternatives were evaluated based on technical feasibility, water quality, available capacity, and cost. Each option was developed to support the projected service area and provide sufficient supply for current and future community needs. The alternatives include:

1. **Highgate Airport Extension** – Extending a municipal waterline from the Highgate Airport, which is served by the Village of Swanton Water System (WSID#5132).
2. **Highgate Elementary School Well** – Utilizing and expanding the existing well at Highgate Elementary School.
3. **Highgate Sports Arena Well** – Utilizing and expanding the existing well serving the Highgate Sports Arena.
4. **New Source Development** – Drilling and developing a new groundwater source in proximity to Highgate Center.

These alternatives represent a range of approaches for consideration. The following sections describe each option in greater detail, outlining its advantages, limitations, and considerations for implementation.

4.2 Highgate Airport Extension

Description

The Highgate Airport Extension alternative involves extending a municipal waterline from the existing infrastructure near the Franklin County State Airport to serve the Highgate Center Village area. The airport is served by the Village of Swanton Water System (WSID#5132). This option builds on recent investments associated with the Airport Corridor Water and Sewer Extension Project, which was funded through federal and state grants in 2025. The existing infrastructure in the airport area is designed to provide both potable water and fire protection to commercial and industrial users along Route 78.

Technical Evaluation

Under this alternative, approximately 13,500 linear feet of new transmission main would be installed along Route 78 from the airport to the Highgate Center service area. The extension would require either an upgrade of the existing booster pump station installed for the Highgate Airport Extension or a new booster pump station. The Highgate Airport Extension booster pump station includes three (3) pumps; two (2) 100 gpm at 65' total discharge head (TDH) to meet average daily demands and one (1) 600 gpm high flow pump at 65' TDH to provide fire and flushing flows. The Highgate Airport Extension does not include any storage. Pressure is maintained by two (2) 80 gallon hydropneumatic tanks to maintain adequate pressure.

Water Quality & Quantity

The Village of Swanton Water System has capacity to meet Highgate Center's existing and future demands. As previously mentioned a booster pump station would be required, as Highgate Center ground elevation is higher than the Village of Swanton and the Highgate Airport.

Water quality would be a significant concern with this alternative. Due to the distance between the airport and Highgate Center, maintaining a chlorine residual would be difficult without adding

in a chlorine booster station. Measures would need to be considered to maintain adequate chlorine residuals in the Highgate Center water system and ensure water turnover is achieved to mitigate stagnant water and formation of disinfection by-products (DBPs).

Land Requirements

It is anticipated that most of the proposed infrastructure would be installed within the VT Route 78 Right-of-Way, however not in the VT Route 78 roadway. While this is not the most direct route, it offers advantages over acquiring permanent and temporary easements from private property owners.

Environmental Impacts

Environmental impacts would likely be minimal as most of the infrastructure would be installed within the Vermont Agency of Transportation Right-of-Way (ROW), which has been previously disturbed. There is potential for wetlands and stream crossings.

Administrative & Permitting

The Airport Extension alternative offers the advantage of connecting to an existing permitted and monitored water source, reducing permitting time and avoiding the need for new or monthly source testing. The Town of Highgate would need to apply to the Vermont Drinking Water & Groundwater Protection Division to become a new water system. The Highgate Center Water System would be considered a consecutive water system to the Village of Swanton. The Village of Swanton would be the wholesale water supplier, and the Highgate Water System would be the distribution (or retail) water system. As a consecutive water system, the Highgate Center Water System would still be required to collect monthly water samples throughout the water distribution system.

Construction

This alternative would primarily be a conventional open-trench excavation. There are a couple of stream crossings that require trenchless technology to avoid disruption to the stream beds, unless suitable separation between the waterline and culvert can be achieved.

Opinion of Probable Construction Costs

This alternative will be cost prohibitive. The cost to install the transmission main from the Highgate Airport will be approximately \$6,075,000 for the transmission main alone. This does not include the cost to refurbish or install a new booster pump station, nor any distribution system infrastructure. With these additional components, the total construction costs increases to approximately \$14,450,000. Refer to Appendix C for a breakdown of the Opinion of Probable Construction Costs.

Advantages	Disadvantages
Existing Water Source Suitable Capacity	Construction Cost Water Quality

4.3 Highgate Elementary School Well

Description

The Highgate Elementary School Well alternative evaluates the potential use of the existing Highgate Elementary School water supply well as the source for a public water system serving the Highgate Center area. The Missisquoi Valley School District (MVSD), which operates the

Highgate Elementary School, currently operates a permitted non-transient, non-community water system (WSID# 6731) regulated by the Vermont Department of Environmental Conservation (DEC) Drinking Water and Groundwater Protection Division. The system provides potable water to the Highgate Elementary School and associated facilities through an on-site drilled well, storage, and treatment infrastructure.

Technical Evaluation

The Highgate Elementary School Water System (WSID#6731) has one (1) gravel packed well with a permitted source yield of 8.3 gpm and permitted average day demand (ADD) of 6,300 gpd. The source yield and ADD are calculated based on 420 students and staff. The Water System has the capability to apply continuous disinfection using sodium hypochlorite prior to storage. Storage is provided by two (2) hydraulically connected concrete tanks, each sized for 2,500 gallons or an effective volume of 5,000 gallons. Booster pumps and two (2) hydropneumatic tanks regulate pressure into the distribution system with is compromised of a mix of 1" thru 2" copper and polyethylene piping. The water system is not designed to provide water for fire protection.

For public water systems, a source isolation zone with a 200' radius around the well is required. Within this source isolation zone, the following land uses are prohibited (Vermont Water Supply Rules, Chapter 21, 3.3.1.2):

- Application of nitrogen or pesticides;
- Buildings other than those required for water systems;
- Parking of motor vehicles;
- Chemical or fuel storage except natural gas or propane and other chemicals that are required by the water system;
- Salted or paved roads passing through the area;
- Septic tanks, subsurface disposal systems and sewer lines

A number of these prohibited activities currently surround the Highgate Elementary School.

Water Quality & Quantity

Other potential concerns include the ability to upgraded or expanded the existing well to serve the broader Highgate Center service area. Based on initial year of 45,000 gpd ADD, the Town would need a source that can supply approximately 63 gpm, based on a 12-hour/day pumping requirement. Further yield testing would need to be performed to determine the Highgate Elementary Schools Well's permitted yield capacity.

Land Requirements

The Town would need to work with the MVSD and adjoining property owners to restrict land use within the 200' well isolation zone. Since the school is located within the Highgate Center area with existing residential development and a small Village center, there would be significant hurdles with prohibiting existing uses that conflict with the VT Water Supply Rules. The creation of a community sewer system would still present a concern with sewerlines within the source protection area, parking, fuel storage, paved roads, etc.

Environmental Impacts

Available land for wellhead protection is limited, and existing septic systems and other prohibited uses make this alternative not viable. The creation of a community sewer system would still present a concern with sewerlines within the source protection area.

Administrative & Permitting

The primary advantage of this alternative is that it relies on an existing permitted and operational well. However, the existing well is permitted as a non-transient non-community water system, so the well source would need to go through a new permit process as a public community water system.

Coordination with the MVSD and DEC would be necessary to establish ownership, operation, and liability responsibilities if the source were converted to municipal use.

Opinion of Probable Construction Costs

Since this isn't a viable alternative, an opinion of probable construction cost was not developed.

Advantages	Disadvantages
Existing Source	Source Isolation Land Requirements Capacity Concerns Permitting

4.4 Highgate Sports Arena Well

Description

The Highgate Sports Arena Well alternative considers the potential use or expansion of the existing Highgate Sports Arena water system as a source to serve the Highgate Center public water system. The Sports Arena, located approximately one-half mile north of the village along Gore Road, operates a transient non-community water system (WSID#21508) regulated by the Vermont Department of Environmental Conservation (DEC) Drinking Water and Groundwater Protection Division.

Technical Evaluation

The Highgate Sports Arena Water System (WSID#21508) provides potable water to the arena and associated facilities through an on-site drilled well, pressure tank, and distribution system. The Source Permit issued on October 29, 2015, notes that "the source is only permitted to withdraw a maximum rate of 2.8 gpm." The water system is not designed to provide water for fire protection.

For public water systems, a source isolation zone with a 200' radius around the well is required. Within this source isolation zone, the following land uses are prohibited (Vermont Water Supply Rules, Chapter 21, 3.3.1.2):

- Application of nitrogen or pesticides;
- Buildings other than those required for water systems;
- Parking of motor vehicles;
- Chemical or fuel storage except natural gas or propane and other chemicals that are required by the water system;
- Salted or paved roads passing through the area;
- Septic tanks, subsurface disposal systems and sewer lines

A number of these prohibited activities currently surround the Highgate Sports Arena.

Water Quality & Quantity

This alternative was initially evaluated in the Otter Creek Engineering Community Wastewater Preliminary Engineering Report (June 2021) as a potential shared or interim water supply option. The report noted that the Sports Arena well has an estimated yield of 20 gallons per minute (gpm) based on original well records, which equates to approximately 28,800 gallons per day (gpd) of continuous pumping capacity. However, the Source Permit issued on October 29, 2015, notes that “the source is only permitted to withdraw a maximum rate of 2.8 gpm”, which would not be suitable for the Highgate Center Public Community Water System unless the permitted yield is increased.

The actual sustainable yield would need to be confirmed through additional pump testing and water quality sampling.

Land Requirements

The Town would need to work with the owner of the Highgate Sports Arena and adjoining property owners to restrict land use within the 200' well isolation zone. Since the sports arena is located at the north end of the Highgate Center area, there would be potential hurdles with prohibiting existing uses that conflict with the VT Water Supply Rules.

Environmental Impacts

Available land for wellhead protection is limited, and existing septic systems and other prohibited uses make this alternative not viable. The creation of a community sewer system would still present a concern with sewerlines within the source protection area.

Administrative & Permitting

The primary advantage of this alternative is that it relies on an existing permitted and operational well. However, the existing well is permitted as a transient non-community water system, so the well source would need to go through a new permit process as a public community water system.

Coordination with the Highgate Sports Arena owners and DEC would be necessary to establish ownership, operation, and liability responsibilities if the source were converted to municipal use.

Opinion of Probable Construction Costs

Since this isn't a viable alternative, an opinion of probable construction cost was not developed.

Advantages	Disadvantages
Existing Source	Source Isolation Land Requirements Capacity Concerns Permitting

4.5 New Source Development

Description

The New Source Development alternative involves identifying, drilling, and permitting a new groundwater supply well to serve the Highgate Center public water system. This alternative would establish a dedicated municipal source located within or near the proposed service area, providing long-term reliability and full control of water system operations. The process would include a

detailed hydrogeologic investigation to determine suitable well locations based on geology, aquifer capacity, water quality, and land availability for required source protection areas.

Technical Evaluation

Potential well sites would likely be located on MVSD or Town-owned properties or otherwise accessible parcels within or adjacent to the Village Growth Center Concept Area. Preliminary siting would consider setback requirements from existing septic systems, floodplains, and property boundaries, while ensuring accessibility for construction and maintenance. Once a potential site is identified, test well drilling and pump testing would be conducted to confirm sustainable yields and to evaluate raw water quality parameters such as arsenic, iron, manganese, hardness, and natural fluoride concentrations. Based on these results, the Town would prepare a Source Evaluation Report and submit it to the Vermont DEC Drinking Water and Groundwater Protection Division (DWGWPD) for approval.

However, this approach carries the greatest initial uncertainty and cost due to the need for exploratory drilling, testing, and permitting. The development of a new water source could offer the most sustainable and locally managed solution for meeting the Town's long-range water supply goals.

Water Quality & Quantity

Water quality and quantity would be evaluated and analyzed under the test well drilling and source permitting. Neither of these parameters are known at this time. However, there is water quality data on file with the DWGWPD and Vermont Department of Health (VDH) which suggests that there is elevated levels of arsenic in multiple wells in the Highgate Center Area. The current maximum contaminant limit (MCL) for arsenic is 10 ppb. The DWGWPD reached out to Mark Johnson, Deputy Director of Community and Environmental Resources at Rural Community Assistance Program (RCAP) in 2023 regarding assistance with sampling private wells in the Highgate Center area. RCAP would be interested in assisting and supporting the Town in this effort.

Provided in Appendix A on Figure 2 is a summary of existing wells, well type, and well capacity for reference. To meet the initial estimated domestic demand of 45,000 gpd, the Town would need to locate and develop a well with at least 63 gpm, based on a 12-hour/day pump requirement.

An ideal groundwater source would meet the following criteria:

- Favorable Aquifer – Quantity & Water Quality
- Adequate Recharge for Long-Term Sustainability
- Adequate Source Protection Area – Remote, Away from Potential Sources Of Contaminations (PSOCs)
- Limited Potential for interference on existing water supplies
- Close to Existing Infrastructure

Land Requirements

The Town would need to find and acquire a parcel of land without any prohibited uses within 200' of the proposed well.

The MVSD owns a parcel of land on Gore Road, just north of the Sports Arena, that could be a potential site for a groundwater source. From initial review, this property doesn't appear to include any prohibited land uses identified in the source isolation regulations.

Environmental Impacts

Environmental impacts will need to be better defined once a potential well is identified. Refer to Section 2.4 regarding environmental impacts and constraints within the Highgate Center area.

Administrative & Permitting

The primary advantage of the New Source Development alternative is that it provides a fully independent, municipally controlled water supply that can be designed to meet current and future demand.

Permitting will be a step-wise process to perform test well drilling in order to identify a potentially suitable well source. This may require several attempts. Once a test well is identified then a more comprehensive test well permitting process will need to occur which requires 72-hour pumping tests, water quality samples, and monitoring of nearby well sources.

Construction

The construction of a new drilled well, whether bedrock or gravel packed, is conventional construction performed by experienced and local well drillers.

Opinion of Probable Construction Costs

The costs for a new groundwater source and treatment (arsenic) plus distribution, as discussed later in Section 5, would be approximately \$8,200,000. Refer to Appendix C for a detailed description of the opinion of probable construction costs.

Advantages	Disadvantages
Independent source	Initial uncertainty
Locally managed	Exploratory costs
Source Protection Area	Upfront testing
Potentially lowest total cost	Potential for water treatment (Arsenic)

4.6 Summary of Construction Costs

Estimated construction costs for the alternatives can be found in Table 4.1. Detailed cost estimates can be found in Appendix C.

Table 4.1
Source Alternatives
Construction Cost

Source Alternative	Estimated Construction Cost ⁽¹⁾⁽²⁾
Highgate Airport Extension	\$14,450,000
Highgate Elementary School Well	N/A
Highgate Sports Arena Well	N/A
New Source Development	\$8,200,000

Notes:

1. Estimated construction costs based on ENR 14100 (December 2025).
2. Costs include distribution system, as evaluated in Section 5.

4.7 Source Recommendation

The existing groundwater sources at the Highgate Elementary School and Sports Arena are not viable alternatives due to concerns with yield and source protection area. The connection to the Highgate Airport while feasible, would be cost prohibitive and present water quality concerns. Therefore, the recommendation would be to pursue the development of a new groundwater source in the area surrounding Highgate Center.

5. DISTRIBUTION ALTERNATIVES

5.1 Introduction

The section will consider and evaluate storage and distribution options. These alternatives would apply to any of the source alternatives, and bring water from the source to the water customer. This evaluation will be limited to a couple options but will ultimately play into the question of affordability for the water customers.

5.2 Distribution Preliminary Design Criteria

5.2.1 Pipe Materials

For most applications, pipe materials for water mains and service connections 4-inches in diameter or larger are typically either ductile iron (DI), polyvinyl chloride (PVC) or high density polyethylene (HDPE). PVC and HDPE have very similar physical properties and were considered together. An evaluation of these pipe materials is presented in Table 5.1. While DI is slightly stronger and more durable, the material is more expensive. PVC/HDPE offers a good balance of cost and durability, so will be the pipe material used in the alternatives developed.

Table 5.1
Pipe Material Alternatives Evaluation

Ductile Iron	HDPE/PVC
<p>Advantages</p> <ul style="list-style-type: none"> • Greater mechanical strength and durability • Resistant to petroleum and VOC contamination • Conductive material • 100 years expected life 	<p>Advantages</p> <ul style="list-style-type: none"> • Lower material cost • More resistant to corrosion • Improved hydraulics • 75 years expected life
<p>Disadvantages</p> <ul style="list-style-type: none"> • Higher material cost • Less resistant to corrosion 	<p>Disadvantages</p> <ul style="list-style-type: none"> • Lower mechanical strength and durability • Cannot be used where petroleum or VOC contamination is present • Requires tracer wire for locating

Water mains and service connections 2-inches in diameter or smaller are typically either copper or high-density polyethylene (HDPE). When properly installed, HDPE is a very durable material that is significantly less expensive and easier to handle than copper, and therefore will be used for the alternatives developed.

It should be noted that in areas where subsurface soil contamination is present, only ductile iron pipe with nitrile gaskets and copper services can be utilized.

5.2.2 Pipe Sizes

In order to provide fire protection, water mains with fire hydrants need to be 8-inches in diameter or larger. However, for the Highgate Center it is not recommended to provide fire flow based on the current demands and the necessary storage requirements as discussed in Section 5.3. Therefore, for this proposed evaluation all mains were considered 4" diameter.

5.2.3 System Pressures

Standards for the design of distribution systems are provided in the Vermont Water Supply Rule, Appendix A, Part 8, latest edition. The Water Supply Rule includes two key provisions for designing water mains:

- The system must be capable of meeting maximum day demands while maintaining a minimum 35 psi residual at all points in the distribution system.
- The system must be capable of providing the recommended fire flows while maintaining a minimum 20 psi residual at all points in the distribution system. The Water Supply Rule specifies a minimum 500 gpm fire flow for all fire hydrants. As stated above, fire flows were not recommended or considered for the Highgate Center water system.

5.2.4 Valve Spacing

Gate valves are typically installed at regular distances to allow individual segments of water mains to be isolated for repair, testing, or maintenance. The Vermont Water Supply Rule recommends isolation valves be spaced no more than 500 feet apart in commercial areas or 800 feet in other areas.

Isolation valves are also typically included wherever a branch connection occurs. The best operational flexibility is typically achieved with valves provided in a three-way or four-way configuration depending on the number of water mains.

5.3 Distribution System Alternative

The distribution system will center on Route 78 between St. Armand Road and Gore Road. The water distribution, for the initial year is expected to include the following roads/streets:

- St. Armand Road (Slightly past the rail trail)
- Gore Road (Slightly past the rail trail)
- Route 78 East (Up to the rail trail)
- Route 78 West (Approx. to Highgate Road)

- Lamkin Street (Up to the cemetery)

The Town may look to reduce the initial service area. More details are provided in Section 6.

The Highgate Center area is relatively flat. Ground elevations within this defined distribution system range from 300' to 310'. If the distribution system were to ever expand further to the west or east along Route 78 or down Lamkin Street, the ground elevations range would extend to 285' to 330'.

In order to supply water to the residents within the Highgate Center, large diameter (4" or greater) PVC water mains will need to be installed within the State or Town Right-of-Way (ROW) along Route 78 or the Town roads.

Services will need to be extended to all homes within the project area. Temporary easements will need to be obtained by all residents to bring services across their property and into their homes. Plumbing changes will also need to occur to ensure that the interior plumbing is suitable and their existing water supply is disconnected. Water meters should also be installed at this time for billing and water audits.

The new distribution system would include the following appurtenances:

- Water Main Isolation Valves
- Flushing Hydrants
- Customer Isolation Valves (Curb Stops)

5.4 Storage Preliminary Design Criteria

5.4.1 Tank Volume

The Vermont Water Supply Rule (WSR) requires that water systems have sufficient storage capacity to meet average daily demands (ADD) and fire flow demands, if fire flow is provided. The minimum fire flow storage is 60,000 gallons, based on a minimum fire flow requirement of 500 gpm for 2 hours. Tanks have a 20+ year life expectancy; therefore, the tank should be designed to meet the design year ADD of 65,000 gallons.

Excessive storage volumes can present water quality concerns if adequate turnover, or volume change is not achieved on a daily basis. Furthermore, a fire pump would be required with a hydropneumatic system which requires significant capital cost for a piece of equipment that would run infrequently. Fire pumps have also been known to cause significant water hammers and surges on distribution systems. Therefore, it is recommended that the tank be sized for ADD.

5.4.2 Tank Types

A variety of tank materials and configurations have been used for the storage of potable water. Several of the most common types are listed below:

- Cast-in-Place Concrete
- Precast Prestressed Concrete
- Welded Steel
- Glass-Fused-to-Steel

A glass-fused-to-steel standpipe would likely be the most cost-effective tank for this size construction.

5.4.3 Location

If the water storage tank is to pressurize the distribution system via gravity, then the tank will need to be located at a higher elevation. The alternative would be an elevated tank, but that would be too cost-prohibitive for the Town of Highgate. The water storage tank would need to be located at least 81' higher than the highest ground elevation in the distribution system to provide a minimum 35 psi. This would result in a ground elevation of approximately 401', based on the potential highest elevation within the distribution system of 330'. To provide a working pressure of 60 psi to the highest elevation in the distribution system, the base elevation would need to be approximately 139' higher, or a ground elevation of 469'.

The only area near Highgate Center that approaches 400' ground elevation is located on Carter Hill Road, just north of the first curve. This location is approximately 5,000' away from Highgate Road, the most western portion of the initial distribution system.

Based on the limited topography gain around Highgate Center to site a storage tank to pressurize the distribution system, and the cost to run a new water main 5,000' away from the Highgate Center distribution system, this alternative is not recommended.

Therefore, the only viable and cost-effective solution for storage to pressurize the water distribution system would be a hydropneumatic system. The tank and hydropneumatic system could be in proximity to the proposed groundwater well.

5.5 Distribution System Recommendation

Based on the discussion above, it is recommended that the Town pursue a distribution system that provides domestic demands, but not fire flow demands. The majority of the water mains within the distribution system would be 4" PVC. A new glass-fused-to-steel tank would be sized for 65,000 gallons which will be adequate for the existing service area and allow for future growth. A hydropneumatic booster pump system, located adjacent to the new storage tank, would pressurize the distribution system.

6. FEASIBILITY ANALYSIS / NEXT STEPS

6.1 General

Based upon input and discussions with the Town, there is a need for a municipal water system in Highgate Center. The Town has identified a potential property owned by the MVSD/Town that would be ideal for a new groundwater source. The parcel is close to the Village Center and undeveloped, so it should comply with the VT Water Supply Rule, Chapter 21, 3.3.1.2 regarding source isolation zone and land uses.

According to feedback from the community during the Community Wastewater Study, the respondents in Highgate Center indicated a sporadic and sparse need for a municipal water system. The responses display a split between those in favor and those against a municipal water system.

At the request of the Town, smaller service areas were explored in Section 6.3 and 6.4. The Highgate Elementary School was included in all alternatives as it represents approximately 43 equivalent residential users (ERUs). Without the Highgate Elementary School, the economic feasibility would be worse than the figures shown in Section 6.2 thru 6.4.

6.2. Full Service Area

6.2.1 Description

Based on the evaluation of available water sources and the creation of a municipal water system, the following alternatives appear to be the most advantageous and conservative based on the current level of detail:

- Source
 - New groundwater source located on MSVD/Town owned property on Gore Road.
- Water Treatment
 - New arsenic treatment system located within new treatment building (30' x 30')
- Storage Tank
 - New 65,000 gallon glass-fused-to-steel water storage tank.
 - New hydropneumatic booster pump system to pressurize the distribution system
- Distribution System – Domestic Demand Only
 - New 4" water mains on Route 78, Gore Road, St. Armand Road, Lamkin Street (~12,000 LF)
 - New service lines (~5,000 LF)
 - Water Meters
- Equivalent Residential Users = 212; which includes the Highgate Elementary School.

Without further investigation into the location of a groundwater source and the quantity and quality of water, the estimated construction cost and operation and maintenance costs come with a lot of variability. More detail on this cost is presented below.

6.2.2 Cost Summary

The opinion of probable construction costs is \$8,200,000. A detailed breakdown of this opinion of probable construction cost is shown below in Table 6.1 and provided in Appendix C.

A detailed total project cost summary at this phase of the evaluation is difficult with so much uncertainty and limited detail. However, in order to provide an order of magnitude, the total project cost for this project based on the size, complexity, and current status should be assumed to be approximately 1.6 times the budgetary cost estimates. The total project cost for the proposed project is approximately \$13,100,000 and is summarized in Table 6.1. The total project cost includes construction, construction contingency, engineering, permitting, administrative, legal, land acquisition, and other costs. All estimates are preliminary and will be refined during the Preliminary Engineering once a source has been identified and preliminary water quantity and quality results are available.

**Table 6.1
Cost Summary**

Item	Construction Cost ¹
Budgetary Construction Cost	\$8,200,000
Total Project Cost	\$13,120,000
USE	\$13,100,000

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Total Project Cost = Total Budgetary Construction Cost * ~1.6

6.2.3 Operation & Maintenance (O&M) Costs

Based on the size, treatment, and number of equivalent residential users (ERUs) that will be served by the Highgate Center Water System, Operation & Maintenance (O&M) Costs were developed for the proposed water system. The O&M Costs were developed based on other similar sized water systems. The estimate assumes one (1) full-time employee, which is the largest expense. There could be some potential cost savings with having one (1) operator sharing duties between either the wastewater or highway department. The total estimated annual O&M Budget with one (1) full-time operator is \$235,000. The general breakdown of this cost is shown below in Table 6.2 and provided in Appendix D.

Table 6.2
Projected O&M Budget
Full-Time Operator

Item	Est. Cost
Salary/Benefits	\$100,000
Office Expenses	\$10,000
Chemicals	\$10,000
Water Testing	\$4,000
Electricity	\$15,000
Tools/Supplies/Materials	\$23,000
Maintenance	\$8,000
Training & Safety	\$6,000
Permit Fees	\$3,000
Legal	\$8,000
Consulting Services	\$10,000
Insurance	\$8,000
Capital Fund	\$30,000
Total O&M Cost	\$235,000

Table 6.3 assumes only a part-time employee. This alternative assumes that the water department and the wastewater department split an operator and each department covers half of the operators salary and benefits. The total estimated annual O&M Budget under this scenario drops to \$185,000. The general breakdown of this cost is shown below in Table 6.3.

Table 6.3
Projected O&M Budget
Part-Time Operator

Item	Est. Cost
Salary/Benefits	\$50,000
Office Expenses	\$10,000
Chemicals	\$10,000
Water Testing	\$4,000
Electricity	\$15,000
Tools/Supplies/Materials	\$23,000
Maintenance	\$8,000
Training & Safety	\$6,000
Permit Fees	\$3,000
Legal	\$8,000
Consulting Services	\$10,000
Insurance	\$8,000
Capital Fund	\$30,000
Total O&M Cost	\$185,000

6.2.4 User Rate Costs

Provided below in Table 6.4 – 6.6 are breakdowns of costs per ERU, which includes the debt repayment for the total project cost and estimated yearly O&M costs. The O&M Costs for part-time operator was assumed for this evaluation. The annual cost per ERU for the O&M costs alone are estimated to be approximately \$873 per year. The annual cost per ERU will increase

significantly based on the total project cost, but will greatly depend upon the financial packages that the Town can secure. Table 6.4 considers the worst case scenario of no grants/subsidies with a loan to cover the total project cost with terms of 2% for 30 years. The annual cost per ERU is \$3,632.

Table 6.4
Cost Summary
No Subsidy

Item	Cost
Total Project Cost ⁽¹⁾	\$13,100,000
Total Loan Amount	\$13,100,000
Annual Loan Repayment ⁽²⁾	\$585,000
Annual O&M Cost (Part-Time Op.)	\$185,000
Total Annual Cost⁽³⁾	\$770,000
Annual Cost/ERU	\$3,632

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Annual Loan Repayment = Total Project Cost at 2% for 30 Years
3. Total Annual Cost = Annual Loan Repayment + O&M Cost
4. Highgate Center has an estimated 212 ERUs.

Table 6.5 considers 25% planning subsidy, 50% construction subsidy, and the loan terms extending to 40 years at 0%. The annual cost per ERU is \$1,804.

Table 6.5
Cost Summary
50% Construction Grant/Subsidy

Item	Construction Cost ¹
Total Project Cost ⁽¹⁾	\$13,100,000
Planning Subsidy (25%)	\$300,000
Construction Subsidy (50%)	\$4,900,000
Total Loan Amount	\$7,900,000
Annual Loan Repayment ⁽²⁾	\$197,500
Annual O&M Cost (Part-Time Op.)	\$185,000
Total Annual Cost⁽³⁾	\$382,500
Annual Cost/ERU	\$1,804

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Annual Loan Repayment = Loan Amount at 0% for 40 Years.
3. Total Annual Cost = Annual Loan Repayment + O&M Cost
4. Highgate Center has an estimated 212 ERUs.

Table 6.6 considers 25% planning subsidy, 75% construction subsidy, and the loan terms extending to 40 years at 0%. The annual cost per ERU is \$1,521.

Table 6.6
Cost Summary
75% Construction Grant/Subsidy

Item	Construction Cost ¹
Total Project Cost ⁽¹⁾	\$13,100,000
Planning Subsidy (25%)	\$300,000
Construction Subsidy (75%)	\$7,300,000
Total Loan Amount	\$5,500,000
Annual Loan Repayment ⁽²⁾	\$137,500
Annual O&M Cost (Part-Time Op.)	\$185,000
Total Annual Cost⁽³⁾	\$322,500
Annual Cost/ERU	\$1,521

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Annual Loan Repayment = Loan Amount at 0% for 40 Years.
3. Total Annual Cost = Annual Loan Repayment + O&M Cost
4. Highgate Center has an estimated 212 ERUs.

The VT Department of Environmental Conservation and University of North Carolina, School of Government, Environmental Finance Center completed a [2021 Study](#) with summarizes and compares water customer rates for water systems in Vermont. Assuming 6,300 gallons per month (210 gpd @ 30 days), the median monthly bill was \$45.53 (\$546.36/year). The minimum monthly bill was \$4.33/month (\$51.96/year) and the maximum monthly bill was \$203/month (\$2,436). All these costs are based on rates as of July 1, 2021.

Without any grant or subsidy, the project would not be viable for the water customers. Even with substantial grant or subsidy, the rates presented for the Highgate Water System would be near the upper percentile of user rates in Vermont. Affordability for annual water bills is typically considered 1% of the MHI. The median household income (MHI) for the Town of Highgate is \$78,897 from the 2023 ACS 5-year estimate. For the Town, a 1% affordability rate would equate to an annual water bill of \$789. Based on the user rates projected above, the annual water bill for the average residential customer would be equivalent to between 2% (\$1,521) and 4.6% (\$3,632).

6.3 Gore Road (Only)

6.3.1 Description

The following would be included to only service from the new source, on the MVSD/Town owned property, down to the end of Gore Road at the intersection of Route 78.

- Source
 - New groundwater source located on School/Town owned property on Gore Road.
- Water Treatment
 - New arsenic treatment system located within new treatment building (30' x 30')
- Storage Tank
 - New 60,000 gallon glass-fused-to-steel water storage tank.
 - New hydropneumatic booster pump system to pressurize the distribution system
- Distribution System – Domestic Demand Only
 - New 4" water mains on Gore Road (~2,500 LF)
 - New service lines (~2,000 LF)

- Water Meters
- Equivalent Residential Users = 95; which includes the Highgate Elementary School.

6.3.2 Cost Summary

The opinion of probable construction costs is \$3,150,000. A detailed breakdown of this opinion of probable construction cost is shown below in Table 6.7.

A detailed total project cost summary at this phase of the evaluation is difficult with so much uncertainty and limited detail. However, in order to provide an order of magnitude, the total project cost for this project based on the size, complexity, and current status should be assumed to be approximately 1.6 times the budgetary cost estimates. The total project cost for the proposed project is approximately \$5,100,000 and is summarized in Table 6.7. The total project cost includes construction, construction contingency, engineering, permitting, administrative, legal, land acquisition, and other costs.

**Table 6.7
Cost Summary**

Item	Construction Cost ¹
Budgetary Construction Cost	\$3,150,000
Total Project Cost	\$5,040,000
USE	\$5,100,000

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Total Project Cost = Total Budgetary Construction Cost * ~1.6

6.3.3 User Rate Costs

Provided below in Table 6.8 are breakdowns of costs per ERU, which includes the debt repayment for the total project cost and estimated yearly O&M costs. The O&M Costs for part-time operator was assumed for this evaluation. The annual cost per ERU for the O&M costs alone are estimated to be approximately \$1,947 per year. The annual cost per ERU will increase significantly based on the total project cost, but will greatly depend upon the financial packages that the Town can secure. Table 6.8 considers the worst case scenario of no grants/subsidies with a loan to cover the total project cost with terms of 2% for 30 years. The annual cost per ERU is \$4,344.

**Table 6.8
Cost Summary
No Subsidy**

Item	Cost
Total Project Cost ⁽¹⁾	\$5,100,000
Total Loan Amount	\$5,100,000
Annual Loan Repayment ⁽²⁾	\$227,715
Annual O&M Cost (Part-Time Op.)	\$185,000
Total Annual Cost⁽³⁾	\$412,715
Annual Cost/ERU	\$4,344

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Annual Loan Repayment = Total Project Cost at 2% for 30 Years
3. Total Annual Cost = Annual Loan Repayment + O&M Cost
4. Highgate Center has an estimated 95 ERUs.

6.4 Gore Road & Route 78 East

6.4.1 Description

The following would be included to only service from the new source, on the MVSD/Town owned property, down to the end of Gore Road and Route 78 East.

- Source
 - New groundwater source located on School/Town owned property on Gore Road.
- Water Treatment
 - New arsenic treatment system located within new treatment building (30' x 30')
- Storage Tank
 - New 60,000 gallon glass-fused-to-steel water storage tank.
 - New hydropneumatic booster pump system to pressurize the distribution system
- Distribution System – Domestic Demand Only
 - New 4" water mains on Route 78, Gore Road, St. Armand Road, Lamkin Street (~4,000 LF)
 - New service lines (~3,000 LF)
 - Water Meters
- Equivalent Residential Users = 143; which includes the Highgate Elementary School.

6.4.2 Cost Summary

The opinion of probable construction costs is \$4,100,000. A detailed breakdown of this opinion of probable construction cost is shown below in Table 6.9.

A detailed total project cost summary at this phase of the evaluation is difficult with so much uncertainty and limited detail. However, in order to provide an order of magnitude, the total project cost for this project based on the size, complexity, and current status should be assumed to be approximately 1.6 times the budgetary cost estimates. The total project cost for the proposed project is approximately \$6,600,000 and is summarized in Table 6.9. The total project cost includes construction, construction contingency, engineering, permitting, administrative, legal, land acquisition, and other costs.

**Table 6.9
Cost Summary**

Item	Construction Cost ¹
Budgetary Construction Cost	\$4,100,000
Total Project Cost	\$6,560,000
USE	\$6,600,000

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Total Project Cost = Total Budgetary Construction Cost * ~1.6

6.4.3 User Rate Costs

Provided below in Table 6.10 are breakdowns of costs per ERU, which includes the debt repayment for the total project cost and estimated yearly O&M costs. The O&M Costs for part-time operator was assumed for this evaluation. The annual cost per ERU for the O&M costs alone are estimated to be approximately \$1,294 per year. The annual cost per ERU will increase significantly based on the total project cost, but will greatly depend upon the financial packages that the Town can secure. Table 6.10 considers the worst case scenario of no grants/subsidies

with a loan to cover the total project cost with terms of 2% for 30 years. The annual cost per ERU is \$3,354.

Table 6.10
Cost Summary
No Subsidy

Item	Cost
Total Project Cost ⁽¹⁾	\$6,600,000
Total Loan Amount	\$6,600,000
Annual Loan Repayment ⁽²⁾	\$294,690
Annual O&M Cost (Part-Time Op.)	\$185,000
Total Annual Cost⁽³⁾	\$479,690
Annual Cost/ERU	\$3,354

Notes:

1. Construction costs based on ENR 14100 (December 2025)
2. Annual Loan Repayment = Total Project Cost at 2% for 30 Years
3. Total Annual Cost = Annual Loan Repayment + O&M Cost
4. Highgate Center has an estimated 143 ERUs.

6.5 Funding Options

A summary of available State and Federal funding sources investigated for this project is described in the following narrative.

6.5.1 – State of Vermont Drinking Water State Revolving Loan Fund (DWSRF)

The State of Vermont offers low interest loans for planning, design, and construction of municipal infrastructure improvements. The State of Vermont offers Drinking Water State Revolving Fund (DWSRF) loan programs for this type of project. The DWSRF program currently offers the following:

- Loans with an administrative rate of 2% and a term of 20 to 40 years, depending on the expected useful life of the proposed improvements, which is approximately 30 to 40 years for this project.
- Construction subsidies of up to 50% to assist disadvantaged communities with funding projects and maintaining reasonable user rates.
- Planning subsidies of 25% for preliminary and final design are also available.

6.5.2 – United States Department of Agriculture (USDA) Rural Development (RD)

The USDA RD program includes both grants and loans, depending on the project and the community's ability to pay. The funds may be used for a variety of projects, including water source, treatment, and distribution. The program offers up to 40-year payback period, based on the useful life of the facilities finances, with fixed interest rates based on the need for the project and median household income of the area which are typically between 1% and 4%. If funds are available, a grant may be combined with a loan if necessary to keep user costs reasonable.

Funding applications (RD Apply) for this program are accepted biannually (December and July) and are typically submitted after a bond vote.

6.5.3 – Vermont Bond Bank

The Vermont Bond Bank (VBB) provides loans to municipalities for a wide range of purposes, including infrastructure projects that may not be eligible for other funding programs described above. While loan terms are generally more favorable than could be obtained from commercial lenders, loan forgiveness is not available and loan terms and interest rates are not as favorable as other funding programs described above.

6.5.4 – US Department of Commerce Economic Development Administration

The US Department of Commerce provides grants through the Economic Development Administration (EDA) in amounts from \$100,000 to \$3,000,000. To qualify, the project must demonstrate alignment with EDA's investment priorities, which include construction of water and sewer infrastructure which are typically focused on serving underserved communities and business/workforce development. Funding applications are accepted on an ongoing basis until that grant cycle's funds are depleted, with funding cycles typically beginning in the fall of each year, with awards made within approximately 3 months. A positive bond vote is required prior to submitting an application and grant recipients typically have up to two years to complete a project after award.

6.5.5 – Northern Border Regional Commission Grant (NBRC) – Catalyst Program

The Northern Border Regional Commission (NBRC) is a Federal-State program that invests in community and economic development projects in economically distressed counties in Maine, New Hampshire, Vermont, and New York. The Catalyst Program supports economic development and infrastructure projects that promote job-creating projects that help to reduce poverty, unemployment, and outmigration. Projects in the past have included modernizing or expanding access to public water and wastewater services. Grants for infrastructure projects range from \$1M to \$3M and include a 20% to 50% match. The match funds can be funded through other loan programs, for example the DWSRF. Typically, the NBRC request applications in the Spring and Fall.

6.5.6 – Vermont Community Development Program (VCDP) Grants

The Vermont Community Development Program (VCDP) administers the US Housing and Urban Development (HUD) Community Development Block Grant (CDBG) funding, which assists communities by providing financial and technical assistance in addressing local needs including: housing, economic development, public facilities, public services, and handicapped accessibility modifications. 70% of the CDBG funds must primarily benefit persons of low and moderate income. Grants can range from \$5,000 to \$1,000,000 and be used for planning or construction.

6.6 Project Schedule

A tentative schedule for the proposed project is shown in Table 6.11 and assumes work starting immediately.

Table 6.11
Project Schedule

Task	Duration (Est.)	Date
Groundwater Availability Study	~3 Months	March 2026
Test-Well Drilling	~3 Months	June 2026
Preliminary Engineering Report	~6 Months	December 2026
Production Well – Install, Testing, Permitting	~6 Months	June 2027
Final Design & Permitting	~12-18 Months	December 2028
Construction	~18-24 Months	December 2030

Based on these estimated durations, if the Town were to begin efforts immediately to develop a public water system, the system would be constructed and operational in 4-5 years. This assumes that no major roadblocks or hurdles are encountered.

6.7 Permit Requirements

The following permits and/or environmental reviews will likely be required for this project:

- Source Permit – Source Permit is required by Vermont DEC Drinking Water & Groundwater Protection Division for authorization of a new public water source after hydrogeologic testing and Source Evaluation Report.
- Construction Permit (Water System) – Required for construction of source, tanks, pump station, water mains, and appurtenances.
- Permit to Operate – At least 30 days prior to the actual operation of the new public water system, a permit to operate application would need to be submitted by the Owner.
- Stormwater Construction Permit – A Stormwater Construction Permit is required from the Vermont DEC Stormwater Program if earth disturbance exceeds one acre.
- Environmental Report – An Environmental Information Document (EID) is required by the State of Vermont Water Investment Division to comply with the National Environmental Policy Act (NEPA). Due to the size of this project, a public hearing will likely be required to solicit comments on the environmental review, a 30-day public comment period, and an issuance of a Finding of No Significant Impact (FONSI).
- Archeological Assessment – In conjunction with the EID, an Archeological and Historic Properties Review will need to be initiated. Due to the proximity to the Missisquoi River, a Phase I Archeological Assessment will likely be required.
- Prime Agricultural Soil Review – Since prime agricultural soil are located in the project area, a review would need to be conducted by the State of Vermont Agency of Agriculture, Food, and Markets.
- Act 250 Land Use Permit – An Act 250 permit will likely be required as it impacts multiple parcels, significant land alterations, buildings, and change of use.
- VAOT ROW Permit – A Section 1111 State Highway Access and Work Permit will need to be obtained for any work within and along Route 78.
- Contaminated Soils Linear Assessment – The Highgate Center area is designated as an Urban Soils Background Area by the Sites Management Division. A linear assessment would need to be completed to identify any contaminated soils with levels exceeding the background urban soil level. If potential contaminated soils are identified during the linear assessment, additional field work would be required to provide more definition on the level of contamination and area of impact.

Prior to the issuance of a Permit to Operate by the Drinking Water and Groundwater Protection Division, the Town will need to demonstrate Technical, Managerial, and Financial (TMF) Capacity. This will be an arduous process that will require substantial commitment and involvement by Town Officials (Town Administrator, Selectboard, Etc.). Work to demonstrate TMF Capacity will include:

Capacity Approval

The following must be completed for capacity approval:

- 5 year budget that includes all income and major expenses
- Verbal agreement with VT certified operator
- Submit Officials Contact form
- Capacity approval letter

The above items are typically required to be completed before the Source Permit is issued.

Long Range Plan

The major elements required in this plan are:

- System & Ownership
 - General System Description
 - Ownership and Organizational Structure
- Cost & Revenue Information
 - 5-Year Operation & Maintenance Budget Projections
 - 5-Year Revenue Projections
 - Capital Fund Information
 - Projected Plan for Improvements
- Planning, Policies, & Procedures
 - Service Area Information
 - Growth and Modernization Plans
 - Policies, Procedures, and By-Laws
 - By-Laws
 - Customer Complaint Policy
 - Disconnect Policy
 - Delinquent Account Policies
 - Other
- Water Conservation
 - Water Usage Evaluation
 - Water Conservation Measures
 - Consumer Awareness and Water Conservation Education

A copy of the DWGWPD's template is provided in Appendix E for reference.

Source Protection Plan (SPP)

The major elements required in this plan are:

- Maps
- Inventory & Assessment of Potential Sources of Contamination (PSOCs)
- Management Plans
- Contingency Plan

A copy of the DWGWPD's SPP criteria is provided in Appendix F for reference.

Operating Permit Criteria

A Permit to Operate will need to be issued and the following items will need to be completed prior to issuance of the Permit to Operate:

- Compliance with Appendix A source water and infrastructure requirements
- Operation and maintenance manual (template provided in Appendix G)
- Retention of a VT certified water system operator
- As-built/record drawings
- Updated Officials Contact Form
- Long Range Plan
- Operating permit application
- Bacteriological sampling plan
- Lead and copper sampling plan
- Disinfection By-Product (if applicable) sampling plan

A copy of the Proposed System Checklist for a new community water system is provided in Appendix H.

6.8 Next Steps

If it is the desire of the Town of Highgate to continue to pursue a municipal water system, then the recommended next steps are to initiate a Groundwater Availability Study with an engineer and hydrogeologist to review existing information in the project area as it relates to groundwater sources and identify potential locations for installing test wells. The Town should be prepared to spend money on the exploration of test wells, that may not prove to be viable options for supporting a municipal water system.

The Town should also continue community outreach to ensure the project is supported by the community and future water customers.

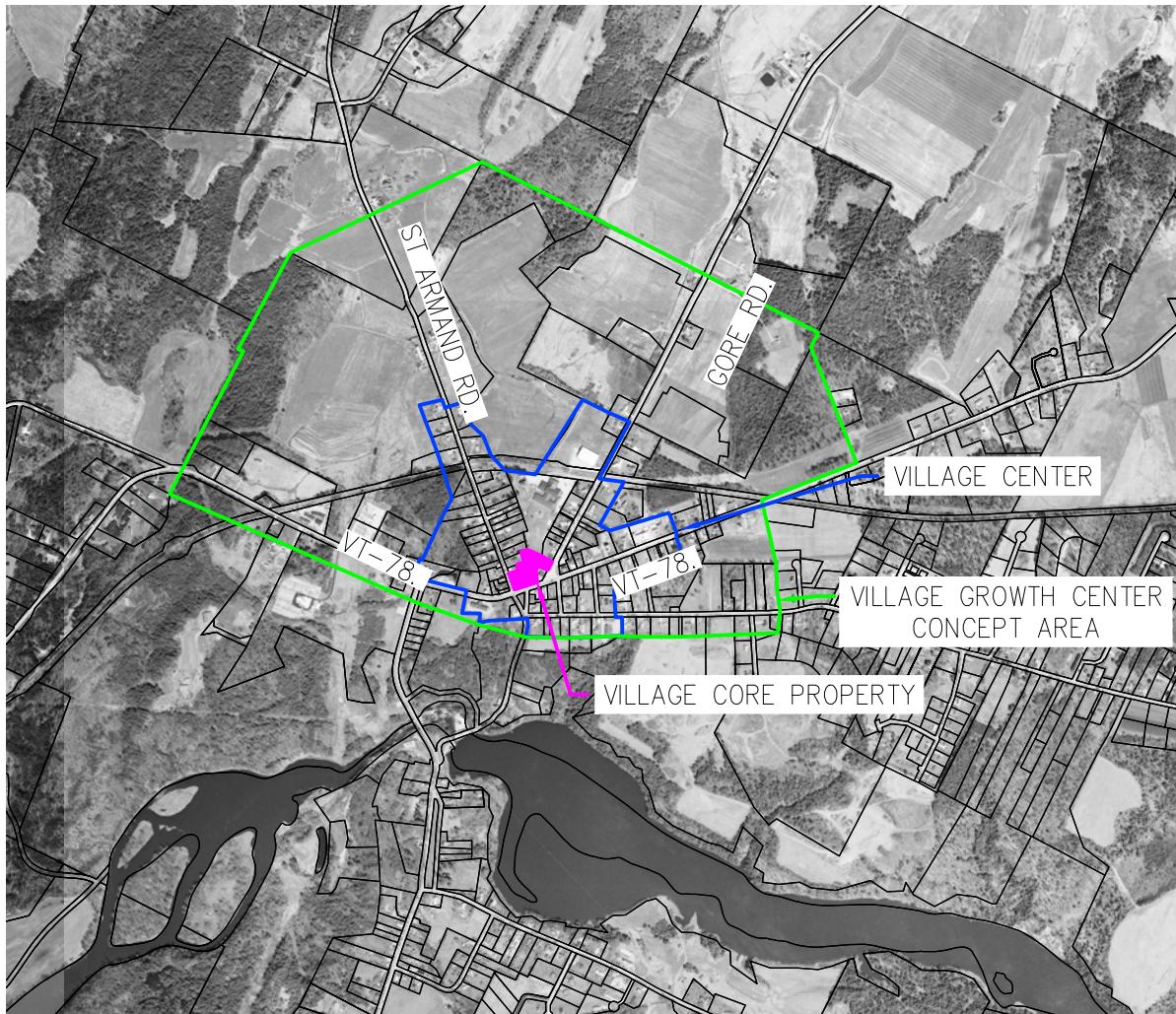
If a test well presents positive results, a preliminary engineering report should be completed to further define the project scope of work, construction and operation and maintenance costs, and user rate fees.

Below is a summary of next steps in sequential order, with budgetary estimates.

- Conduct additional Community Outreach (~\$10,000)
- Complete Groundwater Availability Study (~\$7,500)
- Pursue Test-Well Drilling Phase (~\$70,000)
- Conduct Preliminary Engineering (~\$100,000)
- Identify Funding Sources
- Begin Technical, Managerial, & Financial (TMF) Capacity Requirements

APPENDIX A

FIGURES



LOCATION MAP

SCALE: 1"=2000'



GRAPHIC SCALE

0 2000 3000 4000

(IN FEET)



6 Market Place, Suite 2
Essex Jct., VT 05452

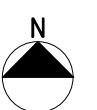
P: 802.879.7733
AEengineers.com

PROJECT LOCATION MAP

HIGHGATE WATER FEASIBILITY STUDY

TOWN OF HIGHGATE, VERMONT

DESIGNED DPW	PROJECT NO. 25011
DRAWN KDL	
CHECKED NAP	FIGURE 1
DATE DEC. 2025	



PLAN

SCALE: 1"=1000'

0 1000 1500 2000
(IN FEET)

GRAPHIC SCALE



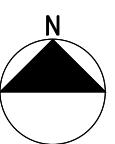
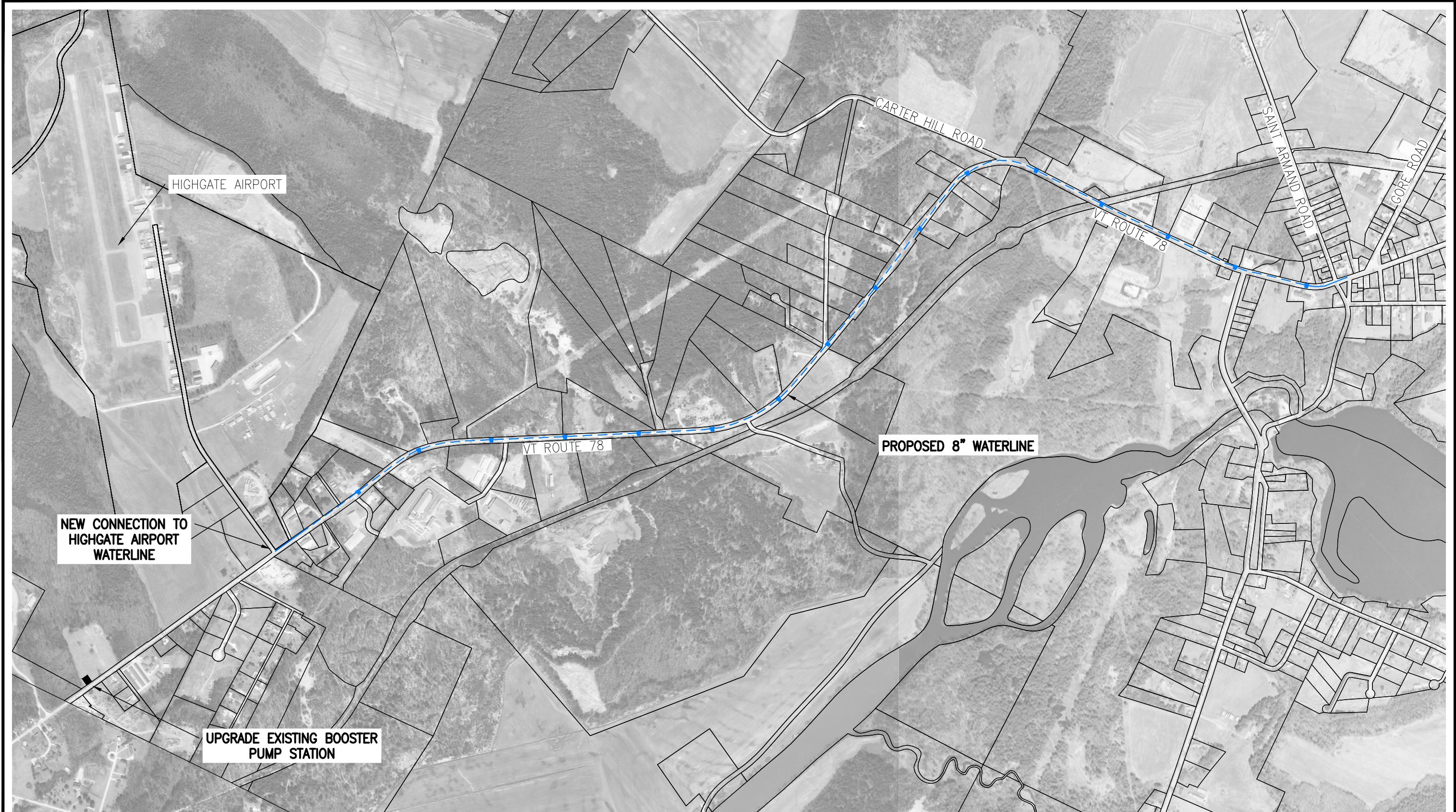
6 Market Place, Suite 2
Essex Jct., VT 05452

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EXISTING WELLS

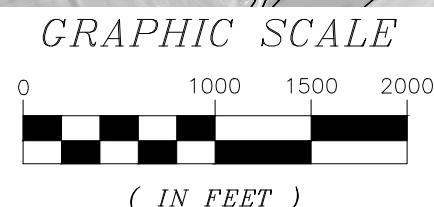
HIGHGATE WATER FEASIBILITY STUDY
TOWN OF HIGHGATE, VERMONT

DESIGNED DPW	PROJECT NO. 25011
DRAWN KDL	
CHECKED NAP	FIGURE 2
DATE DEC. 2025	



PLAN

SCALE: 1"=1000'



ALTERNATIVE #1 AIRPORT WATER EXTENSION

HIGHGATE WATER FEASIBILITY STUDY

TOWN OF HIGHGATE, VERMONT

DESIGNED
DPW

DRAWN
KDL

checked
NAP

DATE
DEC. 2025

PROJECT NO.
25011

FIGURE
3

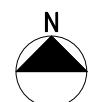


LEGEND

SOURCE ISOLATION ZONE (200' RADIUS)

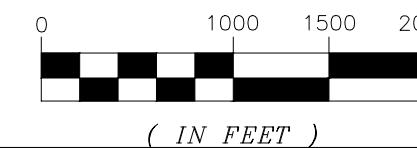


PUBLIC WATER SOURCES



PLAN

SCALE: 1"=1000'



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**ALTERNATIVE #2 AND #3-
ELEMENTARY SCHOOL AND
SPORTS ARENA WELLS**

HIGHGATE WATER FEASIBILITY STUDY

TOWN OF HIGHGATE, VERMONT

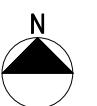
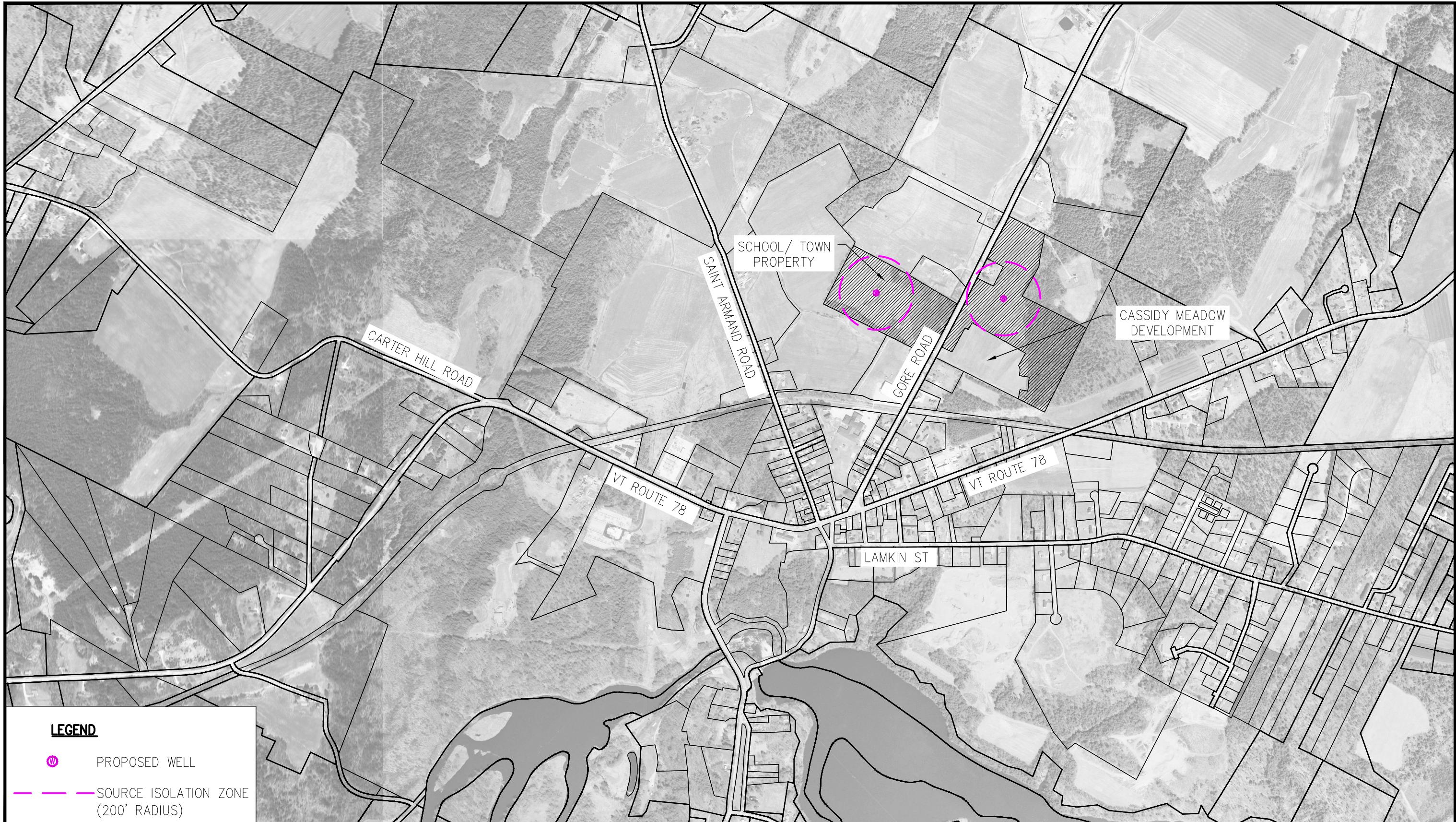
DESIGNED
DPW
DRAWN
KDL

PROJECT NO.
25011

CHECKED
NAP

FIGURE
4

DATE
DEC. 2025



PLAN

SCALE: 1"=1000'

GRAPHIC SCALE
0 1000 1500 2000
(IN FEET)

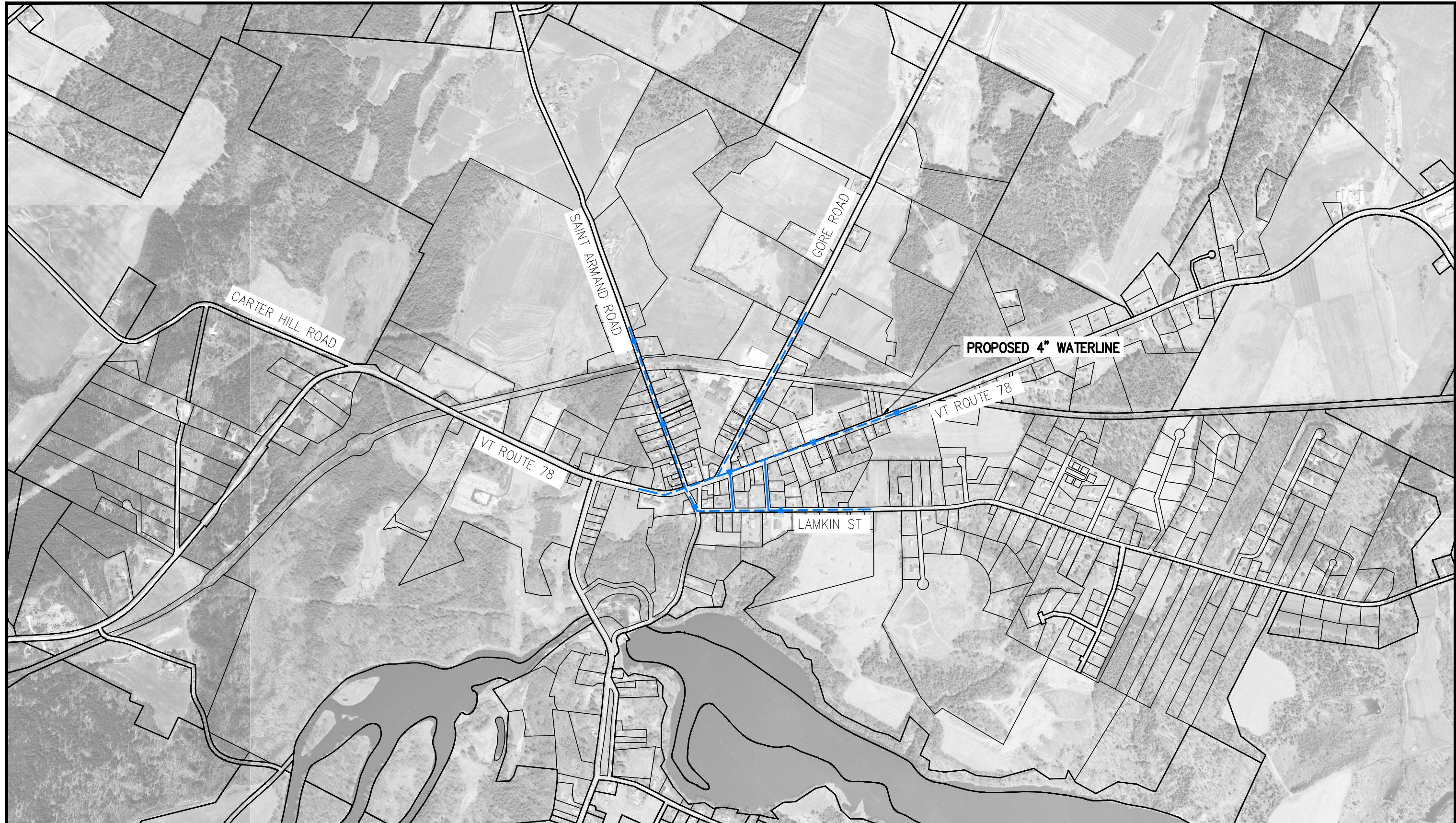


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AEEngineers.com

**ALTERNATIVE #4-
POTENTIAL WELL SITES**

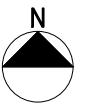
HIGHGATE WATER FEASIBILITY STUDY
TOWN OF HIGHGATE, VERMONT

DESIGNED DPW	PROJECT NO. 25011
DRAWN KDL	FIGURE 5
CHECKED NAP	DATE DEC. 2025



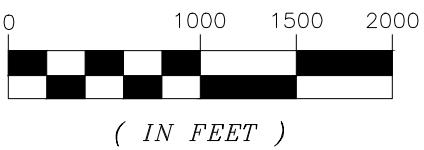
LEGEND

WATER DISTRIBUTION MAINS



PLAN

SCALE: 1"=1000'



PROPOSED WATER DISTRIBUTION SYSTEM

6 Market Place, Suite 2
Essex Jct., VT 05452

P: 802.879.7733
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HIGHGATE WATER FEASIBILITY STUDY

TOWN OF HIGHGATE, VERMONT

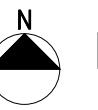
DESIGNED
DPW
DRAWN
KDL
CHECKED
NAP
DATE
DEC. 2025

PROJECT NO.
25011
FIGURE
6



LEGEND

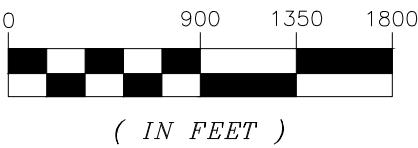
WATER DISTRIBUTION MAINS



PLAN

SCALE: 1"=900'

GRAPHIC SCALE



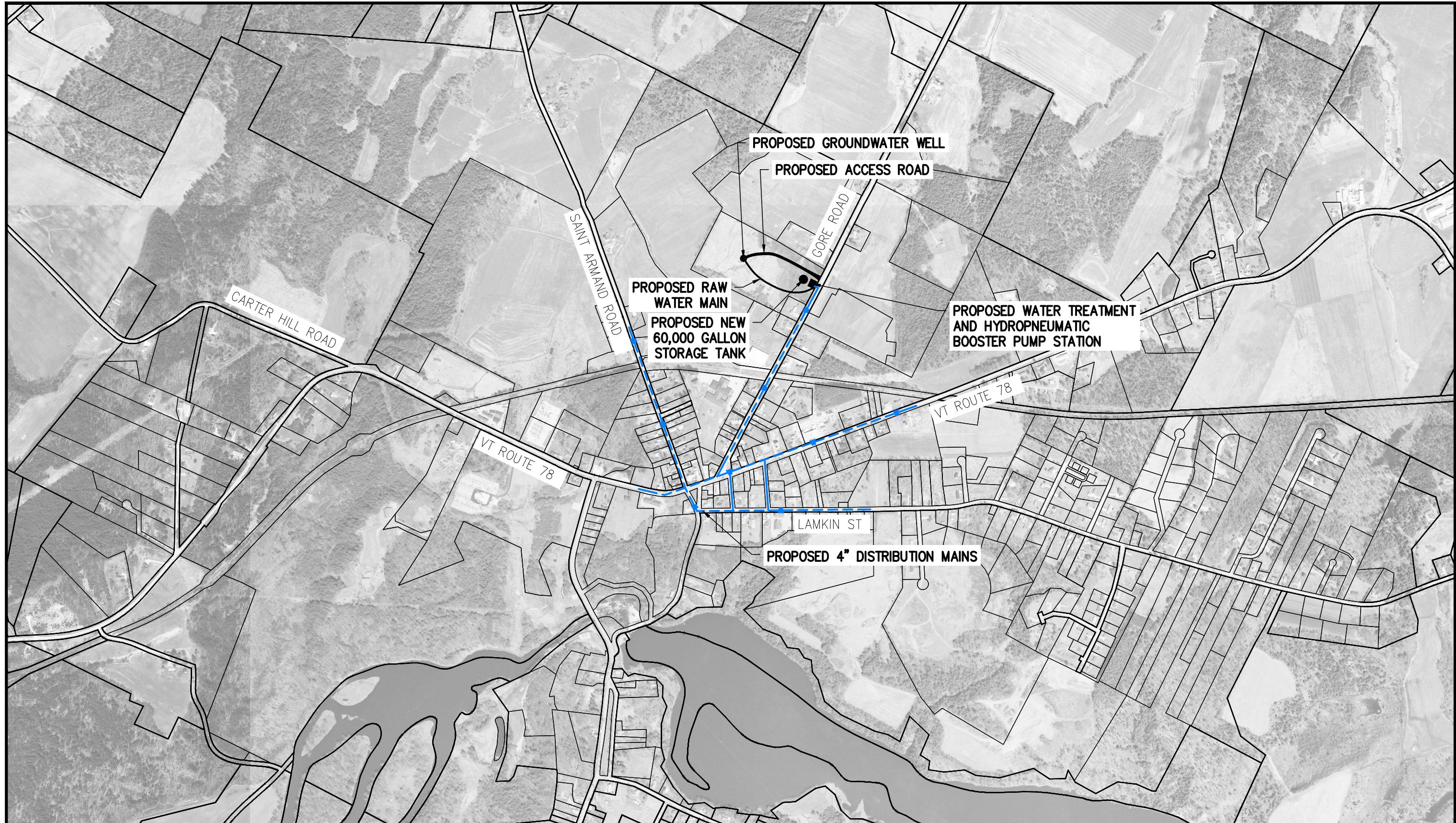
6 Market Place, Suite 2
Essex Jct., VT 05452

P: 802.879.7733
AEengineers.com

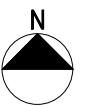
GROUND ELEVATIONS
HIGHGATE WATER FEASIBILITY STUDY

TOWN OF HIGHGATE, VERMONT

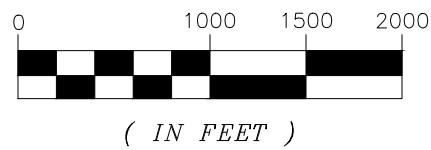
DESIGNED	DPW	PROJECT NO.
DRAWN	KDL	25011
FIGURE		
CHECKED	NAP	
DATE		
		7
DEC. 2025		

**LEGEND**

WATER DISTRIBUTION MAINS

**PLAN**

SCALE: 1"=1000'

6 Market Place, Suite 2
Essex Jct., VT 05452P: 802.879.7733
AEEngineers.com**PROPOSED PROJECT**

HIGHGATE WATER FEASIBILITY STUDY

TOWN OF HIGHGATE, VERMONT

DESIGNED	DPW	PROJECT NO.	25011
DRAWN	KDL		
FIGURE			8
DATE	DEC. 2025		

APPENDIX B

ENVIRONMENTAL RESOURCES



Highgate Center - Hazardous Sites

Vermont Agency of Natural Resources

vermont.gov



LEGEND	
	Hazardous Site
	Hazardous Waste Generators
	Brownfields
	Salvage Yard
	Aboveground Storage Tank
	Underground Storage Tank (working)
	Dry Cleaner
	Parcels (standardized)
Roads	
	Interstate
	US Highway; 1
	State Highway
	Town Highway (Class 1)
	Town Highway (Class 2,3)
	Town Highway (Class 4)
	State Forest Trail
	National Forest Trail
	Legal Trail
	Private Road/Driveway
	Proposed Roads
	Town Boundary

1: 7,815

1in = 651 ft.
1cm = 78 meters



397.0 0 198.00 397.0 Meters

WGS_1984/Web_Mercator_Auxiliary_Sphere

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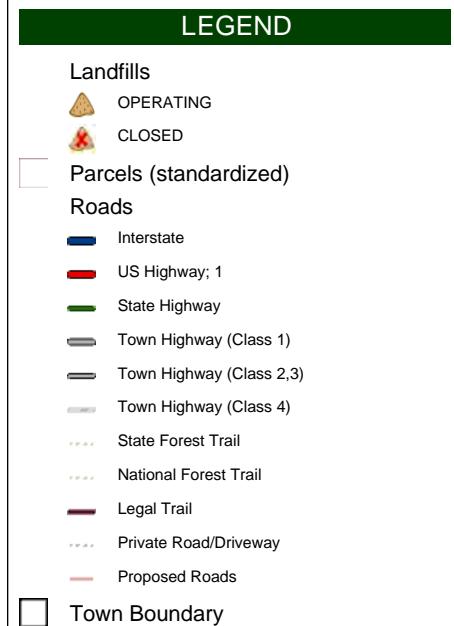
Map created using ANR's Natural Resources Atlas



Highgate Center - Landfills

Vermont Agency of Natural Resources

vermont.gov



1: 7,815
1in = 651 ft.
1cm = 78 meters



397.0 0 198.00 397.0 Meters

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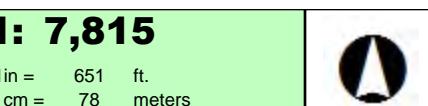
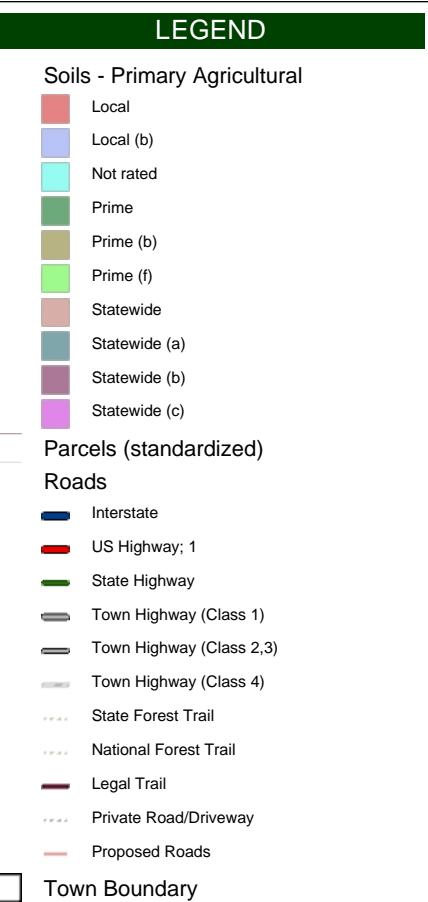
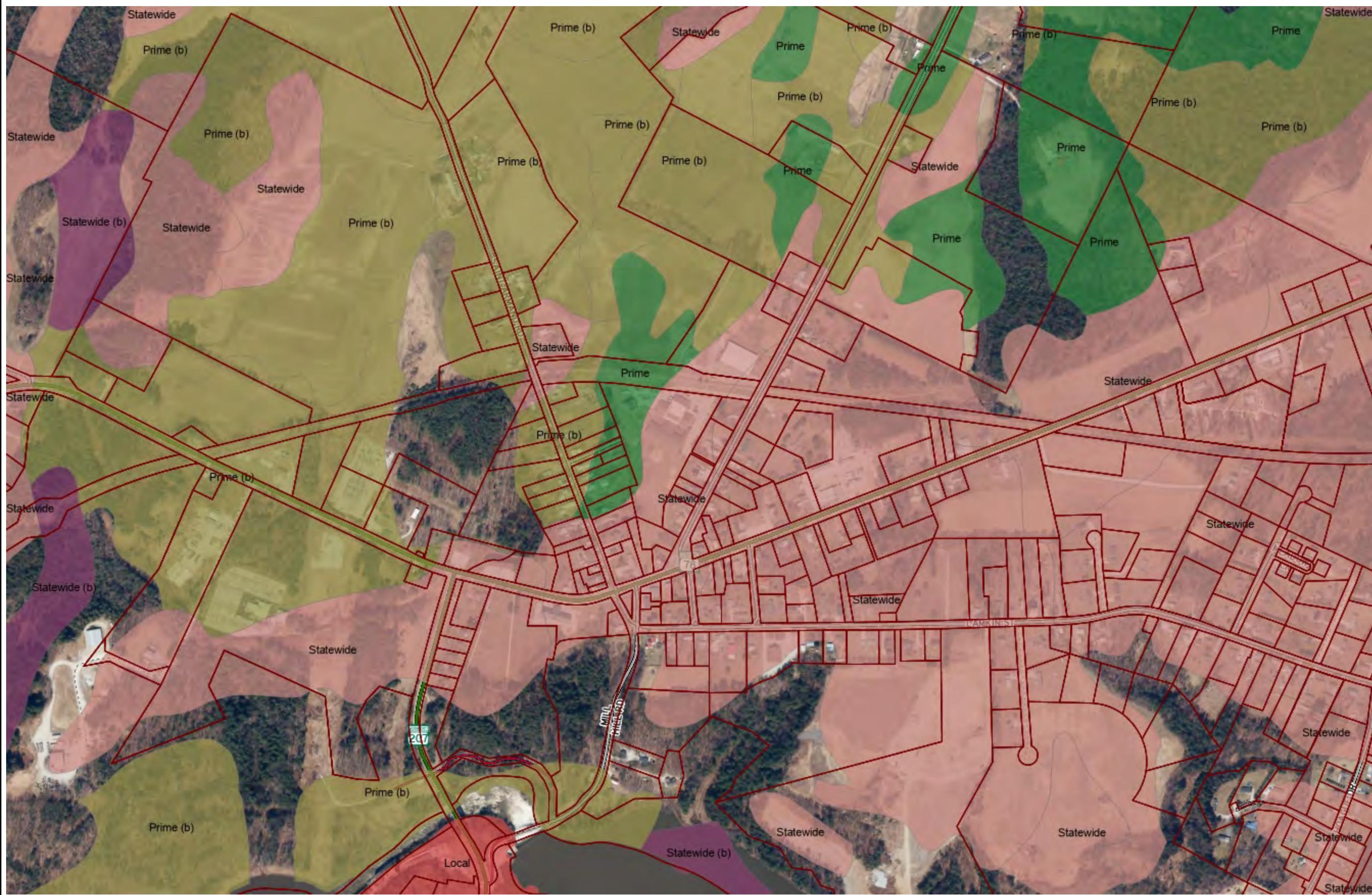
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Highgate Center - Primary Agricultural Soils

Vermont Agency of Natural Resources

vermont.gov



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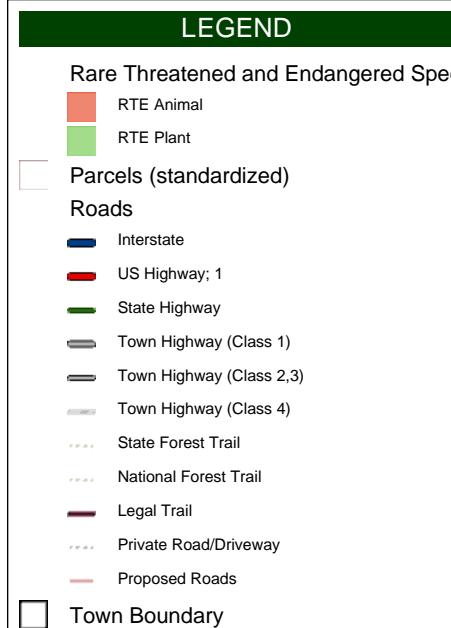
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Highgate Center - Rare, Threatened, & Endangered Species

Vermont Agency of Natural Resources

vermont.gov



1: 7,815

1in = 651 ft.
1cm = 78 meters



397.0 0 198.00 397.0 Meters

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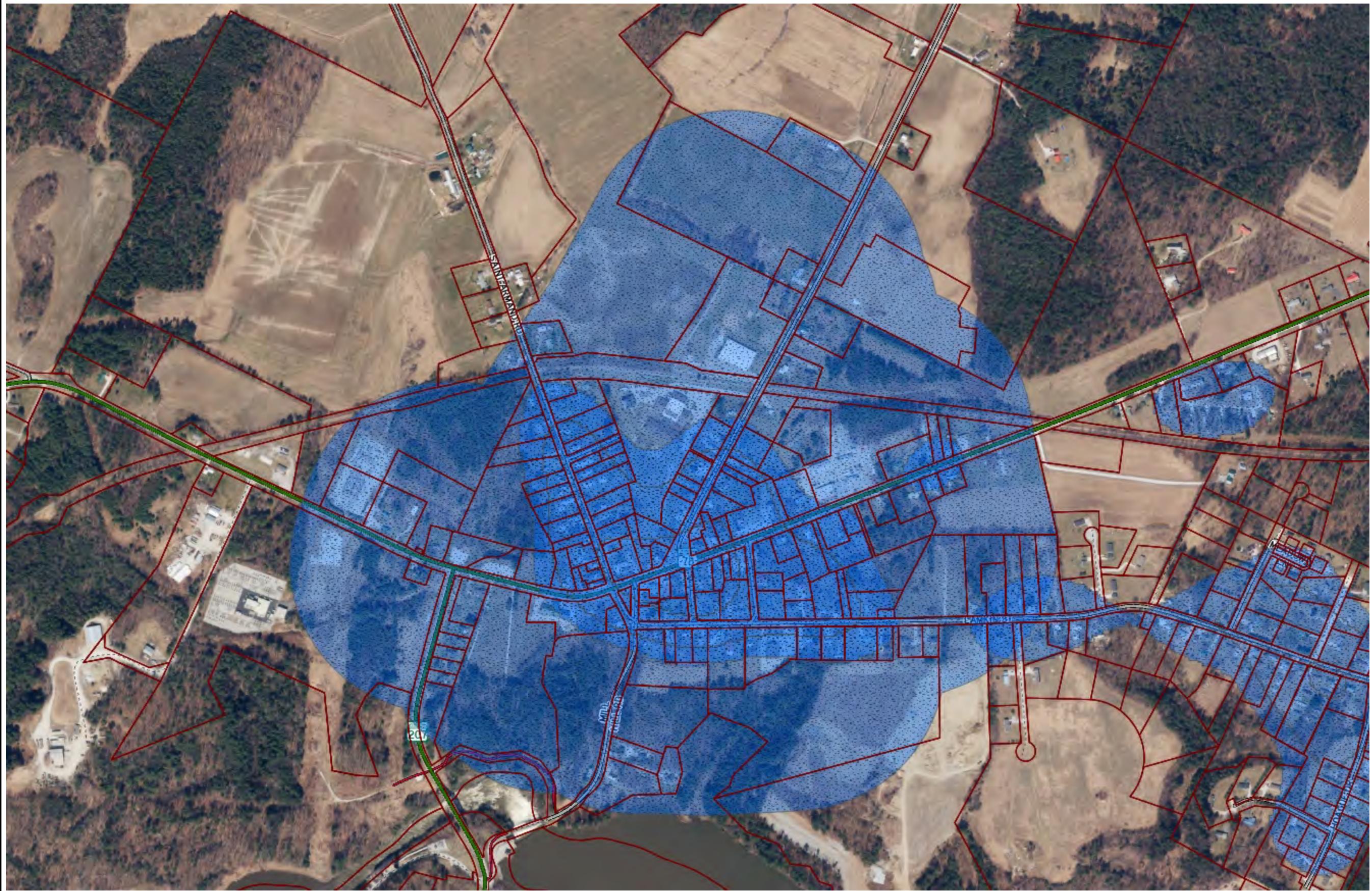
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NOTES

Map created using ANR's Natural Resources Atlas



LEGEND	
	Urban Soil Background Areas
	Parcels (standardized)
Roads	
	Interstate
	US Highway; 1
	State Highway
	Town Highway (Class 1)
	Town Highway (Class 2,3)
	Town Highway (Class 4)
	State Forest Trail
	National Forest Trail
	Legal Trail
	Private Road/Driveway
	Proposed Roads
	Town Boundary

1: 7,815
1in = 651 ft.
1cm = 78 meters



397.0 0 198.00 397.0 Meters

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1: 7,815

1in = 651 ft.
1cm = 78 meters



397.0 0 198.00 397.0 Meters

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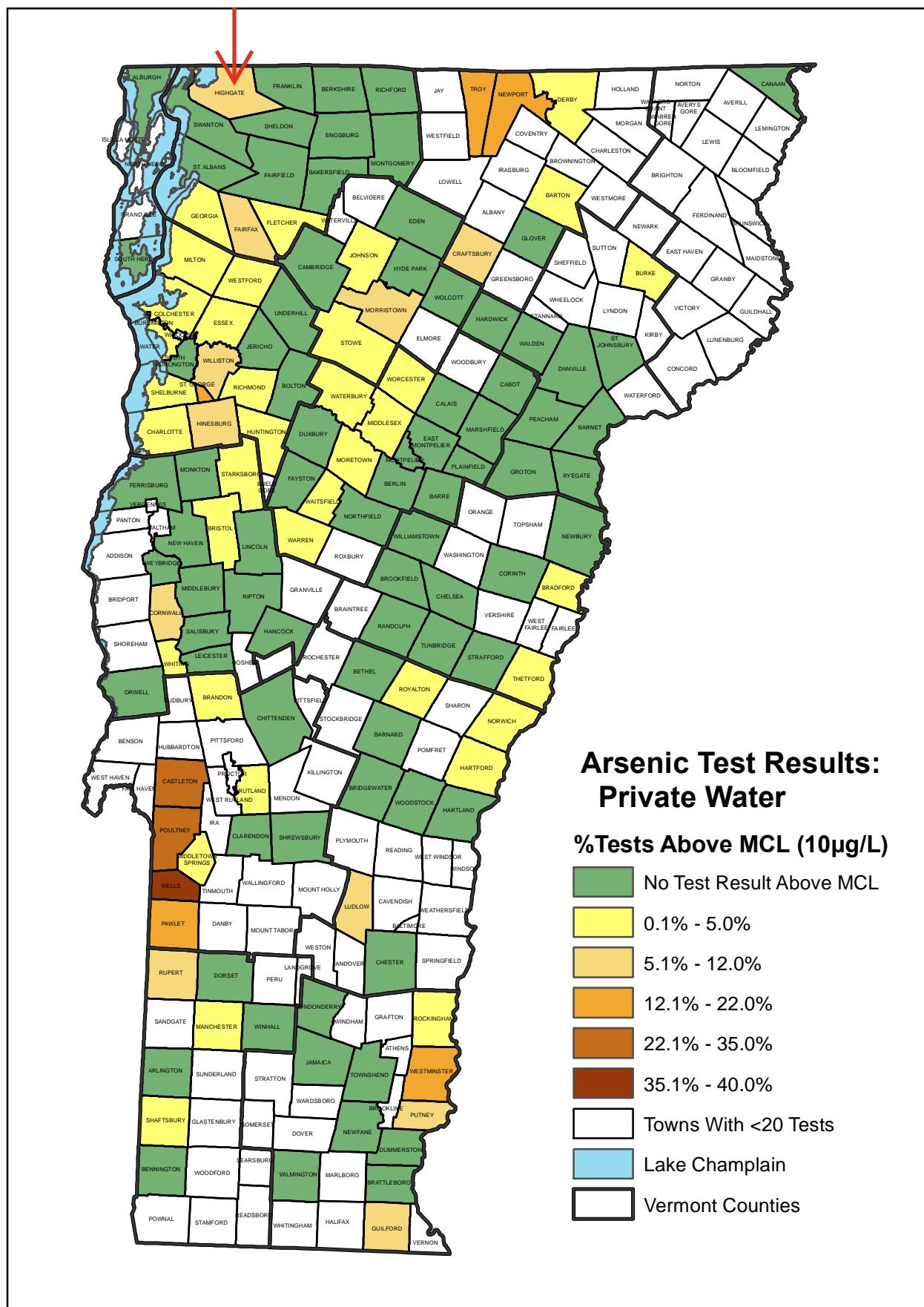
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Arsenic in Private Water by Town: Percent of Tests Above the MCL (Maximum Contaminant Level =10 µg/L)



Arsenic Private Water Test Result Summary

Maximum Contaminant Level (MCL) = 10 µg/L

Data Sources: Vermont Department of Health Laboratory 2003-2016, Vermont Geological Survey 2002-2014



Vermont Towns	Number of Tests	%Tests Above MCL	Concentration of Arsenic in Micrograms per Liter (µg/L)						
			Mean	Standard Deviation	Maximum	95th Percentile	Median	5th Percentile	Minimum
ALBURGH	43	0.0	0.5	0.2	2.0	*	*	*	*
ARLINGTON	37	0.0	0.5	0.2	2.0	*	*	*	*
BAKERSFIELD	23	0.0	0.7	0.6	3.0	2.0	*	*	*
BARNARD	20	0.0	0.6	0.3	2.0	1.3	*	*	*
BARNET	32	0.0	0.5	0.1	1.0	*	*	*	*
BARRE (City&Town)	93	0.0	0.7	0.8	7.0	*	*	*	*
BARTON	26	3.8	1.1	2.5	13.0	3.0	*	*	*
BENNINGTON	74	0.0	0.6	0.5	3.0	2.0	*	*	*
BERKSHIRE	27	0.0	0.6	0.3	2.0	1.0	*	*	*
BERLIN	50	0.0	0.6	0.4	3.0	1.0	*	*	*
BETHEL	46	0.0	0.7	1.2	8.0	*	*	*	*
BOLTON	24	0.0	0.6	0.2	1.0	1.0	*	*	*
BRADFORD	25	4.0	2.1	5.1	24.0	9.0	*	*	*
BRANDON	30	3.3	1.2	3.0	17.0	2.0	*	*	*
BRATTLEBORO	51	0.0	0.7	0.7	5.0	2.0	*	*	*
BRIDGEWATER	26	0.0	0.8	1.1	6.0	1.0	*	*	*
BRISTOL	82	4.9	2.1	6.6	35.0	7.0	*	*	*
BROOKFIELD	20	0.0	*	0.0	*	*	*	*	*
BURKE	33	3.0	1.4	3.6	19.0	10.0	*	*	*
BURLINGTON	57	3.5	1.7	5.1	36.0	6.0	*	*	*
CABOT	34	0.0	0.5	0.1	1.0	1.0	*	*	*
CALAIS	61	0.0	0.5	0.1	1.0	*	*	*	*
CAMBRIDGE	114	0.0	0.8	1.0	8.0	3.0	*	*	*
CANAAN	30	0.0	1.5	1.5	6.0	5.0	*	*	*
CASTLETON	97	30.9	9.0	12.8	87.0	33.0	3.9	*	*
CHARLOTTE	314	1.6	1.7	3.5	48.0	6.0	*	*	*
CHELSEA	22	0.0	*	0.0	*	*	*	*	*
CHESTER	23	0.0	0.8	1.0	5.0	2.0	*	*	*
CHITTENDEN	32	0.0	*	0.0	*	*	*	*	*
CLARENDON	25	0.0	0.9	1.9	10.0	1.0	*	*	*
COLCHESTER	129	1.6	2.6	12.2	100.0	4.0	*	*	*
CORINTH	24	0.0	*	0.0	*	*	*	*	*
CORNWALL	72	5.6	2.2	5.7	41.0	14.0	*	*	*
CRAFTSBURY	49	8.2	3.2	7.0	32.0	22.0	1.0	*	*
DANVILLE	45	0.0	0.5	0.1	1.0	*	*	*	*
DERBY	50	2.0	2.0	4.1	26.0	8.0	*	*	*
DORSET	40	0.0	0.9	1.3	7.0	3.5	*	*	*
DUMMERSTON	39	0.0	0.8	0.9	5.0	3.0	*	*	*
DUXBURY	40	0.0	0.5	0.1	1.0	0.8	*	*	*
EAST MONTPELIER	73	0.0	0.6	0.2	2.0	1.0	*	*	*
EDEN	22	0.0	1.6	2.2	9.0	6.0	*	*	*
ENOSBURG	52	0.0	0.9	1.0	5.0	4.0	*	*	*
ESSEX	172	4.7	2.1	4.9	47.0	10.0	*	*	*
FAIRFAX	161	10.6	4.6	14.1	104.0	16.0	*	*	*
FAIRFIELD	40	0.0	0.9	1.1	5.0	4.0	*	*	*
FAYSTON	31	0.0	0.6	0.4	2.0	2.0	*	*	*
FERRISBURG	129	0.0	1.1	1.4	8.0	5.0	*	*	*
FLETCHER	26	3.8	1.3	3.3	17.0	3.0	*	*	*
FRANKLIN	29	0.0	0.8	0.6	3.0	2.0	*	*	*
GEORGIA	104	1.0	1.3	2.0	12.0	5.0	*	*	*
GLOVER	27	0.0	0.6	0.7	4.0	*	*	*	*
GROTON	25	0.0	0.6	0.3	2.0	*	*	*	*
GUILFORD	40	7.5	5.9	26.5	167.0	20.0	*	*	*
HANCOCK	51	0.0	0.9	1.1	5.0	4.0	*	*	*
HARDWICK	35	0.0	0.7	0.9	6.0	1.0	*	*	*
HARTFORD	80	1.3	0.8	1.6	13.0	1.0	*	*	*
HARTLAND	34	0.0	0.5	0.3	1.0	*	*	*	*
HIGHGATE	71	7.0	2.3	4.0	20.0	13.0	1.0	*	0.2
HINSBURG	217	5.7	9.9	7.1	7.0	13.0	1.0	*	*

Arsenic Private Water Test Result Summary

Maximum Contaminant Level (MCL) = 10 µg/L

Data Sources: Vermont Department of Health Laboratory 2003-2016, Vermont Geological Survey 2002-2014



Vermont Towns	Number of Tests	%Tests Above MCL	Concentration of Arsenic in Micrograms per Liter (µg/L)						
			Mean	Standard Deviation	Maximum	95th Percentile	Median	5th Percentile	Minimum
HUNTINGTON	127	0.8	0.9	1.5	12.0	4.0	*	*	*
HYDE PARK	36	0.0	0.7	0.5	3.0	2.0	*	*	*
JAMAICA	43	0.0	*	0.0	*	*	*	*	*
JERICHO	190	0.0	0.8	0.9	8.0	2.0	*	*	*
JOHNSON	46	4.3	1.8	3.3	16.0	10.0	*	*	*
LEICESTER	30	0.0	*	0.0	*	*	*	*	*
LINCOLN	78	0.0	0.6	0.5	3.0	2.0	*	*	*
LONDONDERRY	23	0.0	*	0.0	*	*	*	*	*
LUDLOW	20	10.0	2.9	7.5	30.0	24.0	*	*	*
MANCHESTER	45	4.4	1.4	2.6	11.0	7.0	*	*	*
MARSHFIELD	43	0.0	0.7	0.2	1.0	1.0	*	*	*
MIDDLEBURY	89	0.0	0.7	0.5	3.0	2.0	*	*	*
MIDDLESEX	95	1.1	1.4	2.4	19.0	6.0	*	*	*
MIDDLETOWN SPRINGS	34	2.9	1.9	4.6	27.0	5.0	*	*	*
MILTON	168	3.0	1.8	3.1	26.0	7.0	*	*	*
MONKTON	51	0.0	0.8	0.9	5.0	4.0	*	*	*
MONTGOMERY	34	0.0	0.7	0.6	3.0	3.0	*	*	*
MONTPELIER	67	0.0	0.6	0.3	2.0	1.0	*	*	*
MORETOWN	51	2.0	1.5	2.5	14.0	5.0	*	*	*
MORRISTOWN	79	8.9	3.7	8.7	50.0	25.0	*	*	*
NEW HAVEN	90	0.0	0.9	1.5	10.0	3.0	*	*	*
NEWBURY	25	0.0	0.5	0.1	1.0	*	*	*	*
NEWFANE	45	0.0	*	0.0	*	*	*	*	*
NEWPORT (City&Town)	47	14.9	4.3	7.5	30.0	21.0	*	*	*
NORTHFIELD	46	0.0	0.9	1.0	6.0	3.0	*	*	*
NORWICH	108	1.9	1.2	2.6	22.0	5.0	*	*	*
ORWELL	31	0.0	1.3	1.8	10.0	3.0	*	*	*
PAWLET	108	13.9	4.5	8.7	49.4	22.6	1.0	0.1	0.0
PEACHAM	32	0.0	0.6	0.2	1.0	1.0	*	*	*
PLAINFIELD	45	0.0	0.7	0.8	5.0	1.0	*	*	*
POULTNEY	67	22.4	10.7	23.8	151.0	63.0	2.0	*	0.1
PUTNEY	69	7.2	2.8	6.2	36.0	16.0	*	*	*
RANDOLPH	53	0.0	0.6	0.7	4.0	*	*	*	*
RICHFORD	32	0.0	0.5	0.3	2.0	*	*	*	*
RICHMOND	192	0.5	1.1	3.0	38.0	3.0	*	*	*
RIPTON	29	0.0	0.8	1.8	10.0	*	*	*	*
ROCKINGHAM	57	1.8	1.7	3.6	24.0	9.0	*	*	*
ROYALTON	24	4.2	1.1	3.0	15.0	*	*	*	*
RUPERT	45	8.9	3.9	10.4	67.0	13.0	*	0.1	0.0
RUTLAND (City&Town)	60	1.7	0.8	1.5	11.0	2.5	*	*	*
RYEGATE	22	0.0	0.7	0.5	2.0	2.0	*	*	*
SALISBURY	33	0.0	*	0.0	*	*	*	*	*
SHAFTSBURY	39	2.6	1.0	2.4	15.0	4.0	*	*	*
SHELBOURNE	144	2.1	1.4	3.6	33.0	5.0	*	*	*
SHELDON	23	0.0	0.7	0.6	3.0	2.0	*	*	*
SHEREWSBURY	29	0.0	0.6	0.3	2.0	*	*	*	*
SOUTH BURLINGTON	55	0.0	0.7	0.6	4.0	2.0	*	*	*
SOUTH HERO	59	0.0	1.1	1.6	9.0	4.0	*	*	*
ST. ALBANS (City&Town)	96	0.0	0.7	0.6	4.0	2.0	*	*	*
ST. GEORGE	41	19.5	5.2	7.8	33.0	19.0	1.0	*	*
ST. JOHNSBURY	50	0.0	0.8	1.0	5.0	3.0	*	*	*
STARKSBORO	82	2.4	1.3	2.8	21.0	3.0	*	*	*
STOWE	206	2.4	4.7	30.3	327.0	6.9	*	*	*
STRAFFORD	27	0.0	0.5	0.1	1.0	*	*	*	*
SWANTON	77	0.0	1.1	1.6	8.0	5.0	*	*	*
THETFORD	87	4.6	2.5	3.9	23.0	9.0	*	*	*
TOWNSHEND	21	0.0	*	0.0	*	*	*	*	*
TROY	26	15.4	7.0	22.4	113.0	24.0	*	*	*
TUNBRIDGE	21	0.0	*	0.0	*	*	*	*	*

Arsenic Private Water Test Result Summary

Maximum Contaminant Level (MCL) = 10 µg/L

Data Sources: Vermont Department of Health Laboratory 2003-2016, Vermont Geological Survey 2002-2014



Vermont Towns	Number of Tests	%Tests Above MCL	Concentration of Arsenic in Micrograms per Liter (µg/L)						
			Mean	Standard Deviation	Maximum	95th Percentile	Median	5th Percentile	Minimum
UNDERHILL	171	0.0	0.5	0.4	6.0	*	*	*	*
WAITSFIELD	68	1.5	1.1	1.6	11.0	4.0	*	*	*
WALDEN	20	0.0	*	0.0	*	*	*	*	*
WARREN	77	3.9	1.5	3.8	23.0	8.0	*	*	*
WATERBURY	121	1.7	1.3	2.3	20.0	5.0	*	*	*
WELLS	101	37.6	23.7	34.8	155.0	92.0	2.2	*	0.3
WESTFORD	88	2.3	1.4	3.0	20.0	8.0	*	*	*
WESTMINSTER	25	16.0	2.8	4.3	14.0	12.0	*	*	*
WEYBRIDGE	30	0.0	0.7	0.5	2.0	2.0	*	*	*
WHITING	21	4.8	1.9	3.2	14.0	6.0	*	*	*
WILLIAMSTOWN	43	0.0	0.5	0.1	1.0	*	*	*	*
WILLISTON	229	11.4	5.5	14.3	109.0	28.0	1.0	*	*
WILMINGTON	26	0.0	0.6	0.3	2.0	*	*	*	*
WINHALL	20	0.0	0.5	0.1	1.0	0.8	*	*	*
WOLCOTT	28	0.0	0.9	1.0	4.0	3.0	*	*	*
WOODSTOCK	38	0.0	*	0.0	*	*	*	*	*
WORCESTER	39	2.6	1.6	2.7	13.0	10.0	*	*	*

* Indicates less than the minimum detection limit (MDL) of the laboratory test, typically less than 1.0 µg/L.

Notes: In order to calculate statistics, a value of 0.5 µg/L (½ the MDL) was substituted as the sample result for each "not detected" value.

Data Sources: Vermont Department of Health Laboratory 2003-2016, Vermont Geological Survey 2002-2014.



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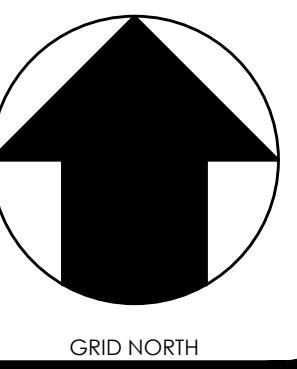
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GRID NORTH

**TOWN OF HIGHGATE
COMMUNITY WATER
AND WASTEWATER
FEASIBILITY STUDY
HIGHGATE, VERMONT**

PRELIMINARY

DATE ISSUED: 6/23/2021

REVISIONS:

DRAWN BY: HB
CHECKED BY:
SCALE: 1"=1000
PROJECT NO.: 978.001
CADD FILE: 978-001 ortho

TITLE: GENERAL
LOCATION MAP

FIGURE NO.

1



APPENDIX C

OPINION OF PROBABLE CONSTRUCTION COSTS

ESTIMATED BUDGET WORKSHEET

PROJECT: Town of Highgate - Municipal Water System
 ITEM: Highgate Airport Extension
 DATE: December 12, 2025

CATEGORY	ITEM	QTY.	COST	UNIT	ENR 14100 SUBTOTAL	TOTAL
General Requirements (10%)		1	\$ 1,216,150	L.S.	\$ 1,216,200	\$ 1,216,200
Demolition					\$ -	\$ -
Sitework/Yard Piping						
4" Water Main - Distribution		12000	\$ 350	L.F.	\$ 4,200,000	
3/4" Services		5000	\$ 125	L.F.	\$ 625,000	
8" Water Main - Transmission		13500	\$ 450	L.F.	\$ 6,075,000	
Site Work		1	\$ 40,000	Allowance	\$ 40,000	
Contaminated Soils		1	\$ 500,000	Allowance	\$ 500,000	
Site Restoration		1	\$ 10,000	Allowance	\$ 10,000	
					\$ 11,450,000	\$ 11,450,000
Concrete	Booster Pump St. Addition	220	\$ 1,200	C.Y.	\$ 264,000	
					\$ 264,000	\$ 264,000
Misc. Metals	Misc. Metals	1	\$ 5,000	Allowance	\$ 5,000	
					\$ 5,000	\$ 5,000
Building	Upgrade BPS	220	\$ 200	S.F.	\$ 44,000	
					\$ 44,000	\$ 44,000
Painting	Building	1	\$ 5,000	Allowance	\$ 5,000	
					\$ 5,000	\$ 5,000
Equipment	Chlorine Analyzer					
	Equipment	1	\$ 15,000	EA.	\$ 15,000	
	Installation	1	\$ 6,000	EA.	\$ 6,000	
	Chemical Feed Equipment and Pumps					
	Equipment	1	\$ 10,000	EA.	\$ 10,000	
	Installation	1	\$ 3,500	EA.	\$ 3,500	
	Chemical Storage Tanks					
	Equipment	1	\$ 12,500	EA.	\$ 12,500	
	Installation	1	\$ 1,000	EA.	\$ 1,000	
	Secondary Containment					
	Equipment	1	\$ 1,000	EA.	\$ 1,000	
	Installation	1	\$ 500	EA.	\$ 500	
	Booster Pumps & Tanks					
	Equipment	3	\$ 20,000	EA.	\$ 60,000	
	Installation	3	\$ 7,500	EA.	\$ 22,500	
	Misc. Equipment					
	Subtotal	1	\$ 10,000	Allowance	\$ 10,000	
					\$ 142,000	\$ 142,000
Process Piping	House Replumbs & Meters	65	\$ 3,000	EA.	\$ 195,000	
	Misc. Piping	1	\$ 20,000	Allowance	\$ 20,000	
	Misc. Valves	1	\$ 10,000	Allowance	\$ 10,000	
	Chem Feed Sleeving/Tubing	1	\$ 5,000	Allowance	\$ 5,000	
					\$ 230,000	\$ 230,000
Heating/Ventilation	Upgrade BPS	1	\$ 11,000	Allowance	\$ 11,000	
					\$ 11,000	\$ 11,000
Electrical	Misc. Electrical	1	\$ 5,000	Allowance	\$ 5,000	
	Upgrade BPS	1	\$ 5,500	Allowance	\$ 5,500	
					\$ 10,500	\$ 10,500
					Subtotal	\$ 13,377,700
					8% OH&P	\$ 1,070,216
					Total	\$ 14,447,916
					Use	\$ 14,450,000

Notes:

1. Costs are for ENR 14100 December 2025
2. The OH&P are based on 8% of the total.

ESTIMATED BUDGET WORKSHEET

PROJECT: Town of Highgate - Municipal Water System - Recommended Plan
 ITEM: New Groundwater Source, Treatment, Hydropneumatic BPS, & Distribution
 DATE: December 12, 2025

CATEGORY	ITEM	QTY.	COST	UNIT	SUBTOTAL	ENR 14100 TOTAL
General Requirements (10%)		1	\$ 687,025	L.S.	\$ 687,000	\$ 687,000
Demolition					\$ -	\$ -
Sitework/Yard Piping						
3" HDPE - Raw Water	850	\$ 80	L.F.	\$ 68,000		
4" Water Main - Distribution	12000	\$ 350	L.F.	\$ 4,200,000		
3/4" Services	5000	\$ 125	L.F.	\$ 625,000		
Gravel Drive	900	\$ 35	L.F.	\$ 31,500		
Electrical	1	\$ 25,000	Allowance	\$ 25,000		
Site Work	1	\$ 40,000	Allowance	\$ 40,000		
Misc. EPSC	1	\$ 5,000	Allowance	\$ 5,000		
Contaminated Soils	1	\$ 500,000	Allowance	\$ 500,000		
Site Restoration	1	\$ 10,000	Allowance	\$ 10,000		
					\$ 5,504,500	\$ 5,504,500
Concrete						
Generator Pad	5	\$ 750	C.Y.	\$ 3,750		
Groundwater Treatment Addition	100	\$ 1,200	C.Y.	\$ 120,000		
					\$ 123,750	\$ 123,750
Misc. Metals	Misc. Metals	1	\$ 10,000	Allowance	\$ 10,000	
					\$ 10,000	\$ 10,000
Building	Treatment Building Addition	1000	\$ 200	S.F.	\$ 200,000	
					\$ 200,000	\$ 200,000
Painting	Building	1	\$ 15,000	Allowance	\$ 15,000	
					\$ 15,000	\$ 15,000
Equipment	Chart Records					
	Equipment Installation	1	\$ 6,000	EA.	\$ 6,000	
	1	\$ 1,000	EA.	\$ 1,000		
	Filtered Magnetic Flow Meter & Transmitter					
	Equipment Installation	1	\$ 5,500	EA.	\$ 5,500	
	1	\$ 1,500	EA.	\$ 1,500		
	Arsenic Treatment Skid					
	Equipment Installation	1	\$ 250,000	EA.	\$ 250,000	
	1	\$ 50,000	EA.	\$ 50,000		
	Chlorine Analyzer					
	Equipment Installation	1	\$ 15,000	EA.	\$ 15,000	
	1	\$ 6,000	EA.	\$ 6,000		
	Chemical Feed Equipment and Pumps					
	Equipment Installation	1	\$ 10,000	EA.	\$ 10,000	
	1	\$ 3,500	EA.	\$ 3,500		
	Chemical Storage Tanks					
	Equipment Installation	1	\$ 12,500	EA.	\$ 12,500	
	1	\$ 1,000	EA.	\$ 1,000		
	Secondary Containment					
	Equipment Installation	1	\$ 1,000	EA.	\$ 1,000	
	1	\$ 500	EA.	\$ 500		
	Booster Pumps & Tanks					
	Equipment Installation	3	\$ 10,000	EA.	\$ 30,000	
	3	\$ 3,500	EA.	\$ 10,500		
	60,000 Gallon GFTS Tank					
	Equipment/Install	1	\$ 180,000	EA.	\$ 180,000	
	1	\$ 25,000	Allowance	\$ 25,000		
	Subtotal				\$ 609,000	\$ 609,000
Process Piping	House Replumbs & Meters	65	\$ 3,000	EA.	\$ 195,000	
	Misc. Piping	1	\$ 40,000	Allowance	\$ 40,000	
	Misc. Valves	1	\$ 10,000	Allowance	\$ 10,000	
	Chem Feed Sleeving/Tubing	1	\$ 10,000	Allowance	\$ 10,000	
					\$ 255,000	\$ 255,000
Heating/Ventilation	WTP/BPS Building	1	\$ 50,000	Allowance	\$ 50,000	
					\$ 50,000	\$ 50,000
Electrical	Misc. Electrical	1	\$ 10,000	Allowance	\$ 10,000	
	Computer	1	\$ 5,000	EA.	\$ 5,000	
	Autodialer	1	\$ 3,000	EA.	\$ 3,000	
	Telemetry	1	\$ 10,000	Allowance	\$ 10,000	
	Emergency Generator	1	\$ 50,000	EA.	\$ 50,000	
	Upgrade WTP Building & Lighting Improvements	1	\$ 25,000	Allowance	\$ 25,000	
					\$ 103,000	\$ 103,000
	Subtotal					\$ 7,557,250
	8% OH&P					\$ 604,580
	Total					\$ 8,161,830
	Use					\$ 8,200,000

Notes:

1. Costs are for ENR 14100 December 2025
2. The OH&P are based on 8% of the total.

APPENDIX D

OPERATION & MAINTENANCE (O&M) COSTS

Town of Highgate
Water O&M Projected Cost
Full-Time Operator
As of December 2025

Item	Est. Cost
Salary/Benefits	\$ 100,000
Office Expenses	\$ 10,000
Chemicals	\$ 10,000
Water Testing	\$ 4,000
Electricity	\$ 15,000
Tools/Supplies/Materials	\$ 23,000
Maintenance	\$ 8,000
Training & Safety	\$ 6,000
Permit Fees	\$ 3,000
Legal	\$ 8,000
Consulting Services	\$ 10,000
Insurance	\$ 8,000
Capital Fund	\$ 30,000
Total	\$ 235,000

Town of Highgate
Water O&M Projected Cost
Part-Time Operator
As of December 2025

Item	Est. Cost
Salary/Benefits	\$ 50,000
Office Expenses	\$ 10,000
Chemicals	\$ 10,000
Water Testing	\$ 4,000
Electricity	\$ 15,000
Tools/Supplies/Materials	\$ 23,000
Maintenance	\$ 8,000
Training & Safety	\$ 6,000
Permit Fees	\$ 3,000
Legal	\$ 8,000
Consulting Services	\$ 10,000
Insurance	\$ 8,000
Capital Fund	\$ 30,000
Total	\$ 185,000

APPENDIX E

LONG RANGE PLAN TEMPLATE

Long Range Plan

Water System Name
WSID #

Date Here

Table of Contents

Section 1. General System Description and Ownership Information

- A. General System Description**
- B. Ownership and Organizational Structure**

Section 2. Cost and Revenue Information

- A. 5-year Operation & Maintenance Budget Projections**
- B. 5-year Revenue Projections**
- C. Capital Fund Information**
- D. Projected Plan for Improvements**

Section 3. Planning, Policies and Procedures

- A. Service Area Information**
- B. Growth or Modernization Plans**
- C. Policies, Procedures and By-Laws**
 - 1) By-Laws**
 - 2) Customer Complaint Policy**
 - 3) Disconnect Policy**
 - 4) Delinquent Account Policies**
 - 5) Other**

Section 4. Water Conservation

- A. Water Usage Evaluation**
- B. Water Conservation Measures**
- C. Consumer Awareness and Water Conservation Education**

APPENDIX
Service Area Map
Detailed Budget Information

Section 1. General System Description

A. General System Description

The _____ Water System is a (privately owned) (public owned) (Co-op) (homeowners association) and is regulated by the VT Water Supply Division as a Public (Community) (Transient Non-Community) (Non-Transient Non-Community) Water System, WSID# _____. The system serves a population of ____, has ____ connections and is located in the town of _____.

Below describe the developmental history of the water system.

B. Ownership and Organizational Structure

The _____ Water System is owned and operated by (legal entity name) _____ . All official mail should be sent to _____ .

Chain of Command - List owner/responsible person, alternate responsible person, operators and other key people here.

Name/Title	Address	Contact Information Phone/Fax/e-mail

Section 2. Cost and Revenue Information

Describe here information about fiscal year audit schedule or any other financial controls established for the system

A. 5 year Operation and Maintenance Budget Projections

Explain how budget was developed

Expenses	Current FY Budget	Year 2 Budget	Year 3 Budget	Year 4 Budget	Year 5 Budget

Payroll					
Property Taxes					
Telephone					
Electricity					
Testing					
System Supplies					
Equip. Purchases					
Contract Services					
Maintenance					
Bond Payment					
Loan Interest					
Office Expenses					
Training					
Sinking Fund					
Depreciation					
Contingency					
Total Expenses					

Describe line items if appropriate.

B. 5-Year Revenue Projections

Explain how revenues are collected.

Revenue	Current FY Revenue	Year 2 Revenue	Year 3 Revenue	Year 4 Revenue	Year 5 Revenue
Rent / User Fees					
Water Sold					
Other					
Total Revenue					

Describe if appropriate user rates and or rate structure

C. Capital Fund Information

CAPITAL BUDGET PLAN

Projected Capital Items	Years in service	Expected Life	Estimated Current Cost	Future Cost	Annual Payment
1					
2					
3					
4					
5					
6					
7					

D. Projected Plans for Improvements (Narrative)

Section 3. Planning, Policies and Procedures

A. Service Area Information

Describe the service area boundaries, and either include a map of service area here or refer to it in an appendix.

B. Growth or Modernization Plans

Describe here if there is expansion capability or opportunity to consolidate with another system in the future.

C. Policies, Procedures and By-Laws

Include here or in an **APPENDIX: 1) By-Laws, 2) Customer Complaint Policy, 3) Disconnect Policy or 4) Delinquent Account Policy** and any **5) Other** policies or procedures established for the water system.

Section 4. Water Conservation

A. Water Usage Evaluation

Describe here water usage and how the system determines leaks in the distribution or in the home.

B. Water Conservation Measures

Describe here measures taken to conserve water, such as when drought conditions occur, low flow fixture incentives, rate structures that encourage water conservation, policy to assure water is not run to keep pipes from freezing etc.

C. Consumer Awareness and Water Conservation Education

Describe here any methods used to educate the customer such as notes on bills, information added into newsletter information to customers etc.

APPENDIX F

SOURCE PROTECTION CRITERIA



SOURCE PROTECTION PLAN REQUIRED INFORMATION

I. Maps

- A. An orthophoto or USGS topographic map showing the location of the water supply(s) and the delineated Source Protection Area (SPA). A SPA is the surface and subsurface area from or through which contaminants are reasonably likely to reach a water system source. A SPA is described further in the Source Protection Plan (SPP) guidance document [Protecting Public Water Sources in Vermont](#).
To find the location of the SPA for your water system, please use the [Agency Atlas](#).
- B. A map showing locations of water system's groundwater sources and/or surface water intakes, the landowners within the SPA, and Potential Sources of Contamination (PSOCs) within the SPA. A tax parcel map with the SPA overlay may be most helpful to locate PSOCs and to identify the responsible parcel owner. Include on all maps the WSID # and name of the water system

II. Inventory and Assessment of Potential Sources of Contamination (PSOCs)

- A. Include an inventory and description of the PSOCs that occur within the SPA (i.e., septic system/leach fields, underground storage tanks, above ground storage tanks, agricultural and forestry activities, businesses, high traffic areas, hazardous sites, etc.).
- B. Include a cross indexed list of the PSOC with the landowner/responsible person's contact information.
- C. Provide a risk ranking of high, medium, or low for each PSOC with an explanation of the reasons for the ranking.

III. Management Plans

The SPP identifies how the water system will manage the identified risks in conjunction with the PSOC's responsible parties. These plans shall be directed toward controlling risks from existing potential sources of contamination, where possible, and reducing risks of potential contamination.

- A. The management plans shall include one or more actionable items from the source protection list (below), or other appropriate actionable activity.
 1. The water system will provide educational opportunities and activities to improve source protection understanding (for example: school presentations, meetings for residents to raise their source protection awareness, the state is invited to explain the utility of a SPA is to the planning commissions).
 2. The town will make zoning district changes to decrease risks in their Source Protection Area (for example: change development density in SPA, locate industrial/commercial development zones outside of SPA, place septic treatment facilities outside of a prime groundwater aquifer).
 3. The town will incorporate zoning overlays for source protection areas (for example: prohibit certain activities within SPA Zone 1, Zone 2 and/or Zone 3).
 4. The town will reclassify Source Protection Areas to Class II Groundwater areas



(this pertains to municipal water systems primarily and is for both existing SPA and likely proposed new SPA). Other Agency programs restrict or prohibit certain activities in Class I and Class II groundwater areas. It also raises public awareness of the groundwater resource and groundwater protection by recognizing its importance at an elevated level.

5. The water system will draft specific letters targeting the identified potential contaminants and send them to those land owners in the Source Protection Area (for example: targeted letters to specific land uses, provide more explanation regarding the relationship of land use activity and groundwater flow/recharge to the water supply).
6. Describe in detail the enhanced surveillance activities the water system will take, including frequency (for example: visiting with the owner/manager of high and moderate risk activities bi-yearly, walk or drive the SPA to observe what is happening every other week), and incorporate changes found into the SPP.
7. Purchase land or land use easements (i.e. development rights) within the Source Protection Area to have control over land use activities in sensitive areas. (for example: use the DWSRF loan set-asides for land purchase, fund a targeted land purchase/development rights acquisition account).
8. Incorporate and discuss how the bedrock and surficial materials base maps derived from the new State Geologic Maps, specific to the SPA, relate to specific source protection activities. This can be the basis for reevaluating risk assessments and determining more effective protection activities or assigning zoning districts.
9. Coordinate with DWGPD staff, depending on their workload, to accompanying water system personnel on a “windshield survey” or walk through the SPA to help identify unrecognized Potential Sources of Contamination (PSOC) or reevaluate existing ones, and understand their significance if released into the recharge area.
10. Coordinate with DWGPD staff, depending on their workload, to assist in priority ranking the identified risks in the SPA (as High, Medium, or Low) to improve targeting the water system’s protection activities. This could be done in conjunction with discussing the geologic surficial materials/bedrock type maps, the topography, the concentration/volume of contaminant, etc.).
11. Attend specific source protection training opportunities that are presented at various trainings and meetings (for example: Vermont Rural Water Association (VRWA) annual meeting, as a component of Operator Training. (VRWA is a partner with the Division in Operator Training and Source Protection)).
12. Discuss other deterrent measures to contamination or vandalism that will be installed or implemented (for example: signage, fencing, volunteer activities for education, surveillance).
13. Other actionable activities.

B. Specifically address the water system’s control of 200-foot isolation zone 1, and if not owned or controlled by the system, the water system’s plan to manage it.

C. Commitment to update the SPP every year for changes/additions of PSOCs and landowners, and every three years to submit an updated SPP to the Division for review and approval.



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www.dec.vermont.gov/water

Agency of Natural Resources

- D. Include copies of educational letters to be mailed to Town officials, and landowners and businesses within the SPA. These letters can involve education about proper septic tank use and cleaning, requests to reduce pesticide/herbicide/fertilizer use, reduce salting of roads, and other educational efforts specific to the PSOC, such as health effects or consequences of contamination of the source.

IV. Contingency Plan

- A. Identify alternate drinking water supplies in the event of source contamination or disruption. Contingency plans address both short- and long-term needs, i.e., bottled water, hauled water, boiling water, drilling a new well, purchasing water from another water system, etc.
- B. Emergency procedures for non-scheduled sequenced system shutdown and start-up. This information may be found in the Operation and Maintenance Manual for the water system.
- C. List name and telephone numbers of people to contact in case of emergencies, spills, discharges, etc. (i.e. Fire Department, Police Department, Drinking Water & Groundwater Protection Division, Hazardous Material Spills (1-800-641-5005), etc.).



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WSID # _____
Water System Name _____ Date _____
Reviewer _____

SOURCE PROTECTION PLAN CHECKLIST

Note: Not all sections may be applicable to all water systems.

YES

NO

IA. Orthophoto or USGS topographical maps with Source Protection Area delineation showing Source Location and:

- _____ 1. Zone I, 200 foot radius isolation zone
- _____ 2. Zone II
- _____ 3. Zone III
- _____ 4. two year time of travel delineation

IB. Tax maps with the following information identified and labeled:

- _____ 1. Name of water system and WSID #.
- _____ 2. Town name, scale, legend.
- _____ 3. Groundwater sources (wells, springs)
- _____ 4. Surface water inlets
- _____ 5. Source Protection Area delineation
- _____ 6. Potential Sources of Contamination (septic systems/leach fields, businesses, agriculture, forestry, USTs, ASTs, etc.) within the SPA
- _____ 7. Landowner parcels and buildings within the SPA

II. Inventory of PSOCs and Assessment

- _____ A. Inventory and description of PSOCs (septic systems/leach fields, businesses, agriculture, forestry, USTs, ASTs, etc.) present and past.
- _____ B. A list of the land parcels within the SPA cross-indexed with the landowner and the PSOCs.
- _____ C. Assessment and ranking (whether PSOCs are high, moderate, or low risk)

III. Management Plan

- _____ A1. Educational activities to be performed.
- _____ 2. Zoning changes to be enacted.
- _____ 3. Zoning overlays to be incorporated.
- _____ 4. Groundwater reclassification to Class II petition to be submitted.
- _____ 5. Targeted PSOC letters to be developed and sent.
- _____ 6. Enhanced surveillance activities to be implemented.
- _____ 7. Land or easements to be purchased.
- _____ 8. Enhance geologic understanding of aquifer.
- _____ 9. Enhance PSOC identification.
- _____ 10. Enhance PSOC ranking.
- _____ 11. Attend source protection training.
- _____ 12. Enhance Deterrent measures to contamination or vandalism.
- _____ 13. Other, describe _____

- _____ B. Zone 1 management: Management techniques to be used, i.e., land purchase within SPA, posting signs, purchase of development rights, local ordinances, public educational efforts, other _____
- _____ C. Commitment to update the SPP every three years



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D. Copy of letter sent to businesses/landowners within SPA and copy of letter sent to town, county, and state officials.

IV. Contingency Plan

A. Alternate water supply made available, both long- and short-term solutions, with list of suppliers and phone numbers.

B. Emergency procedure for non-scheduled sequenced system shut down and startup.

C. A plan for notifying key contact people, including names, functions, and phone numbers.

APPENDIX G

OPERATION & MAINTENANCE (O&M) MANUAL TEMPLATE

*PLEASE NOTE: This template is out of date and must be used *only as a guide*. The Water System is required to ensure that all information in the O&M Manual is up-to-date, is specific to the Water System, and meets the requirements of the Water Supply Rule, Appendix D.*

This guidance sheet and related environmental information are available electronically via the internet. For information visit us through the Vermont Homepage at <http://www.vermont.gov> or visit VT WSD directly at <http://www.vermontdrinkingwater.org>

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WSID ⁽¹⁾
(2)

Operations and Maintenance Manual

Original Completion Date: (3)
Updated:

Approved by Vermont State Water Supply Division: (xx/xx/yyyy)

Table of Contents

Chapter	Page
I. General System Description	7
<i>Permitted Source</i>	7
<i>Raw Water Mains and Storage.....</i>	7
<i>Raw Water Treatment</i>	7
<i>Finished Water Storage</i>	8
<i>Storage Tank Summary Table.....</i>	8
<i>System Pressure Maintenance.....</i>	8
<i>Pump Station Summary Table.....</i>	8
<i>Distribution System.....</i>	9
<i>Source Protection Area.....</i>	9
<i>Groundwater Source</i>	9
<i>Surface Water Source.....</i>	9
II. System Schematic	10
III. Startup Procedure	11
<i>Initial Flushing and Disinfection</i>	11
<i>Sequenced Start-up Procedure.....</i>	11
IV. Normal Operations.....	12
<i>Daily Tasks</i>	12
<i>Routine Tasks</i>	13
<i>Directions for Completing Routine Tasks.....</i>	15
<i>Daily Tasks</i>	15
<i>Monthly Tasks.....</i>	16
<i>Semi-Annual Tasks.....</i>	17
<i>Annual Tasks</i>	18
<i>Less Frequent Than Annual Frequency</i>	19
V. Safety	20
<i>Personal Safety.....</i>	20
<i>System Safety.....</i>	21
VI. Contingency Plan	22
<i>Required Notification</i>	22
<i>Alternate Water Supply Made Available</i>	22
<i>Sequenced System Shutdown</i>	22
<i>Posting of any Notice Required for Use of Emergency Source</i>	22
VII. Trouble Shooting Operation Problems	24
VIII. Distribution.....	28

<i>Main Line Description</i>	28
<i>System Flushing</i>	28
<i>Special Appurtenances</i>	28
<i>Fire Protection</i>	28
IX. Maintenance Program	29
<i>Equipment List</i>	29
<i>Specification Sheets</i>	29
X. Vendor List	30
XI. Official Water System Records and Maintenance Procedures	31
XII. Customer Notification	32
XIII. Customer Complaint Procedures	33
<i>General Procedure</i>	33
<i>Appeal Process</i>	33
<i>Relevant Phone Numbers</i>	33
<i>Complaint Forms</i>	33
XIV. Water Conservation Program	34
XV. Cross-Connection Control Program	35
XVI. State of Vermont Water Supply Rule	36
Appendix A	37
<i>Water System Maps</i>	37
Appendix B	38
<i>Water System Schematic Drawings</i>	38
Appendix C	39
<i>Source Protection Plan</i>	39
Appendix D	40
<i>Material Safety and Data Sheets (MSDS)</i>	40
Appendix E	41
<i>Sample Documents and Forms</i>	41
Appendix F	42
<i>Standard Operating Procedures</i>	42
Appendix G	43
<i>Fire Hydrant Testing and Information</i>	43

Appendix H	44
<i>Technical Specifications</i>	44
Appendix I	45
<i>Sampling Plans</i>	45
Appendix J	46
<i>Emergency Response Plan</i>	46

Preface

This Operation and Maintenance (O&M) Manual was completed by (4) as a requirement of the Vermont Water Supply Rule (WSR), Subchapter 21-7. The document should be updated at least annually with the date the update occurs recorded in the space provided on the front cover of this document.

The purpose of the O&M Manual is to provide a stand-alone document to allow daily routine and trouble shooting operation by a properly trained operator including testing and monitoring requirements necessary for this particular system. As such, no piece of information is "too small" to be included in the document, as the more information that is included, means the less information that is unknown.

Used in conjunction with "as-built" water system blue prints, the document should be usable for full system maintenance to insure an adequate water supply is available to all users of the water system and public health is protected. Because of this, this manual reflects only actual installation of equipment, facilities, and treatment, NOT plans, future additions or "wish-lists". This qualifying statement should be kept in mind for all future updates of this document.

The Water System must be operated and maintained in accordance with its permitted, engineered design and in compliance with this approved document.

I. General System Description

Permitted Source

The approved or permitted source(s) for the Water System is(are):

1. Source WL001(or IN001) – (5)
2. Source WL002 (or IN002) – (6)
3. Source WL003 (or IN003) (emergency source) – The Water Supply Division must be notified prior to any use of this non-permitted, unapproved source. The phone number for the Division is 1-800-823-6500 or 802-241-3400. (7)

A map showing all sources relative to the area is contained in the Appendix A, titled "Water System Maps". (8)

Raw Water Mains and Storage (if applicable)

Prior to treatment or distribution raw water is pumped directly to the raw water storage tank. This tank is located (9a). The capacity of the tank (in gallons) is (9b) and the tank is generally operated at (9c)% of maximum capacity. The vent, overflow and drain for the tank are located at (9d), respectively. The drain can be manually opened or closed by turning the valve located (9e). Prior to opening the drain, the following things should be completed: (9f). A schematic drawing of the raw water storage is contained in Appendix B, titled "Water System Schematic Drawings". (9g)

(10)

Raw Water Treatment

Prior to distribution and finished water storage, the raw water is treated with the following process(es) in the specified order:

(11)

1. Chlorination – Chlorine is added to the raw water for the purpose of disinfection prior to consumption by any users on the water system. This disinfection system is operated on a continuous basis (12)% Sodium Hypochlorite solution (12a) is added to the raw water line via a flow-paced injection system composed of a positive displacement chemical feed pump (12b) that draws the diluted chlorine solution from a (12c)gallon holding tank/reservoir and directly injects it to the raw water line (see Section IV – Normal Operations, for information on adding solution or tank/pump maintenance). The chemical feed pump is plugged into an outlet that is controlled by a solenoid valve to ensure that the circuit is only "live" when the well pump that is located inside the source is on and pumping water. (12d) This ensures that the chlorine is added to the system only when the pump is on and fresh raw water is added to the system. An additional safeguard is a flow-sensor either immediately prior to the chlorine injection point to halt the chemical feed system if water flow stops, or to stop water flow if the chemical feed solution stops. This sensor records actual flow of water in the pipe to guard against accidental injection of chlorine when the source pump is on but no water is being added to the system. If the sensor does not detect water flow it de-energizes the outlet, preventing the introduction of chlorine into the system. The other flow sensor will halt water flow if there is a chemical feed pump failure. Following the injection point and prior to the water entering the distribution system, the treated water flows to (12e)to ensure that proper disinfection occurs by ensuring a minimum of 20 minutes of contact time is applied (12f) After this contact time, the water may enter the distribution system.
(13)
2. Potassium Permanganate (Algae, Zebra Mussel control, Iron and Manganese, taste and odor control)
3. Sediment Filter Cartridge
4. Ion Exchange (water softener unit)
5. Phosphate Addition (sequester iron and manganese, corrosion control, lead & copper)

6. Soda Ash (raise raw water pH)
7. Filtration (slow sand, rapid sand, pressure sand, conventional, direct)
8. Filtration
9. Fluoridation
10. Anion exchange
11. Activated Carbon

A schematic drawing of the entire treatment train is contained in Appendix B, titled "Water System Schematic Drawings". (14)

Finished Water Storage

Finished water (water ready to be consumed) is stored in a (15a) – gallon storage tank made out of (15b) called (15c) that is located (15d). The storage tank has an overflow that discharges. Additionally, there is a drain that can be manually opened or closed by turning the valve located (15f). Prior to opening the drain, the following things should be completed: (15g) A schematic drawing of the finished water storage, piping, valve ties, etc. is contained in Appendix B, titled "Water System Schematic Drawings". (15h)

(16)

Below is a table summarizing the pertinent information of each of the storage tanks for the Water System.

Storage Tank Summary Table

Tank	Tank name	Size	Type	Location	Overflow Location	Drain Valve Location
001	Big Tank	100,000	Steel	Old Smith Farm	SW corner of bank behind tank	Marked with orange pole, NE corner

System Pressure Maintenance

Pressure in the distribution system is maintained and/or regulated by (17) the (18) is located (19). Routine maintenance for each of these systems is discussed in further detail in Section IV – Normal Operations. (20)

Pump Station Summary Table

Pump Station #	Pump Station Name	Number of Hydropneumatic Tanks and sizes	Number of Booster pumps	Low/high pressure (psi)	Location
001	Big Pumper	3 – 100 gallon	2	55-80	Jones Farm Rd.

Distribution System

(21)

Source Protection Area

Groundwater Source

The source protection area for each of the water system sources has been delineated and is described in detail in the system Source Protection Plan (SPP). A Source Protection Plan identifies the potential sources of contamination in a specific land surface area, assesses the risks of these potential sources of contamination, describes how to manage the risk from the potential sources of contamination, and discusses how to handle simple emergencies that may be associated with inadequate source water quality or quantity. Activities within the protection area are managed by the Water System through their Source Protection Plan to minimize their effect on the drinking water source. Any activity which may contaminate the water supply is prohibited from being located within the isolation zone for the source. A copy of the Water Supply Division-approved SPP, including maps) is attached as an appendix to this document (See Appendix C). (22)

AND/OR

Surface Water Source

The source protection area for each of the water system sources has been delineated and is described in detail in the system Source Protection Plan (SPP). A Source Protection Plan identifies the potential sources of contamination in a specific land surface area, assesses the risks of these potential sources of contamination, describes how to manage the risk from the potential sources of contamination, and discusses how to handle simple emergencies that may be associated with inadequate source water quality or quantity. Activities within the protection area are managed by the Water System through their Source Protection Plan to minimize their effect on the drinking water source. Any activity which may contaminate the water supply is prohibited from being located within the isolation zone for the source. A copy of the Water Supply Division-approved SPP, including maps) is attached as an appendix to this document (See Appendix C). (22)

II. System Schematic

A current and continually updated system schematic makes routine, as well as emergency maintenance on a water system significantly easier. Contained within this section of this document is a system-wide schematic of the distribution system. This schematic is a representation of all system components as well as all known hydrants, blow-offs, air-releases, valves, meters, and connections. All items are "tied-in" to a known, permanent location so that they can be easily located, even if the item becomes hidden (such as by snow or dirt). (23)

The following table identifies and describes each of the items listed on the schematic: (24)

(25)

Item	Location	Description	Function
Valve 001	Main St / Smith Rd	12" gate valve	Shuts off all water to north side of system
Valve 008	300 block Ryan Rd.	8" gate valve	Shutoff valve for Ryan Park, open 7 th in flushing routine
Hydrant 056	Elementary School	ISO Fire Hydrant	Provides fire protection for elementary school, used in system flushing
Etc.			
Etc.			
Etc.			

III. Startup Procedure

Initial Flushing and Disinfection

All walls, pipes, tanks, and equipment that can convey or store potable water must be disinfected in accordance with American Water Works Association (AWWA) standards – see www.awwa.org/bookstore/category for available guidance documents.. These procedures must be followed to ensure that the water system has been properly prepared to supply safe drinking water. The steps that should be completed are as follows (26)

1. Add chlorine disinfectant to the source (27)
2. *XXX*
3. *XXX*
4. *XXX*
5. *XXX*
6. *XXX*
7. *XXX*

Sequenced Start-up Procedure

In order to start the operation of the water system, the following sequence of events must be completed, in order (28):

1. Turn on power to system components (29)

IV. Normal Operations

The operations of the Water System can be broken down into a number of categories that are defined by how often certain tasks must be completed. Many of the tests and tasks are necessary for compliance with drinking water regulations while others are requirements of the equipment or chemical manufacturer to ensure the reliability of the product and water system. Some tasks will only need to be completed on an annual (or less frequent) basis; however they cannot be forgotten about! Other items of a good water system need daily or even continuous monitoring. If your water system has a residential population of greater than or equal to 3,300 persons, the Emergency Response Plan shall also address these issues. This section has a checklist for items that must be completed less frequently to ensure that they are being completed as often as is necessary. It also provides a record of maintenance that has been completed, that can be used to show regulatory compliance for different facets of the system. Each item listed in the checklist has a corresponding entry on the following page that gives details about how to do the required task.

The page following the maintenance records and directions is the compliance monitoring schedule provided by the Water Supply Division. (30) The Water System monitoring schedule is updated annually in December of each year and includes a schedule of each chemical group that must be monitored for and the quarter in which the compliance sample must be collected (31). The schedule shows a two-year period; however only the first year is a required sampling schedule. The second year shows an estimated sampling schedule that may be used for planning and budgeting purposes, but a formal schedule will again be provided in December, prior to the schedule becoming official.

Daily Tasks

- Ensure that all continuous monitoring devices are operating correctly by grab sample analysis if the monitoring devices are used for reporting purposes. If the instruments are not used for reporting purposes, ensure proper operation by a visual inspection of the instrument (attend to, log, and clear alarms) and flow through the instrument
- Conduct a general site inspection. Check all storage tank hatches and building locks for signs of unauthorized entry, leakage, etc.
- Inspect Chemical Feed Systems for proper operation, that dosage rates are accurate and/or potential problems
- Collect necessary compliance samples (pH, chlorine residual, fluoride residual, etc.);
- Add new charts to chart recording devices
- Monitor, measure and log all measurements, residual analyses, including the total amount of water produced by each source
- Xxx
- Xxx
- Xxx

Routine Tasks

(32)

Monthly									
Task	Date last completed								
Collect Bacteriological Sample for TCR compliance (<i>if applicable</i>)									
Record Monthly Source Water Production (daily if introducing chemicals)									
Submit Monthly Report to Water Supply Division									
Fill Chemical Solution Tanks (<i>if applicable/needed</i>)									
Chemical feed pump draw down tests									
Calibrate All Analysis Equipment/Replace fluids as necessary/clean and flush as needed									
System maintenance (pumps, valves, etc.)									
Quarterly									
Task	Date last completed								
Collect Required Chemical Monitoring Samples									
Calibrate All Analysis Equipment									
Semi-Annually		Date last completed							
Test Fire Hydrants									
Inspect Surface Water Intake									
Calibrate All Analysis Equipment									
Annually									
Exercise All Valves in Distribution System									
Calibrate All Analysis Equipment									
Anti siphon and Backflow prevention device testing									
Flush Distribution System (unidirectional)									
Prepare/distribute consumer confidence report (Due July 1)									
Less Than Annual Frequency									
Task	Frequency		Date last completed						
Inspect and Clean Storage Tanks	Every 5 years								

Update Monitoring Waivers & SPP	Every 3 years			
Apply to renew Permit to Operate	Based on permit expirati on date			
Renew Certified Operator certification	Every 3 years			

Daily Tasks (33)

(The following is an example. Directions for ALL tasks that are identified in the checklist on the previous page should be accounted for in these pages)

- Check all continuous monitoring devices – Flow-meter, online chlorine analyzer and turbidity analyzer (34) must be checked for proper operation. Is the power on to all equipment? Are readings within the expected range? Is there a read-out on all equipment? Are results being charted? Has all daily maintenance (calibration, reagent addition, new chart added, etc) been completed?
- Security check of property, equipment and tanks – A visual inspection of all storage tanks and buildings on the property must be completed. Walk completely around all structures and check the tops of all building that have an accessible roof. Check all entryways, hatches and locks for signs of disturbance.
- Chemical feed system monitoring - How many gallons of water did you produce and how many gallons (or pounds) of each chemical did you use (calculate dosage as a double check of residuals that were measured). Any leaks on the feed lines? Does secondary containment have any solution in it? Carrier water flows ok? Etc.
- Etc. –
- Etc. –

Monthly Tasks (35)

- Collect bacteriological samples for TCR compliance – Check Bacteriological Sampling Plan located in Appendix I of this manual for sampling location. Properly prepare sampling location and collection materials (according to standard operating procedures). Measure disinfectant residual if disinfectant is present in the system. Collect sample and send to (36).
- Record monthly water production – Go to master source water meter and record the total gallons produced on the front of the yellow monthly reporting sheet located (37). Subtract reading from the first day of the month (already recorded on sheet) to determine total water production for the month. Ensure that back of form has recorded daily water production, chlorine residuals, and any other daily chemical monitoring that is required by the Permit to Operate and mail to the Water Supply Division listed at the bottom of the front of the form.
- If disinfecting, did the Water System meet daily CT goal during peak hourly flow?
- Submit Monthly Report to Water Supply Division.
- Provide water bill to customers.
- Etc. -
- Etc. -
- Etc. -

Semi-Annual Tasks

- Flush Distribution System –
- Inspect Surface Water Intake –
- Read distribution system meters at service connections(might be done more often) - Visit each service connection and record the number shown on the service connection water meter. Check to ensure that the value recorded is within the bounds of reason, e.g. there isn't a grossly significant error signifying a potential leak.
- Etc. -
- Etc. -

Annual Tasks

- Exercise all valves in distribution system –
- Etc. –
- Etc. –

Less Frequent Than Annual Frequency

- Inspect and clean storage tanks –
- Etc. –
- Etc. –
-

V. Safety

Personal Safety

Operation of a drinking water system poses some job-related hazards that must be adequately addressed to ensure not only an adequate supply of safe drinking water, but to provide for the health and safety of all employees associated with the water system. These hazards include, but are not limited to slips, trips, falls, electrocution, drowning, engulfment, asphyxiation, and chemical poisoning. The table below lists many of the known hazards associated with the standard operation of the (38) water system, as well as the precautions that must be taken to lessen the likelihood of a potential injury. Precautions include the use of appropriate personal protective equipment (PPE) including, but not limited to, gloves, face shields, SCUBA, and respirators. Material Safety and Data Sheets for all chemicals used in the water system are contained in Appendix D of this document (39) The location of all permit or non-permit required confined spaces is identified on the map titled "Confined Spaces" located in Appendix A – Water System Maps (40).

(41)

Hazard	Location	Necessary Precautions
Sodium Hypochlorite	Pump-house and storage room	Proper PPE: gloves, eye-shield, appropriate ventilation. Note that oxidizing compound will deteriorate electrical equipment
Sodium Hydroxide	Pump-house and storage room	Proper PPE: gloves, eye-shield, appropriate ventilation
electrocution	Electrical panel	Follow lock-out tag-out procedures, disconnect main power before work
drowning	Storage tanks, pond	Two person system for work in and around potential drowning locations, life-vests as appropriate
Fluoride	Pump-house and storage room	Proper PPE: gloves, eye-shield, appropriate ventilation
Soda Ash	Pump-house and storage room	Proper PPE: gloves, eye-shield, appropriate ventilation

System Safety

Besides the inherent personal risks involved in operating a drinking water system, there are additional safety issues that must be considered to ensure that all users of the water system, as well as the system itself remains safe. This is the main function of the water system - to ensure that water is protected from the source to the tap for all users. Included in this definition is the often overlooked facet of system safety. If a portion of the system breaks down, then your main job (supplying safe drinking water) has been upset because the system has been disrupted. Timely completion of the daily and monthly tasks identified in Section IV should make system safety much easier to obtain and maintain, but problems will still occur. Knowing how to deal with those problems as they occur (or even preventing them) will make operation of the water system significantly more reliable. The following system safety-related issues are duplicated in Section VII – Troubleshooting without the “effect” column and an expanded “fix” column.

(42)

Hazard	Effect	Fix
Burned out lights in pump-house	Increased risk of slips, trips falls; decreased security	Replace light bulbs
No disinfectant in system	Increased risk of bacteriological contamination or actual colonization of bacteria; possible regulatory consequences	Check injection pump, lines, and disinfectant reservoir, replace as necessary and search for the source of contamination, (leaking water line, cross-connection, back-pressure, etc.) as necessary.
Low pressure in distribution	Angered customers; increased risk of backflow situations; potential regulatory consequences	Check pressure systems, check for system leaks, booster pump failures; identify low pressure cause
Elevated disinfectant levels	Angered customers; risk of harm to consumers; possible regulatory consequences	Check injection pump, lines, and disinfectant reservoir, especially anti-siphon valve, replace as necessary; take appropriate measures to solve problem
Identified Cross-Connection	Potential harm to consumers through ingestion of non-potable water; contamination of entire distribution system	Remove cross-connection immediately. Install appropriate backflow protection
Etc.		
Etc		
Etc.		

VI. Contingency Plan

Despite your best efforts as an operator, there will be times that events are out of your control. During these times, it is possible that your supply of water will no longer be available for use by the consumer. For this reason it is imperative that a contingency plan be already developed and practiced (as is necessary, applicable or practical) so that again, your highest priority – supplying safe drinking water – can experience minimal or no interruption. Your contingency plan is also contained in the Division-approved SPP for the water system. It is copied here for convenience. (43) A full Emergency Response Plan is included in Appendix J of this document. (44)

Required Notification

Before implementing the water system's contingency plan, the water system must contact the Water Supply Division at 1-800-823-6500, 802-241-3400, or if after-hours by pager at 802-741-5311.

Additionally the water system must notify: (45)

Alternate Water Supply Made Available

An alternate water supply has been identified for use in emergency situations. Prior to the use of any unapproved source, you must make sure that all required notification as required by the Division has been completed (see section immediately prior to this one). The alternate supply for the (46) water system is (47) which is located. (48) In order to start using this source, the following steps should be completed in order: (49)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

Sequenced System Shutdown

In addition to the start-up of the emergency source and distribution system, shutdown of the main water system may be necessary due to contamination or other unsafe conditions. The following steps must be completed, in order, to ensure the safe shut-down of the main water system:

(50)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

Posting of any Notice Required for Use of Emergency Source

Use of most emergency sources will require the posting of either a "Do Not Use" or a "Don Not Drink" (the exception being when 100% of the emergency supplied water is bottled). This Public Water Notice may eventually be removed by the Water Supply Division, pending the submission of satisfactory water quality test results. Sample Notices are contained in Appendix E of this document. (51)

Public notice must be delivered to all customers of the water system as soon as possible (prior to any potential consumption of the emergency source water), but no later than 24 hours after switching to

the emergency source. Public notice may be given by hand-delivery, broadcast media (TV and radio) and/or placed in conspicuous public places throughout the distribution system. The notice must stay posted during the entire period that notification is required.

VII. Trouble Shooting Operation Problems

During the course of daily operations there are literally thousands of potential problems that could occur. Some of these problems are so obscure and rare that it is futile to try and address every single issue in print; however, the vast majority of problems that occur can be predicted and a plan to address them completed prior to the actual event ever occurring. This section of the Operation & Maintenance Manual offers a view to dozens of potential problems geared toward a quick solution to ensure very limited or zero interruption of water service to the customer. (52)

Problem	Remedy
No water	
Broken Well Pump	
Chemical overfeed	
Chemical underfeed	
No disinfectant residual	
Disinfectant residual too high	
High water alarm	
Low Water Alarm	
Service Connection Break	
Main Line Break	
Leaking Hydrant	
Stuck Valve	
Broken Valve Handle	
Clogged Filter	

Lightning Strike of pump-house	
Broken Booster Pump	
Flooded Pressure Tank	
Leaking Storage Tank	
Leaking Chemical Storage Tank	
Security Breach of Building	
Security Breach of Storage Tank	
Security Breach of Source	
Dead Animal in Storage Reservoir	
Low Water Pressure in Distribution System	
Broken Master Water Meter	
Chemical Spill in Pump House	
Flooded Meter Pit	
Frozen Main Line	
Frozen Service Connection line	
Low pressure in distribution system	
High pressure in distribution system	

Public disease outbreak. (caused by waterborne bacteria/parasites)	
Fire Hydrant hit by automobile	
Lost/Can't find an isolation valve	
Customer complaints	See customer complaint procedure in Section XIII of this manual
Insufficient Yield	
No electrical power or low voltage	
Pump Failure	
Electrical Controls failure	
Discolored Water	
Taste associated with water	
Odor associated with water	
Treated water discharge to environment	

VIII. Distribution

Main Line Description

The main distribution lines of the water system are composed of (53) that is approximately (54) years old. Main line shutoff valves are located on the system-wide schematic that is contained in Section II of this document and the valve tie books show measured locations from fixed objects, make, model, open/shut direction(s), and maintenance history (if applicable) (55). Additionally, a less detailed map showing only key shut-off points is contained in Appendix A, "Water System Maps". (56) Shut-offs can all be operated manually; any special directions for a particular shut-off are noted next to that valve on the map in Appendix A. (57)

System Flushing

All distribution valves should be operated at least once annually. Unidirectional distribution system flushing – following the distribution flow of water to the ends of the system - should be conducted annually at a minimum and is a good way to also incorporate a valve-exercising program. Sound distribution maintenance practices are an important part of ensuring future system reliability. The following method should be adhered to in all flushing for the water system. Strict adherence to this protocol will ensure that the entire system is adequately flushed and that no "pockets" of water remain stagnant in the system as well as ensure that pipe interiors are flushed to scouring velocity to prevent build up on the interior of the piping and that any sediments that are present in the piping are removed. When the system has been routinely disinfecting the water with chlorine it is also important to ensure that all water is dechlorinated prior to, or at, the discharge point to prevent an intentional release of chlorine to the environment. The entire flushing protocol is also included in Appendix F – Standard Operating Procedures, of this document. (58) Each time that system flushing is completed, the date should be recorded in the appropriate table in Section IV of this document and in the valve tie books (for systems that have valve tie books).

Special Appurtenances

The following items need different or additional maintenance relative to the standard valves identified above. Each of these appurtenances should be maintained according to the manufacturer or installer's instructions which are included alongside their descriptions. Each of these items is included in the detailed system schematic in Section II of this document; additionally, a less detailed drawing showing their locations is included in Appendix A. (59) Each of the individual items is represented in Appendix B with either a manufacturer's schematic or a drawn representation of the item. (60)

- (61)

Fire Protection

(62) The distribution system is equipped with (insert number of hydrants) for fire protection. Each of these hydrants is included in the detailed system schematic in Section II of this document, additionally, a less detailed drawing showing their locations is included in Appendix A (63). The fire hydrants are utilized in the distribution system unidirectional flushing program that is completed (64) per year.

During annual inspection of the fire hydrants, the rated flow per hydrant, pumping capacity, minimum fire-fighting pressures and any other pertinent data is collected and produced by the testing organization. Test results for the fire system and each hydrant are contained in Appendix G of this document. (65)

IX. Maintenance Program

Most maintenance of the water system is addressed in Section IV of this manual "Normal Operations". Within Section IV is the maintenance log associated with all tasks identified in this section. As scheduled maintenance is completed it must be logged in Section IV. Contained within this section is more detailed information and direction regarding specific attributes of the system including specification sheets for all components of the water system. The following list includes all equipment within the water system, the year it was installed or purchased, and a maintenance schedule for each component (the checklist is in Section IV).

(66)

Equipment List

Item	Year Installed	Maintenance Schedule	Estimated Replacement date	Estimated Cost	Vendor Contact
Well Pump	1997	As needed	2012	\$	Pumps r' Us; 1-800-555-5555
LMI Chlorine pump	2001	quarterly	2006	\$	LMI; 1-800-555-5555
GE Booster Pumps	1994	quarterly	2014	\$	GE; 1-800-555-5555
Hach in-line turbidimeter	1990	daily		\$	Hach; 1-800-555-5555
pH Probe/meter	2004	daily		\$	Hach; 1-800-555-5555
RPZ backflow preventer	1990	2x/year		\$	Pipes n' stuff; 1-800-555-5555
Well				\$	
Hydropneumatic tank				\$	
Telemetry/Controls				\$	
Transmission Main				\$	
Etc				\$	
Etc				\$	
etc					

Specification Sheets

Specification sheets for all equipment in the water system are contained in Appendix H titled "Technical Specification Sheets", of this manual. (67) These sheets are updated as new equipment replaces old equipment.

X. Vendor List

This section of the O&M Manual is a constantly evolving compilation of vendors for chemicals, parts and equipment used in the daily operations of the water system. Some of this information is duplicated from Section IX, but this list should be assumed to be a complete listing of any vendor that is currently being used by the water system or has been used in the past (although a note should be made if they are not to be used in the future). It is also a convenient location to keep track of additional vendors that may be used in the future. (68)

Vendor	Phone Number	Supply what?
Water Supply Division	800-823-6500 802-241-3400 802-741-5311 (pager)	Technical and regulatory support and Guidance www.vermontdrinkingwater.org
Vermont Occupational Health & Safety (VOSHA)	802-828-2765	29CFR 1910 (OSHA Regulations)
		Chemical supplier (chlorine, sodium hydroxide, soda ash, etc)
		Grab sample testing equipment (chlorine residual test kit, pH probe)
		Online analyzer technical support and supply
		Well pump supplier
		Storage tank cleaning company
		Pressure tank supplier
		Plumbing supplies (pipes, valves, unions, etc)
		Storage tank construction company
		Engineering firm that designed system
		Laboratory that does testing
		Shipping company that delivers water samples
		Pipe locators and metal locators
		Dig Safe

XI. Official Water System Records and Maintenance Procedures

All water system files and records are the responsibility of the system owner and are to be managed by them and maintained by properly trained and certified drinking water system operators. Files and records are kept (69). The files maintained by the water system include:

(70)

- This Operation & Maintenance Manual
- Source Protection Plan
- The Complete Vermont Water Supply Rule
- Valves Book
- Hydrants Book
- Maintenance Record
- Regulatory Compliance Test Results
- Water Supply Division Correspondence
- Billing and warranty Documents
- Emergency Response Plan
- Customer Complaints
- Water Quality Data
- Chemical Analyses Results (10 yrs)
- Bacteriological Analyses Results (5 yrs)
- Drinking Water Violations (3 yrs)
- Copies of Public Notices –including Consumer Confidence Reports – (3 yrs)
- Etc.
- Etc.
- Etc.

(71)

All files are updated at a frequency that corresponds to each item; however all manuals and books are to be updated a minimum of one time per year.

XII. Customer Notification

(72) The water system is required to provide annual drinking water quality reports to all of their customers. This document is called a Consumer Confidence Report (CCR) and must be delivered to all customers by July 1 of each year. The CCR summarizes the quality of water that the water system has provided over the previous year relative to state and federal safe drinking water standards. The water system must complete a certification statement that it has provided this information to all customers. Simply stated, your customers should have confidence that the product with which you are providing them is high quality drinking water.

Distribution of any information or notification (including the CCR) to customers of the water system must be accomplished by mail or an alternative direct delivery method, which must be specified in the certification statement and submitted to the Water Supply Division. "Good faith" efforts must be made to reach all non-bill paying customers (i.e. consumers that are provided water for free or as part of a larger contract like mobile home park fees). (73)

The following information must include specific information in order to be considered complete. This includes, but is not necessarily limited to, all of the items from the following list:

1. The violation or situation, including the contaminant(s) of concern, and (as applicable) the contaminant(s) level(s);
2. When the violation or situation occurred;
3. Any potential adverse health effects from the drinking water;
4. The population at risk, including subpopulations particularly vulnerable if exposed to the contaminant in their drinking water;
5. Whether alternative water supplies should be used;
6. What actions consumers should take, including when they should seek medical attention, if known;
7. What the Water System is doing to correct the violation or situation;
8. When the Water System expects to return to compliance or resolve the situation;
9. Your name, business address, and phone number or those of a designee of the Water System as a source of additional information concerning the notice; and
10. A statement encouraging notice recipients to distribute the notice to others, where applicable.

XIII. Customer Complaint Procedures

(74)

General Procedure

The general procedure for handling customer complaints is as follows (75)

Appeal Process

If the customer is not satisfied with the action(s) taken or not taken by water system personnel, they have a right to an appeal. That process follows: (76)

Relevant Phone Numbers

Water System Owner	xxx-xxx-xxxx
Water System Operator	xxx-xxx-xxxx
Vermont Water Supply Division	800-823-6500
Vermont Department of Health Protection	802-241-3400
Vermont Department of Health Protection	800-439-8550
(77)	
Consumer Affairs and Public Information Division (Department of Public Service)	800-xxx-xxxx
	802-xxx-xxxx

Complaint Forms (*to be completed by water system personnel fielding the complaint*)

Upon receipt of any customer complaint, the person receiving the complaint must complete a Customer Complaint Form and submit it to (78). A copy of these forms is included in Appendix E – Sample Documents/Forms. (79)

XIV. Water Conservation Program

Water conservation strategies to ensure the long-term ability to provide adequate quantities of safe drinking water to all users have been instituted by the water system. On a daily basis this includes the required use of (80). The water system proactively monitors the total production of water on a daily and monthly basis and when any anomalies are noted, appropriate leak detection strategies are employed. The standard operating procedure associated with leak detection is contained in Appendix F. (81)

During periods of low water, either through drought or other uncontrolled water shortage, the water system may periodically ask consumers to conserve water. These additional restrictions will be conveyed to all users in a manner consistent with Section XII – Customer Notification, of this O&M Manual. These restrictions may include, but are not limited to car-wash and lawn watering bans as well as (82). The water system owner/responsible person and operator should make this decision together and then follow notification procedures as appropriate. (83)

XV. Cross-Connection Control Program

Cross-connections are defined as actual or *potential* connections between a potable and a non-potable water supply, or a connection whereby contaminants can flow into (back pressure) or be drawn into the potable water supply. Cross-connections are a very serious threat to public health and must be controlled through in-depth knowledge and understanding of the water distribution system infrastructure and hydraulics, as well as administration of a strict backflow prevention and cross-connection control program.

While detection and identification of cross-connections may seem to be readily apparent, it can be much more complicated in practice as many cross-connections may be subtle or in hidden locations. Again, education and general knowledge of not only the water system, but basic hydraulics is a necessary tool in fully evaluating the risk posed by connections in a water system. Always keep in mind that water flow, without appropriate backflow devices, is *not* obligated by some unwritten governing law to flow in only one direction. Reversal of hydraulic gradient (one possible cause being a pressure loss within the system), so that water flows opposite the direction you would like it to go, is a very real possibility that must be understood so that it can be prevented. This is called backflow or back-siphonage and is one possible means of non-potable liquid entering the distribution system. A second very common situation is the submersion of meters, valves or other "open" pipes that may allow the entrance of non-potable fluids into the distribution system, again potentially through the principle of backflow identified above.

To mitigate the potential of cross-connections in the distribution system a comprehensive control program has been instituted. This includes (84). The standard operating procedures for backflow preventer installation, testing and maintenance is included in Appendix E of this document. (85)A written explanation and agreement between all relevant parties identifies who is responsible for installation, testing and maintenance of backflow protection devices is also contained in Appendix E (86). This agreement also identifies who will be held accountable for violations of this agreement and/or failure of backflow protection devices that would have been preventable through adequate maintenance or testing.

There are several manuals that give guidance on types of backflow prevention as well as cross-connections that are routinely identified in all types of water systems. The U.S. EPA Cross-connection Manual (EPA Manual 816-R-03-002) and the American Water Works Association Manual 14 are two that can give overall guidance to the water system on the management of day-to-day cross-connection control.

XVI. State of Vermont Water Supply Rule

The Agency of Natural Resources, Department of Environmental Conservation, Environmental Protection Rules, Chapter 21 – The Water Supply Rule including all appendices is located [\(87\)](#). This rule is updated as the state issues periodic revisions to the current standard, approximately once every two years.

Appendix A

Water System Maps

Appendix B

Water System Schematic Drawings

Appendix C

Source Protection Plan

Appendix D

Material Safety and Data Sheets (MSDS)

Appendix E

Sample Documents and Forms

Appendix F

Standard Operating Procedures

Appendix G

Fire Hydrant Testing and Information

Appendix H

Technical Specifications

Appendix I

Sampling Plans

Appendix J

Emergency Response Plan

APPENDIX H

NEW COMMUNITY WATER SYSTEM CHECKLIST



Drinking Water & Groundwater Protection Division

Capacity Checklist

Proposed System Checklist New Community Water Systems (CWSs)

Proposed New Water System:

WSID #VT

Date:

Pre-Application Meeting with DWGPD Capacity Program (Date:)

Capacity Approval (must be completed **before** Source Permit is issued):

5 year Property Owner Budget - must include: all incomes and major expenses, including water system expenses – system installation cost(s), operator costs, sampling costs, etc.

Verbal agreement with VT certified operator

Submit Officials Contact form (excluding designated operator)

Capacity Approval Letter issued (Date:)

Source Permit (must be **issued** before Construction Permit will be **issued**)

Source Permit Application submitted (Date submitted:)

Source Testing Review Application submitted

Source Evaluation Report submitted

Water Quality Results submitted

Source Permit issued (Date:)

Construction Permit

Construction Permit Application submitted (Date:)

Construction Plans & Specifications submitted

Engineering Report submitted

Construction Permit issued (Date:)

Operating Permit Criteria (all must be completed prior to receiving a Permit to Operate)

Compliance with Appendix A source water and infrastructure requirements

Approved Operation and Maintenance manual

Retention of a VT certified operator (detailed owner/operator contract)

Approved as-built/record drawings

Submit updated Officials Contact form

Approved Long Range Plan in accordance with Appendix B submitted

Operating Permit Application submitted by water system Owner

Bacteriological Sampling Plan submitted

Lead and Copper Sampling Plan submitted

Disinfection By-Product (if applicable) Sampling Plan submitted

Operating Permit issued

Note: Indicates that the item has been completed.

This (fact sheet/form/application) and related environmental information are available electronically via the internet at www.drinkingwater.vermont.gov.

APPENDIX I

COMMUNITY WASTEWATER PRELIMINARY ENGINEERING REPORT



OTTER CREEK
ENGINEERING

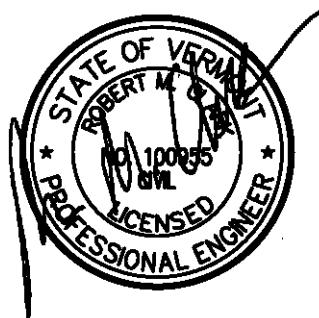
TOWN OF HIGHGATE
COMMUNITY WASTEWATER
PRELIMINARY ENGINEERING REPORT
EPA-PC-395

HIGHGATE, VERMONT

December, 2021

TOWN OF HIGHGATE
HIGHGATE CENTER
COMMUNITY WASTEWATER
PRELIMINARY ENGINEERING REPORT
EPA-PC-395

HIGHGATE, VERMONT



December, 2021

Otter Creek Engineering, Inc.
404 East Main Street
P. O. Box 712
East Middlebury, VT 05740
802-382-8522
802-382-8640 - Fax
Info@OtterCrk.com



**TOWN OF HIGHGATE
COMMUNITY WASTEWATER
PRELIMINARY ENGINEERING REPORT
EPA-PC-395**

**HIGHGATE, VT
December, 2021**

TABLE OF CONTENTS

ITEM	PAGE
EXECUTIVE SUMMARY	
1.0 PROJECT PLANNING	8
1.1 Location, Study Area, and Potential Service Area	8
1.2 Goals of the Study	8
1.3 Unique Economic Opportunity (Village Core Property)	9
1.4 Planning Analysis	10
1.5 Environmental Resources Present	10
1.6 Historical Resources Present	12
1.7 Population Trends	12
1.8 Community Engagement	13
2.0 EXISTING CONDITIONS	15
2.1 Existing Water and Wastewater Systems (Village Core Property)	15
2.2 Existing Water and Wastewater Systems (Project Area)	15
2.3 Regulatory Requirements	17
2.4 Design Flows in Existing Village Center	20
3.0 NEED FOR PROJECT	21
3.1 Health, Sanitation, and Security	21
3.2 Aging Infrastructure	21
3.3 Reasonable Growth	22
4.0 COMMUNITY WASTEWATER DISPOSAL OPTIONS	23
4.1 General Considerations	23
4.2 Approach to Identifying Potential Wastewater Solutions	24
4.3 Finding Suitable Wastewater Disposal Sites	24
4.4 Approach to Wastewater Treatment	26
4.5 Approach to Wastewater Collection and Conveyance	27
5.0 COMMUNITY WATER SUPPLY OPTIONS	28
5.1 Potential Source Locations	28

5.2 Treatment	28
5.3 Storage	29
6.0 DEVELOPMENT PHASES AND SCENARIOS	30
7.0 ALTERNATIVES ANALYSIS	31
Phase I – Initial Development	
Alternative 1A – Wastewater Holding Tanks	31
Alternative 1B-1 – Village Core - Arena Conversion	33
Alternative 1B-2 - Village Core - Steel/Griswold Disposal	36
Alternative 1B-3 - Village Core - Wright Disposal	39
Alternative 1C – Village Core - Decentralized Wastewater	42
Phase II – Full Buildout	
Alternative 2A - Expanded Wastewater Capacity on the Wright Property	45
Alternative 2B - Decentralized Disposal w/ STEP systems	48
Alternative 2C - Public Community Water System, No Wastewater	51
8.0 SELECTION OF AN ALTERNATIVE	54
9.0 PROPOSED PROJECT	55
10.0 FUNDING OPTIONS	59
11.0 RECOMMENDATIONS/NEXT STEPS	64

TABLES

- Table 1 – Population Trends**
- Table 2 – Regulatory Summary**
- Table 3 – Existing Uses in Potential Service Area**
- Table 4 – Potential Large-Scale Community Wastewater Disposal Sites**
- Table 5 – Potential Community Water Supply Source Sites**
- Table 6 – Summary of Wastewater Options Considered**
- Table 7 – Summary of Water System Options Considered**
- Table 8 – Summary of Alternatives Considered**
- Table 9 – Total Project Cost Summary with Funding Options (CWSRF Funding with No Subsidies)**
- Table 10 - Total Project Cost Summary with Funding Options (Rural Development Funding with 45% Grant)**

FIGURES

Figure No. 1 – General Location Map
Figure No. 2 – Existing Water and Wastewater Systems
Figure No. 3 – Potential Wastewater Disposal Locations
Figure No. 4 – Potential Water Source Locations

- Figure No. 5 – Alternative 1A**
- Figure No. 6 – Alternative 1B-1**
- Figure No. 7 – Alternative 1B-2**
- Figure No. 8 – Alternative 1B-3**
- Figure No. 9 – Alternative 1C**
- Figure No. 10 – Alternative 2A**
- Figure No. 11 – Alternative 2B**
- Figure No. 12 – Alternative 2C**

APPENDICES

- Appendix A – Estimated Wastewater Design Capacity and Conceptual Plans, Excerpts from implementation Plan for Highgate Town Center, by Build Strategies Consulting, Centerline Architects, and The Housing Initiative, January 2019**
- Appendix B – Highgate Village Core Wastewater and Water Feasibility Study: Planning Analysis, by Northwest Regional Planning Commission, February 2020**
- Appendix C – ANR Atlas Environmental Maps and Flood Insurance Rate Map**
- Appendix D – Hazardous Waste information**
- Appendix E – Archeological Resource Assessment**
- Appendix F – Property Owner Survey Results**
- Appendix G – Excerpts of soil type descriptions from the April 1979 United States Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Franklin County, Vermont, and the January 2015 USDA Natural Resources Conservation Service (NRCS)**
- Appendix H – Soil Test Pit Logs, Wright Property**
- Appendix I – Construction Cost Estimate**
- Appendix J – Life Cycle Cost Analysis**

1.0 PROJECT PLANNING

Highgate is a rural town in Franklin County, Vermont. Highgate (the Town) received a planning advance from Vermont Department of Environmental Conservation (DEC) to conduct a wastewater feasibility study for the Highgate Center Village area (Highgate Center) located along Route 78 near the center of the Town. Otter Creek Engineering, Inc. (OCE) and the Northwest Regional Planning Commission (NRPC) have collaborated with the Town's Village Core Master Plan Committee to conduct this study.

1.1 Location, Study Area, and Potential Service Area

The Study Area, the Potential Service Area, and other notable features and landmarks for easy reference are depicted on **Figure No. 1**. The "Potential Service Area" is defined as the area the Town will focus on providing opportunities for alternative water and/or wastewater solutions. Primarily, the Potential Service Area is the Village Center Designation limits plus an area within the Village Zoning District along St. Armand Road with potentially unsuitable or marginally suitable soils for septic systems. The Town Plan has also defined a "Village Growth Center Concept" area which identifies parcels reasonably close to the Highgate Center that may be suited for future commercial and industrial uses.

In addition to reviewing potential community wastewater solutions, this study includes the review of a public community water supply as a potential alternative to address community wastewater issues. Therefore, the Study Area was chosen to include land within approximately one mile from Highgate Center, which is generally considered the maximum distance for new water supply sources, beyond which the length of transmission piping would not be cost effective.

1.2 Goals of the Study

The existing Town Plan indicates the following broad-based goals regarding water and wastewater disposal:

1. Under the topic of water supply, wastewater disposal, and stormwater,
 - a. Consider creating one or more municipal water systems (fire districts) for the Town.
 - b. Reduce the environmental impact from stormwater runoff and wastewater disposal systems, especially those systems in densely settled and environmentally sensitive areas, including areas which have had subsurface contamination as a result of existing and historical industry.
2. Under the topic of economic development, the Town Plan aims to encourage economic development, with a focus on creating job opportunities while maintaining high environmental standards.

The specific objectives of this study are to:

- Review readily available information and identify areas where construction of new onsite or offsite systems are needed, or would be necessary if new development occurs;
- Identify potential wastewater disposal sites;

- Review the potential for providing off-site water supplies as an alternative to off-site wastewater solutions;
- Develop and analyze system and/or management alternatives;
- Prepare preliminary conceptual plans and cost opinions for meeting the immediate needs of the Town;
- Present preliminary funding options and the potential range of user fees that may be needed to support the preliminary concepts;
- Offer concepts to consider for future planning efforts if the Town wants or needs to provide off-site water and wastewater solutions to portions of or the entire Village Center in the future.
- Convey information in a format that would be suitable to be considered a Preliminary Engineering Report if the Town chooses to pursue one of the reasonable alternatives recommended in this study.

There is evidence that providing community water and wastewater infrastructure, either with physical systems or with support and guidance on management of on-site systems, will help the Town provide opportunities for environmentally-responsible economic development.

1.3 Unique Economic Opportunity (Village Core Property)

An immediate economic-development opportunity for the Town is a property known as the "Village Core" property, located at the Intersection of Vermont Route 78, St. Armand Road, and Gore Road. The site is made up of two parcels (referred to as the Stinehour Hotel and the former Town Garage site) and a portion of land of the Elementary School. The Town acquired the subject properties and formed the "Village Core Master Plan" (VCMP) Committee to determine its best use. Information about the Committee including committee members, past reports, meeting agendas, and minutes are available on the Town's website at <http://www.highgatevt.org> under the "Boards, Commissions & Committees" tab.

In general, the property is located within the Village Center Designation, and the extents of it have been delineated in purple on **Figure No. 1**, and more closely represented on **Figure No. 2** which presents notable existing water and wastewater systems in the area. The VCMP Committee has been reviewing conceptual options for the development of this lot since the Town acquired the properties in 2017, and is interested in pursuing a mixed-use development, consisting of a community library, commercial / retail space and an opportunity for a restaurant. Three conceptual plans developed for a January 2019 study entitled "Implementation Plan for Highgate Town Center" were used to estimate the range of wastewater design flow needs for the site. These conceptual plans are presented in **Appendix A** and show anticipated design flows ranging between 1,330 gallons per day (gpd) and 2,500 gpd, depending on the specific uses and designations.

For the purpose of this study, we have assumed a design capacity associated with the Village Core property of 2,500 gpd. As depicted on **Figure No. 2**, the ability to develop this parcel is severely limited, due to the following constraints:

- There are many individual water sources serving properties in the area, and the isolation distances from these wells cover virtually the entire parcel. If any wastewater

capacity is to be located on the site, off-site water supplies will be required for multiple properties, which may require formation of a public water supply.

- The concept development plans presented utilize a large majority of the parcel and will include new impervious areas that will likely bring the resulting footprint of impervious area above 1 acre for the parcel, which would trigger the requirement for stormwater permitting. This permit process requires an alternatives analysis of various construction practices to retain the stormwater on-site during storms to keep the discharge at pre-development levels. These practices may include retention tanks under parking lots or other measures. If the development is not able to meet the State requirements, then a large impact fee would be imposed.
- Information about the existing well is unknown; however, the proposed new development will require testing of the well and monitoring of the neighboring wells in order to verify the water supply requirements for the development will be met without adversely affecting other wells.
- It is an active brownfields site, based on potential arsenic and lead contamination at the previous Town Garage site. A site investigation is pending.

1.4 Planning Analysis

The NRPC completed the initial planning effort for the project, which included a discussion of current demographic, land use, and other planning information. The findings are presented in the document entitled "Highgate Village Core Wastewater and Water Feasibility Study: Planning Analysis" and is included as **Appendix B**.

1.5 Environmental Resources Present

A community project of this type is likely to receive federal funding, and thus would require an environmental review under the National Environmental Policy Act (NEPA). The Study Area was reviewed using the State of Vermont Agency of Natural Resources online interactive database and mapping tool. **Appendix C** includes ANR Resource Atlas Maps depicting known natural and environmental resources within the Study Area. The following information provides a discussion of the environmental resources of note.

a. Wetlands

Several Class II wetlands have been mapped in the Study Area, and additional advisory wetland areas are shown on the ANR Atlas. Unmapped wetlands may exist on some properties. In general, development within the wetlands will not be permitted, but temporary impacts to those wetlands or their associated buffers may be required to complete utility infrastructure. The overall goal of any infrastructure project will be to utilize the techniques of avoidance and minimization to limit wetland impacts.

b. Primary Agricultural Soils

In addition to the surrounding farmlands, Highgate Center does contain soils which are classified as primary agricultural soils by the State of Vermont. The designation is important for development projects which would require an Act 250 permit, as impacts to the land's ability to be used for agriculture must be minimized. In general, designated growth centers with pre-existing development, as is the case here, are less of a concern, especially for buried utility infrastructure projects.

c. Hazardous Waste Sites

There are five hazardous waste sites identified in the Study Area. These sites, listed by the DEC Waste Management and Prevention Division, are clustered in Highgate Center, near the intersections of Saint Armand Road and Gore Road with Route 78:

- i. Two separate hazardous waste sites are identified on the Village Core site: The Stinehour Hotel site, also referred to as the Machia Estate site (site # 20174707) is a hazardous site due to a spill of Polycyclic Aromatic Hydrocarbons (PAH). In addition, the former Highgate Town Garage site (site # 20174716) is a former landfill site that is now considered a Brownfield due to arsenic and lead contamination. A Phase II Site Investigation was completed in January 2018 for both sites, and soil remediation is required.
- ii. Another site exists at the Highgate Village Mobil (site # 890317), where remediation of contamination from a gasoline underground storage tank (UST) is complete and monitoring is ongoing. No indoor air or drinking water supply impacts remain, and this site is also considered low priority.
- iii. The Highgate Municipal Building site (site # 20184796) is contaminated but also considered a low-priority site. A Phase I Site Investigation was conducted for the Town, and a Phase II ESA is to follow. Metals were found in groundwater above standards, and additional work to be conducted to delineate source and extent.
- iv. The M & R Beverage site (site # 982371), currently a Jolley Mart and Valero Gas Station, was found to have petroleum contamination during closure of a 1,000-gallon kerosene UST in 1998. The site has been remediated and is listed as "Site Management Activities Completed" or SMAC, so is no longer considered a source of contamination.

Excerpts from the various reports on hazardous waste sites are included in **Appendix D**. Soil boring logs provide additional information about soil types and the static groundwater elevation in the area.

In addition, three landfills exist within the Study Area. All three of them are closed, with the closest being approximately 1,000 feet from the Highgate Center, to the southwest of the Highgate Municipal Building, although there is no documented impact to the groundwater in this area. Three underground storage tanks have been identified in the Study Area, concentrated near Highgate Center along Route 78.

d. Water Bodies

There are no impaired water bodies in the Study Area, but the area north of the Village is part of the Rock River watershed, which is on the 303(d) list of impaired lakes and ponds for nutrients and sediment resulting from agricultural land uses.

Highgate Center is less than 1,000 feet from the Missisquoi River. The surrounding floodplain contains land in the Federal Emergency Management Agency (FEMA) Zone B and Zone A5, as shown on the FEMA Flood Insurance Rate Map (FIRM). The mapped river corridor roughly follows the FEMA floodplain areas and is shown on the River Corridor Map. No actions are proposed in or near FEMA floodplain areas or the river corridor. A few streams in the north and south of the Study Area have narrow river corridors, but none are located close to Highgate Center.

e. Rare Threatened and Endangered Species

Several rare, threatened or endangered (RTE) species have been identified within the Study Area. Several state endangered animals and a state endangered vascular plant have been mapped in the Missisquoi River and surrounding floodplains but are over 1,000 feet from Highgate Center. Another state endangered animal was identified along Gore Road, which crosses through the northeastern portion of the Study Area. Several other uncommon species exist within the Study Area, along with a Significant Natural Community along the Missisquoi River. Deer Wintering Areas are mapped in the forested areas in the northwestern portion of the Study Area, but they are not close to the Village.

f. Village Core Property

In addition, the Village Core property was reviewed for affected Natural Resources. The Village Core property contains soils of Statewide agricultural importance but are not considered Prime Agricultural Soils. The property is adjacent to the State Endangered animal occurrence shown surrounding Gore Road. The Machia Estate hazardous waste site and the former Highgate Town Garage site (Brownfield) are both located on the Village Core property. No other natural resources of concern are located on the Village Core property.

1.6 Historical Resources Present

During the course of the study, an Archeological Resource Assessment (ARA) was completed by the University of Vermont Consulting Archaeology program for sites identified as potential subsurface disposal sites, and sites with an interest in performing test pits. A copy of the ARA is included as **Appendix E**. Given the expected funding sources for the alternatives presented in this report, any proposed construction disturbance will be subject to archeological review.

1.7 Population Trends

As stated in the Planning Analysis, according to the 2010 U.S. Census, Highgate has a population of 3,535. This represents an increase of 138 residents from the 2000 Census

population of 3,397. Historically, the primary industry of the Town has been agriculture. Industrial and commercial growth have lagged behind residential growth.

In general, Franklin County has been a region in Vermont which has been experiencing growth for five decades, and so has the Town of Highgate. Refer to the population by State, County and Town data presented in **Table No. 1**.

Table 1 Town of Highgate Community Wastewater Feasibility Study Population Trends						
Year	State of Vermont		Franklin County		Town of Highgate	
1970	444,330		31,282		1,936	
1980	511,456	15%	34,788	11%	2,493	29%
1990	562,758	10%	39,980	15%	3,020	21%
2000	608,827	8%	45,417	14%	3,397	12%
2010	625,741	3%	47,746	5%	3,535	4%
2019*	623,989	-0.3%	49,402	3%	3,608	2%

Source: 2010 U.S. Census
Data presented include population and relative growth rate over previous 10-year period.

In 2018, according to the U.S. Census American Community Survey, the Town had 1,452 total housing units. Of those units, 1,277 were occupied and 175 were vacant. According to the Vermont Department of Labor, in 2019 Highgate had 33 private businesses employing 276 people.

The Planning Analysis describes Highgate's population as projected to continue to grow by 2-6% through 2030, and the Town has designated a "Growth Center Concept Area" to encourage development close to Highgate Center.

1.8 Community Engagement

The Town issued a survey to the 262 properties in the Village Growth Center area, requesting feedback on the condition of existing water supplies and wastewater systems. A copy of the survey results are included as **Appendix F**. The following observations are offered:

- Only 15% of surveys were returned, less than expected; however, we were unable to provide a standard level of follow up, as the surveys were sent out at the beginning of the COVID-19 pandemic. Despite the low return rate, responses received conveyed a consistent message and provided insight into the existing conditions of water and wastewater facilities in Highgate Center.
- The majority of respondents appeared to be knowledgeable about their water and wastewater systems, and in general are maintaining the facilities in a responsible manner.

- 5 respondents (out of 6 who answered the question) indicated the replacement cost of a septic system was a concern.
- 6 respondents (out of 11 who answered the question) indicated drinking water quality or potential for well contamination was a concern.
- None of the information received provided an indicator of a widespread problem regarding drinking water or groundwater quality or contamination.

Moving forward, community engagement will be completed through public informational meetings and presentations to discuss the study, options and paths forward for the Town, with the goal of gaining valuable feedback from property owners and residents on what is important to them.

Throughout the COVID-19 pandemic, the community has utilized virtual (remote) meetings to continue to solicit public input, and has posted interim and final versions of reports and investigations on the Town website.

2.0 EXISTING CONDITIONS

Currently, the majority of residential and commercial properties within the Town obtain water from on-site water supply wells and dispose of wastewater into individual on-site disposal systems. This scenario of having both water supply wells and wastewater disposal systems on the same lot, many which are relatively small, is common but is not desirable since in some cases the isolation distances between wells and disposal systems do not meet current regulations and health hazards exist or can be created.

The following were used to document and evaluate existing water and wastewater facilities:

- Property Survey Information
- Phone and in-person interviews with State regulators and Highgate property owners
- Review of available information on the State of Vermont website, including:
 - Geographical Information System (GIS) data
 - Public Water System Information
 - Regional Office Permit Information
 - Hazardous Waste Site Information

2.1 Existing Water and Wastewater Systems (Village Core Property)

As stated previously, the Village Core property is a good example of the challenges presented to property owners who are encumbered by small, densely developed lots within the Village. Existing property uses take precedent, which reduces or eliminates the potential for redevelopment and economic growth. **Figure No. 2** depicts the approximate locations of existing water and wastewater systems of properties in Highgate Center, documented from the sources above. It is presumed that all other properties have water and wastewater systems on their own individual lots.

Due to the size of the lot and expected uses, the Village Core site is not able to be developed with both on-site water and wastewater systems. Development of an on-site water supply is not recommended due to the proximity to potential sources of contamination, including area septic systems, hazardous waste sites, and the restrictions on development of the property to maintain proper isolation distances from buildings, drives, parking areas, and other features. Development of an on-site wastewater system on the Village Core site is possible but will require many neighboring properties to find off-site water supplies as well in order to remove the existing well isolation shields to maintain proper isolation distances between water and wastewater systems. As a result, alternatives have been developed for the Village Core site that include off-site water supplies coupled with on-site and off-site wastewater systems. These are presented in Section 7.

2.2 Existing Water and Wastewater Systems (Project Area)

Figure No. 2 also presents the notable water and wastewater systems that are (or have been) operated in the Highgate Center area. These include:

Highgate Elementary School – This wastewater system was constructed in 1986 and was one of the first systems in the State to obtain a permit under the Indirect Discharge Rules (IDRs), a

permit program which regulates wastewater systems with a capacity in excess of 6,500 gpd. Since the system was in operation at the time the IDRs were implemented and did not meet all the regulatory requirements of the program, it is considered a grandfathered system, and was granted a permit with a "book value" capacity of 10,645 gpd based on the occupancy, not actual wastewater flows. Thus, the School is unable to expand its capacity (or accept new connections) because the School still has the capacity to serve the same number of students attending in 1986, regardless of the current or predicted future enrollment.

Connection of the Village Core property to the School wastewater system was not considered a reasonable option, for the following reasons:

- In order for the School to accept wastewater from new connections, the system would need to come into compliance with the current IDRs. The size of the current wastewater disposal fields is less than 50% of what is needed under the IDRs, and is essentially undersized to meet the current design standards. Expansion of the disposal fields is not practical given the existing site constraints.
- Secondary wastewater treatment, such as a recirculating sand filters, is allowed to treat the wastewater and allow a higher loading rate onto the existing disposal fields. However, there are severe site limitations for a facility, and the initial cost and ongoing operation and maintenance costs would be significantly higher than other alternatives considered.
- In addition to the cost for wastewater treatment, off-site water supplies would need to be provided for most of the properties adjoining the School property, which would require development of a Public Community Water system.
- The Town does not appear to be interested in negotiating a long-term service agreement with the local School District if other reasonable alternatives exist.

The School also owns and operates a Non-Transient, Non-Community (NTNC) public water system (known as Water System identification Number (WSID#) 6731.

McCuin Water System – The McCuin family had operated a public NTNC water system (WSID# 21492) serving approximately 10 properties, using a large capacity well located on the Highgate Sports Arena property. Due to recent regulatory issues, the McCuins decided to disconnect several properties (concurrent with the drilling of an on-site well for each disconnected property) to avoid the regulatory requirements of a public water system. Small water systems like this can be subject to the same regulations and authorities as municipalities small and large throughout Vermont, which can be a challenge to operate and maintain without an adequate user base.

Highgate Sports Arena – The Town-owned Highgate Sports Arena was one of the properties which was disconnected from the McCuin water system, and as a result drilled a new individual well for the property, and is currently operated as a Transient, Non-Community (TNC) public water system. This well has a driller's yield of 60 gallons per minute (gpm) and has excess capacity beyond the needs of the Arena. There are some site constraints based on the location of the well in proximity to the Arena, but it may be possible to utilize this well as a Public Community Water Source for most, if not all properties within the Village Center.

Highgate Village Market - owned by R.L. Vallee, operates a TNC public water system (WSID# 21032) and a wastewater system with an advanced filter system. The systems are shared with the neighboring Town Library.

Cassidy Meadow – A planned 34-unit residential development on Gore Road north of the Sports Arena obtained a permit for a Public Community Water System (PCWS), WSID# 21246, with a new drilled well source with a permitted capacity of 8 gpm, and a permit for a wastewater system with a capacity of 5,500 gpd. Some of the permits have expired and it is unclear of the status of the proposed development.

Also included in **Figure No. 2** are examples of systems that have received State small-scale Wastewater System and Potable Water Supply permits in recent years, based on information available on the State permit database. It appears there is a relatively small sampling of properties within the Highgate Center Village area that have needed to apply for State permits due to a failure of a water supply or wastewater system. However, when these occur there are difficulties with meeting the current standards for systems, and often the property owner is required to apply for variances from State Rules and implement a “best fix” solution which may require advanced treatment, such as the case of the Highgate Village Market system. These systems are not only more expensive to construct, but also require regular on-going maintenance with an operations contract with a vendor as a permit condition.

2.3 Regulatory Requirements

The Vermont Department of Environmental Conservation (DEC) Drinking Water and Groundwater Protection Division (DWGPD) regulates most of the water and wastewater systems throughout the State. **Table No. 2** presents a summary of the different categories of systems that may be considered for the Town in developing water and wastewater solutions for the Village Center.

Table 2 Town of Highgate Community Wastewater Feasibility Study Regulatory Summary			
Category of System	Regulatory Authority	Description	Applicability to Highgate Community WW Study
Wastewater			
Small-Scale	EPR, Ch. 1, WW Rules	For soil-based systems with capacities less than 6,500 gpd	
Indirect Discharge	EPR, Ch. 14, IDR	For soil-based systems with capacities at or greater than 6,500 gpd	If soil conditions allow for larger systems, these system
Direct Discharge	Title 40 CFR, Section 122, NPDES	For systems with point source discharges to waterways	Not applicable
Water Supply			
Non-Public	EPR, Ch. 1, WW Rules	Covers all water systems that are not considered "Public" including single family residences with private wells, to 9 lot developments with a shared water system	
Public Transient Non-Community (TNC)	EPR, Ch. 21 (WSR)		
Public Non-Transient Non-Community (NTNC)	EPR, Ch. 21 (WSR)		
Public Community (PCWS)	EPR, Ch. 21 (WSR)	For systems serving at least 10 residential connections or 25 year-round residential population	Would provide safe, reliable water to all properties
Abbreviations:			
EPR = Environmental Protection Rules			
WW Rules = Wastewater System and Potable Water Supply Rules			
IDR = Indirect Discharge Rules			
WSR = Water Supply Rule			
CFR = Code of Federal Regulations (Title 40 is "Protection of Environment")			
NPDES = U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System			

a. Wastewater

In Vermont, sanitary wastewater disposal systems are regulated under two sets of rules, depending on the design capacity. Systems which are less than 6,500 gallons per day are considered "small scale" wastewater systems, and subject to Chapter 1 of the Vermont Environmental Protection Rules (EPRs), also known as the Vermont Wastewater and Potable Water Supply Rules (WW Rules). Chapter 1 of the EPRs are administered through the DWGPD Regional Offices and provide regulation, requirements and guidance for the design, construction, replacement, modification, operation and maintenance of small-scale soil-based wastewater disposal systems with the primary goal of protecting public health and the environment. The WW Rules are applicable from single family residential septic systems up to shared community systems equivalent to the size of a development of approximately 25 homes.

Soil-based wastewater systems with capacities of 6,500 gallons per day or greater are considered "indirect discharges" of sewage and are subject to Chapter 14 of the EPRs, the

Indirect Discharge Rules (IDRs). The Elementary School is the only example of an IDR system in the Town. The requirements to obtain an Indirect Discharge Permit are significantly more substantial than for systems that are regulated under the WW Rules, and as a result there are many building developments around the State with capacity of 6,499 gpd or less.

For larger scale systems above 30,000 gpd (or approximately 120 homes), the system is required to provide secondary wastewater treatment (such as an aerated lagoon) prior to discharge. At this size, the IDRs also allow for "spray disposal," which is similar to an irrigation system, where treated wastewater effluent is spread over a protected area and allowed to percolate into the ground. These required systems are typically used in the ski areas and other locations where subsurface disposal is not practical.

Systems larger than 40,000 gpd require tertiary treatment, which requires significantly more expensive capital and operational costs. These types of systems would not be applicable for Highgate.

Some wastewater systems have treatment facilities which discharge directly to a surface water source such as a lake or river, are regulated under the federal National Pollutant Discharge Elimination System (NPDES) Permit program, administered by the DEC Watershed Management Division. This program is not applicable for Highgate, given the reasonable availability to find wastewater solutions with subsurface discharges to the soil.

b. Water Supply

All new (and modifications to) potable water supply systems in the State are regulated as either non-public (typically for small systems regulated through the WW Rules) or public water systems, which are regulated by Chapter 21 of the EPRs, the Water Supply Rule (WSR).

A public water system is one which serves at least ten (10) service connections and/or serves at least 25 residents (note: the WSR indicates serving at least 15 connections, but practically the DWGPD has acted based on the assumption that only 10 single family homes with an average household size of 2.5 persons per household, will trigger the threshold for serving 25 persons). Public water systems are categorized as follows:

- i. Public Community Water Systems (PCWS) regularly serve at least 25 year-round residents (or 10 single family homes).
- ii. Public Non-Transient Non-Community (NTNC) Systems serve at least 25 of the same persons daily for more than six months of the year. Examples of these types of systems are schools and office buildings.
- iii. Public Transient Non-Community (TNC) Systems serve transient populations such as restaurants and motels.

Each of the systems are regulated differently because the risk of acute and chronic exposure to contaminants for varying populations is reduced from PCWS to TNC systems, respectively.

2.4 Design Flows in Existing Village Center

Design capacity of a wastewater disposal system is a critical component in completing the engineering design and permitting. **Table No. 3** (see Table section) presents a listing of the existing uses within the Village Center Designated boundary (shown with more detail in Figure 3 of the Planning Analysis in Appendix B). In addition, Table No. 3 attempts to show the potential future design capacity that may be needed to cover water and/or wastewater needs in areas targeted for development by the Town. Although this was not an exhaustive analysis of existing use and capacity, **Table No. 3** is intended to provide a general range of capacity needed to provide for existing conditions and estimated potable water supply and wastewater design flows associated with the current and projected future uses. In developing the design flows, Table Nos. 8-1 and 8-2 of Chapter 1 of the EPRs were utilized.

Based on the existing property uses within the service area, wastewater design flows are anticipated to range between 25,000 and 35,000 gallons per day, at full build out and current land uses.

3.0 NEED FOR PROJECT

3.1 Health, Sanitation, and Security

In 2007, the State revised the WW Rules to eliminate certain exemptions and assumed jurisdiction over all small-scale wastewater systems throughout Vermont, including previously exempted systems when they are modified or deemed to have failed. Over time, issues identified during property transfers may help to monitor the risk of overlapping water and wastewater systems in the Highgate Center Village area.

Based on information received, at this time there does not appear to be widespread environmental or public health concerns throughout the study area. Only a small number of properties have needed to renovate their wastewater systems with new State permits, and new development does not appear to be constrained by the availability to develop a water or wastewater system, except in the densely developed Village Center.

The Village Center area includes a configuration of small lots, combined with both individual on-site water and wastewater disposal systems which likely do not meet current day standards for separation/isolation on their own properties, and impact the isolation distances for both water and wastewater systems on neighboring properties. Some communities have defined this as an "emergent condition," where there is no obvious public health threat (such as widespread septic system failures or bacterial contamination of water supplies), but the inability to meet current standards acknowledges the risk to public health is real and presumed. This argument has been accepted as means to become eligible for certain State and Federal funding programs, which require documentation of public health or environmental impacts in order to provide funding. This declaration has not been made in Highgate, nor is it warranted without acknowledgement and support from the community. Public discourse on this topic is recommended.

One option the Town may consider is to offer a water quality test of individual wells in targeted areas. State funding may be available to assist with this effort.

3.2 Aging Infrastructure

Given the low numbers of properties in the Highgate Center Village area that have a State permit for their water and wastewater system, it can be inferred that many systems have been in place for decades. Depending on the site-specific conditions, such as types of soil and depth to groundwater, and the level of maintenance performed, it is unclear what the remaining useful life is of these systems. Use of pretreatment with septic tank effluent filters, regular pumping of septic tanks, and monitoring what is disposed in household wastewater may help to prolong the life of a septic system. Providing public outreach to educate property owners in responsible maintenance of septic systems is always recommended as a helpful strategy in improving outcomes, or at least lowering the risk of public health and environmental concerns related to wastewater.

3.3 Reasonable Growth

The Town has made efforts to promote reasonable growth of residential, commercial, and industrial uses throughout Town with targeted zoning districts and Village Center designations. The efforts made to re-develop a parcel in the center of the Village area is evidence of the Town's commitment to provide the opportunity for reasonable economic development. This study is intended to provide options by which the Town can offer basic utility services to promote this type of growth within Highgate Center.

4.0 COMMUNITY WASTEWATER DISPOSAL OPTIONS

4.1 General Considerations

Wastewater disposal alternatives considered should include both on-site and off-site options. The following alternatives were considered for the project:

1. Centralized vs Decentralized Options
2. Collection and Pumping Out of Service Area
3. Direct Discharge vs. Indirect Discharge

a. Centralized vs. Decentralized Options

In the 1970s and 80s, Federal and State grants promoted the construction of centralized wastewater treatment systems. Centralized systems are generally designed and constructed to convey untreated wastewater to a single location where it is treated and then typically discharged to a large body of water (such as a lake or river). Over the past several decades, it has become clear that simply relying on the centralized approach to address the wastewater needs of a community is not viable as many smaller communities cannot afford the high cost of a centralized treatment system.

Recently, the U.S. Environmental Protection Agency (EPA) and the State of Vermont have been encouraging the use of decentralized systems for difficult areas in rural settings. Decentralized systems are basically any type of system that is not "centralized" in the typical sense, and often includes multiple smaller-scale shared systems in "clusters" for a group of properties in close proximity of each other.

In essence, the existing conditions of Highgate Center have created a mix of "decentralized" wastewater solutions by default. The Elementary School was permitted as a best fix and is functional but unable to expand. As individual wastewater systems fail, individual property owners have searched for and collaborated with neighboring properties to build small-scale shared wastewater systems out of necessity. Although happening at a slow rate, this pattern is expected to continue as more systems reach the end of their useful life. This study aims to find reasonable alternatives the Town can implement (or secure land for future opportunities) to prevent these reactionary "best-fix" scenarios.

b. Collection and Pumping Out of Service Area

The Town is currently working on a plan to provide water and wastewater service to the Franklin County Airport by extending service from the Village of Swanton. This plan includes approximately 1.5 miles of new water main and approximately 2 miles of new wastewater force main to connect the facilities at the Airport to the Village, each at a potential construction cost of over \$1 million. Consideration of extending water and sewer facilities from Swanton to Highgate Center would require an additional 2.5 miles both utilities. Even without consideration of the availability of capacity from Swanton Village, it is not cost effective to utilize these options as wastewater disposal or water source alternatives, and thus are not included in the alternatives analysis.

c. Direct Discharge vs Indirect Discharge

Indirect wastewater disposal involves a process of treating and discharging wastewater to a soil and land-based application, rather than directly into an open surface water body.

Indirect discharge is a preferred method of wastewater disposal in Vermont, as it does not require substantial levels of secondary and tertiary treatment of wastewater, when soil conditions are suitable. Based on the size and density of the service area, a wastewater disposal system which would involve a direct discharge to the Missisquoi River is not a recommended (or practical) alternative.

Therefore, only soil-based wastewater solutions are considered further in this study.

4.2 Approach to Identifying Potential Wastewater Solutions

When evaluating alternatives for community-based disposal, the following process is often used, regardless of the size of the system proposed:

1. Identify suitable wastewater disposal sites and potential disposal capacity based on a review of on-site soil mapping, parcel information, and local knowledge of landowners who would be willing participants.
2. Identify treatment options to increase the disposal capacity of a particular site and/or address effluent water quality concerns.
3. Determine collection system alternatives to convey wastewater to the disposal site(s)

4.3 Finding Suitable Wastewater Disposal Sites

Areas which would be suitable for community-based wastewater disposal include:

- Large tracks of land which would allow for construction of a soil-based disposal system and the ability to meet all setback requirements,
- Properties which have been mapped as containing soils which are predominately sands and gravels, generally well-draining, and a low seasonal high groundwater table.

The most relevant resources to review the suitability of soils for wastewater disposal are the April 1979 United States Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Franklin County, Vermont, and the January 2015 USDA Natural Resources Conservation Service (NRCS). The SCS conducted extensive field testing and created maps showing general soil types throughout the State. **Figure No. 3** presents the SCS mapping data throughout the Potential Service Area, along with Town-owned properties, and our opinion of potential areas to be considered for community wastewater disposal (numbered 1 through 7). The NRCS surveys have provided guidance with categories of soil "groups" that are ranked based on the suitability for wastewater disposal. These groupings are generally ranked on Figure No. 3 with color-coding:

- **Green** for areas that are well suited for on-site wastewater disposal,

- **Yellow** for areas that are moderately or marginally suited, and may require mound systems or other accommodations,
- **Red** for areas that are generally not suited for wastewater disposal.

Excerpts of the NRCS survey with soil type descriptions in the Potential Service Area are provided in **Appendix G**.

Figure No. 3 shows that most of the Village Center Designation is within areas of good soils, which supports the general observations from the surveys and general knowledge that septic system failures are uncommon in the area.

a. Soil Evaluations for Potential Wastewater Disposal

Property information for the potential wastewater disposal area identified is presented in **Table No. 4** (see Table section). Two of the potential areas are located on Town-owned properties, including the Town Transfer Station site and a site referred to as the “former Steele/Griswold” property. Other Town-owned properties with suitable soils are not available for wastewater disposal due to other existing uses, such as cemeteries, the Park & Ride, and memorial spaces. There are also a number of regulatory challenges associated with the use of a historically unlined solid waste facility.

b. Initial Site Investigations

Based on a cursory review of the properties with respect to proximity to the Village Core property (as the “hub” or center of the Potential Service Area) and discussions with area landowners, two Potential Disposal Areas were identified for further study and site testing, Area No. 3 (the former Steele/Griswold property) and Area No. 4 (an active sand pit owned by WRB, LLC, referred to hereafter as the “Wright” property).

i. Former Steele/Griswold Property (Area No. 3)

A site visit to the Steele/Griswold property was conducted on September 9, 2020 to review the potential disposal area, review the potential limits of a disposal area for a Phase 1 Archeological Study needed prior to test pits, and identify any issues related to performing the test pits. The former Steele/Griswold property is a wooded area adjacent to an excessively steep slope (of what appeared to be 1-foot vertical to 1-foot horizontal). Hand probes revealed coarse to fine sands. Some members of the VCMP Committee attended and offered that the static groundwater level in this area is greater than 35 feet. Some select clearing would be needed to bring a backhoe in for test pits. However, access to the property from the east is severely limited to a narrow walking path between a neighboring property line with trees and an excessively steep slope. It was determined that test pits would not be able to be performed on this property.

ii. Wright Property (Area No. 4)

A site visit to the Wright property was also conducted on September 9, 2020 and revealed a significant area of open land, which could potentially be used for a large capacity subsurface disposal field. The area had been previously disturbed; it appeared a significant amount of earth was extracted from the site. Test pits were performed on the Wright property on October 14, 2020. The test pits were logged by Bill Norland, a Certified Professional Geologist (CPG) at Otter Creek Engineering. The

pits were witnessed by Bryan Harrington and Edward Grenier from the DEC Indirect Discharge Program. Representatives of the Essex Regional Engineer's Office were invited but were unable to attend.

Test pit locations were collected using a survey-grade GPS device a short time after the work. Test pits logs and a general map are provided in **Appendix H**. The results confirmed the SCS Soil Types as fine to medium sands in all pits, with no confirmed evidence of a seasonal high groundwater table above a depth of 8 feet. Generally, the pits on the easterly edge showed some finer, "tighter" soils but there appears to be more than enough area on the western portion of the open areas that is conducive for a subsurface wastewater disposal site. And the site conditions appear to be ideal for a large capacity disposal field, with the ability to meet all required setback from property lines, area water supply wells, and a large receiving water in the Missisquoi River to provide dilution to presumably meet the specific criteria of the IDRs of making sure the discharge does not significantly affect the aquatic biota in the receiving waters.

Due to the proximity of the site to Highgate Center, favorable soils, and the ability to meet all setback requirements, the Wright property appears to be a highly favorable site and opportunity to provide significant wastewater capacity, possibly even up to 30,000 gpd which could serve most of the existing Highgate Center, or provide significant capacity for redevelopment.

Regardless of the wastewater solutions considered (if any) as an outcome of this Study, it is recommended the Town enter into negotiations with the property owner to obtain rights (by easement, right of first refusal, or an option) to use a portion of the property for community wastewater disposal, now or in the future. It is also likely that the system can be designed and constructed in phases, expanding in capacity as the Town's needs change.

iii. Village Core Property

The Town is interested in pursuing a review of an option for find an "on-site" wastewater disposal option for the Village Core property. With the prevalence of overshadowed wastewater systems and site constraints, performing test pits on the Village Core property was not initially recommended, nor considered further in this evaluation.

4.4 Approach to Wastewater Treatment

All wastewater systems in Vermont require at least primary treatment, typically with the use of septic tanks. Due to the good soils in the area, many properties in Highgate Center have completely passive septic systems from the plumbing fixtures to subsurface discharge, with no operating parts or motors to maintain. However, even these passive systems require periodic maintenance to keep their systems operating effectively.

Some municipalities in Vermont and beyond provide various levels of oversight and management of on-site septic systems to help to maintain public health and limit environmental concerns. Management models range from simple ordinances that require property owners to pump out septic systems on a periodic basis to performing full operations

and maintenance service of individual and shared wastewater systems throughout a given service area for a utility fee.

Based on review of the information and interactions with Town representatives during this study, it is not expected nor recommended to implement any type of management structure at this time for individual properties. The Town may consider providing public outreach and information to residents on the benefits of septic system maintenance in prolonging the life of the system and encouraging the periodic pumping of septic tanks installation and maintenance of effluent filters, which can help to keep solids from overflowing to the disposal field.

Higher levels of treatment allow for a higher “loading rate”, or the gallons of wastewater per square foot of disposal field area available. In general, higher levels of treatment are only used when there is insufficient land available to receive a permit, due to the high construction costs and also higher ongoing maintenance costs associated with these systems. Given the good soils in the area, and the projected full buildout capacity of just over 30,000 gpd, no advanced treatment alternatives are needed for a community wastewater solution.

4.5 Approach to Wastewater Collection and Conveyance

The topography of the service area should also be considered when reviewing options for collection system alternatives. Highgate Center is extremely flat, with minimal topographic change. As such, construction of long runs of gravity sewers could result in piping greater than 20 feet in depth in some areas.

Cluster systems disposal systems could be completed with low pressure force mains and disposal areas which are less than 6,500 gallons per day. Essentially, this option would result in the construction multiple pump stations, multiple disposal areas, and a large amount of community infrastructure, without the benefit of consolidation.

In general, gravity collection of wastewater provides the best life cycle analysis, when compared with Septic Tank Effluent Pumping (STEP) systems, however there are practical limitations when deep excavations are involved.

5.0 COMMUNITY WATER SUPPLY OPTIONS

Although not commonly thought of as a reasonable alternative to wastewater disposal needs, construction of a community water system can be a suitable alternative when on-site soils have not been problematic and allow for expanded on-site wastewater disposal capacity.

The process for developing the basics of a community water system can be paired down into the following key categories:

1. Review extent of distribution system,
2. Identify suitable water supply source sites,
3. Comment on treatment options, if necessary,
4. Identify suitable water storage tank alternatives,
5. Review transmission main.

5.1 Potential Source Locations

A tool commonly used to increase the chance of drilling a bedrock well with a sufficient yield is to conduct a fracture trace, or lineament analysis of the area. For the fracture trace or lineament analysis, aerial photographs from Google Earth were reviewed under plain light at various angles, the Agency of Natural Resources (ANR) Atlas database Lidar maps, and USGS topographic maps of the Highgate area were reviewed to determine the locations of linear features that may represent bedrock structures and/or groundwater-bearing fractures. The linear features, or lineaments, were then plotted on the **Figure No. 4**. A total of 26 lineaments were identified using the Google Earth aerial photographs, 48 lineaments were identified using the ANR Lidar map, and 30 lineaments were identified using surface topography from the USGS topographic map. Since many of the lineaments were duplicative between the aerial photos, Lidar map, and topographic maps, some of the lineaments are shown on **Figure No. 4**.

By drilling a bedrock well along a lineament, at the intersection of or in close proximity to two or more lineaments, the chance is increased that the well will have a greater groundwater yield than a randomly located bedrock well. As shown on **Figure No. 4**, there are ten potential water supply well locations identified within the study area. The well locations are labeled with the numbers 1 through 10.

In order to be deemed a suitable location for a public community water system, it is desirable to site the source away from Potential Sources of Contamination. In addition, Chapter 21 of the Vermont Environmental Protection Rules (EPRs) requires public water systems to own and control a 2-200-foot radius around the source of supply, to minimize the risk of contamination. Properties which are relatively close in proximity to the Village Center, have identified lineaments, and have no known contaminant concerns are outlined on **Table 5** (see Table section).

5.2 Treatment

Public community water systems are required to provide levels of treatment to ensure that Federal Drinking Water Standards are met for primary contaminants of concern. Common water quality issues in this area of Vermont involve the presence of iron, manganese at levels

which are more than desirable for drinking water.

At this time, there is no data available to determine whether a municipal water treatment system would be required. At a minimum, Public Community Water System's (PCWS) are required to have the ability to chlorinate and disinfect the supply, in the event there is a bacteriological concern.

5.3 Storage

PCWS are required to provide finished water storage, which at a minimum, meets the average daily demands of the water system. Based on the extents of the service area discussed earlier in this report, the estimated minimum volume of storage is 40,000 gallons per day.

Many communities throughout Vermont are fortunate to have natural topography which can provide a suitable means for elevated finished water storage. Elevated storage has two primary benefits when compared with ground storage.

The first benefit is that the storage tanks are providing a stable hydraulic grade throughout the entire distribution system, simply based on the elevation of the water in the tank. Water systems by rule are required to provide 35 pounds per square inch (psi) at the foundation wall of connected properties. This means that an elevated storage tank would need to be provided a bare minimum of 81-feet above the highest connected home. Often times it is higher than that, when calculating friction losses in pipes.

The second benefit is that the system can provide fire protection, without the need for substantial pump capacity. To be defined as a Fire Protection System under the current drinking water rules, a water system must meet the following minimum requirements:

1. Provide an additional storage volume (above demand) to ensure the system can deliver 500 gallons per minute (gpm) for a duration of not less than 2-hours. This equates to an additional 60,000 gallons of finished water storage.
2. The water system must be able to provide 500 gallons per minute at any hydrant on the system, without reducing the pressure at any point in the distribution system to less than 20 pounds per square inch (psi).

Without elevated storage, it can be significantly more challenging for communities to provide fire protection capacity. Based on a review of topographic maps, there does not appear to be a suitable location for elevated storage, within close proximity to the existing developed Village center.

6.0 DEVELOPMENT PHASES AND SCENARIOS

Throughout the project development, the Committee desired to review different alternatives, scenarios and phases which would provide varying levels of service to the Highgate community. The phases were broken down into two simplified steps:

Phase I – Development of the Village Core property and immediate vicinity of infrastructure. Under this phase, there were a variety of scenarios which would provide varying levels of service to the Village.

Scenario A – Under this, the system design would involve a limited capacity for development of the Village Core Property, with no option for full build out.

Scenario B – This development scenario would provide enough water and wastewater service so that the full development potential of the Village Core Property could be realized.

Scenario C – Under this Scenario, the Village core property would be served in addition to properties with soil limitations on St. Armand Road.

Phase 2 – Complete buildout of the system to serve the entire Village Center. Under this scenario, the community would expand upon wastewater solutions discussed in phase I, as a means of impacting the entire community.

7.0 ALTERNATIVES ANALYSIS

Phase I – Initial Development

Scenario A – Limited Capacity at Village Core Property

Alternative 1A – Wastewater Holding Tanks

- a) **Description** – This alternative provides an interim off-site water solution and a limited wastewater solution for only the Village Core Property. In the alternative, wastewater capacity is limited, and only municipal uses would be allowed on the core property. This alternative is represented on **Figure 5**.
- b) **Design Considerations**
 - i) **Applicability** – This design alternative does not allow for full buildout of Village Core Property or future development as desired, nor would it address any of the other items identified in the system, and therefore would not be applicable to meet the needs and goals of the Highgate Community.
 - ii) **Design Capacity** – The design capacity of this alternative is 600 gpd.
 - iii) **Water Supply Components** – This alternative consists of the following components:
 - (a) 100 Feet of water service line,
 - (b) 75 feet of water service crossing under Vermont Route 78 from an adjoining property. Since the service crosses under a State highway, it will need to be completed by Jack and Bore method, or directional drill and it is assumed that the service will be installed in a 3-inch HDPE casing,
 - (c) Interconnection to existing water system.
 - iv) **Wastewater Components** - This alternative consists of the following wastewater components:
 - (a) 5,000 gallon on-site holding tank (2 each),
 - (b) 150 feet of building sewer service (4-inch SDR 35 PVC),
 - (c) 1 wastewater manhole.
 - v) **Land Requirements** – This alternative would involve construction primarily on land owned by the Village, with exception of the water service connection occurring within existing highway rights of way, and through an easement associated with either the Highgate Market or the Town Office property.
 - vi) **Environmental Impacts** – This alternative is not anticipated to have any significant environmental impacts.
 - vii) **Assumptions** – For this alternative, we have assumed that a water treatment system will not be required.

viii) Construction – This alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.

ix) Cost Estimate – The construction cost estimate for this alternative is broken down into two major components. The first component is the water supply / distribution, consisting of the following:

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Interconnect with Existing System	1 EA	\$3,000	\$3,000
2	Water Service Line	100 LF	\$45	\$4,500
3	1-Inch Water Service in 3-Inch Sleeve - Highway Crossing	1 LS	\$10,000	\$10,000
		LS		\$0
	General Conditions & Miscellaneous Work	15%		\$2,625
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$20,125

The next component is wastewater disposal. Since there is only a connection to the proposed municipal uses, no collection cost was separated out.

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	5,000 Gallon Precast Tanks	2 Each	\$15,000	\$30,000
2	4" SDR35 PVC Sewer Service	150 LF	\$50	\$7,500
3	Sewer Manhole	1 Each	\$5,000	\$5,000
4	Electrical/Controls	1 LS	\$2,500	\$2,500
5	General Conditions & Miscellaneous Work	15%		\$6,750
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$51,750

The total estimated construction cost of this alternative is \$72,000

x) Advantages – This option involves the least amount of capital expense, and provides immediate relief to the Village Core Property only.

xi) Disadvantages – This option does not allow for expansion of the Village Core property or address any other future buildout scenarios within the Village.

Phase I – Initial Development

Scenario B – Serve Village Core Property Only

Alternative 1B-1 - Village Core - Arena Conversion

- a) **Description** – This alternative provides an interim off-site water solution and a limited wastewater solution for only the village core property and neighboring properties so the well source isolation issues are resolved, allowing an on-site wastewater solution for full development of the Village Core Property. This alternative is depicted on **Figure 6**.
- b) **Design Considerations**
 - i) **Applicability** – This design alternative allows for full buildout of Village Core Property, and by converting the Highgate sports arena to a public community water system, additional on-site wastewater capacity would be made available to properties within the village for redevelopment.
 - ii) **Design Capacity** – The design capacity of this alternative is 2,500 gpd.
 - iii) **Water Components** – This alternative consists of the following components:
 - (a) Building addition at the sports arena for equipment,
 - (b) Process water piping including hydropneumatics tanks, flow meters and chemical feed system,
 - (c) 40,000 gallon finished water storage tank,
 - (d) 2,000 feet of water transmission main from the Highgate Sports Arena,
 - (e) 8 water service connections,
 - (f) Interconnection to existing water system.
 - iv) **Wastewater Components** - This alternative consists of the following wastewater components:
 - (a) 2,500-gallon grease tank,
 - (b) 5,000-gallon septic tank with effluent filter,
 - (c) 250 linear feet of wastewater service,
 - (d) 2 wastewater manholes,
 - (e) Wastewater disposal field (2,500 gpd).
 - v) **Land Requirements** – This alternative would involve construction primarily on land owned by the Village, with exception of the water transmission main occurring within existing highway rights of way. Significant land acquisition is not anticipated for this alternative.
 - vi) **Environmental Impacts** – This alternative is not anticipated to have any significant environmental impacts and involves construction in areas which have been previously disturbed / impacted by development.

vii) Assumptions – For this alternative, we have assumed that a significant water treatment system will not be required, and that the soils on the Village Core property can accommodate a design flow of up to 2,500 gpd.

viii) Construction – Construction of this alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.

ix) Cost Estimate – The construction cost estimate for this alternative is broken down into three components, consisting of water supply, water distribution, and wastewater disposal. The first component is the water supply:

WS1 - Convert Highgate Sports Arena to Public Community Water System				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Building Addition to Sports Arena for Equip	200 SF	\$400	\$80,000
2	Piping/Mech (booster pumps, flow meters, pressure tanks)	1 LS	\$40,000	\$40,000
3	Electrical/Controls	1 LS	\$10,000	\$10,000
4	Replace Well Pump	1 EA	\$7,500	\$7,500
5	Water Storage Tank	40,000 gallons	\$3.00	\$120,000
6	General Conditions & Miscellaneous Work	15%		\$38,625
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$296,125

The next component is water distribution, which would involve the extension of a water transmission main from the Highgate Sports Arena to the Village Core Property, and consist of the following:

WD2 - Water Transmission Main from Highgate Sports Arena to Village Core, plus Service Connections to Eliminate Source Isolation Zones on Village Core Property				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	4-Inch Water Transmission Main to Village Core	2,000 LF	\$120	\$240,000
2	4-Inch Water Service in 12-Inch Sleeve - Highway Crossing	1 LS	\$15,000	\$15,000
3	1-Inch Water Service Connections	10 EA	\$7,500	\$75,000
4	General Conditions & Miscellaneous Work	15%		\$49,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$379,500

The next component is wastewater disposal. Since there is only a connection to the proposed municipal uses, no collection cost was separated out.

DIS2 - On-Site Septic at Village Core Property (2,500 gpd)					
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost	
1	2,500 Gallon Grease Tank	1 EA	\$10,000	\$10,000	
2	5,000-Gallon Septic Tank with Effluent Filter	1 EA	\$15,000	\$15,000	
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500	
4	Sewer Manholes	2 Each	\$5,000	\$10,000	
5	Distribution Box	1 LS	\$5,000	\$5,000	
6	Wastewater Disposal Field	2,500 gpd	\$10	\$25,000	
7	Electrical/Controls	1 LS	\$2,500	\$2,500	
8	General Conditions & Miscellaneous Work	15%			\$12,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$92,000	

The total estimated construction cost of this alternative is \$768,000.

- x) Advantages – This alternative will provide a municipal water service option to the Village Core and surrounding properties, which will allow for redevelopment and onsite wastewater to be available to those properties without impacting isolation distances.
- xi) Disadvantages – This option does not address properties with poor soil conditions on St. Armand Road to be addressed.

Phase I – Initial Development

Scenario B – Serve Village Core Property Only

Alternative 1B-2 - Village Core - Steel/Griswold Disposal

- a) Description** – This alternative provides off-site water and wastewater solutions for full development of the Village Core Property. The wastewater disposal would occur on the Steel / Griswold property under this alternative, and the Highgate Sports Arena well would not be converted to a public community water supply, but rather an extension provided to service the Village Core property only. This alternative is represented on **Figure 7**.

- b) Design Considerations**
 - i) Applicability – This design alternative allows for full buildout of Village Core Property; however, it would not address any of the other items identified or allow for future development.

 - ii) Design Capacity – The design capacity of this alternative is 2,500 gpd.

 - iii) Water Components – This alternative consists of the following components:
 - (a) 2,000 feet of water service line from the Highgate Sports Arena,
 - (b) Interconnection to existing water system.

 - iv) Wastewater Components - This alternative consists of the following wastewater components:
 - (a) 2,500-gallon grease tank,
 - (b) 5,000-gallon septic tank with effluent filter,
 - (c) 250 linear feet of wastewater service,
 - (d) 4 wastewater manholes,
 - (e) Wastewater Pump Station,
 - (f) 1,000 feet of effluent force main,
 - (g) Wastewater disposal field (2,500 gpd).

 - v) Land Requirements – This alternative would involve construction primarily on land owned by the Village, with exception of the water transmission main occurring within existing highway rights of way. For wastewater disposal, the Town would need to acquire easements or land associated with the Steel/Griswold property.

 - vi) Environmental Impacts – This alternative is not anticipated to have any significant environmental impacts and involves construction in areas which have been previously disturbed/impacted by development.

 - vii) Assumptions – For this alternative, we have assumed that the soils on the Steel/Griswold property can accommodate a design flow of up to 2,500 gpd.

viii) Construction – Construction of this alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.

ix) Cost Estimate – The construction cost estimate for this alternative is broken down into three major components, consisting of water distribution, wastewater collection, and wastewater disposal. The first component is the water distribution, which would involve the extension of a water service connection from the Highgate Sports Arena to the Village Core Property, and consist of the following:

WD3 - Water Service Connection from Highgate Sports Area for Village Core Site Only				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2-Inch Water Service Piping	2,000 LF	\$90	\$180,000
2	Interconnection with Sports Arena Piping	1 LS	\$5,000	\$5,000
3	General Conditions & Miscellaneous Work	15%		\$27,750
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$212,750

The next major component is the wastewater collection system, which would consist of the following:

CS1 - Septic/PS at Village Core, Force Main to Steele/Griswold Property				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	1 EA	\$10,000	\$10,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$30,000	\$30,000
6	Effluent Force Main	1,000 LF	\$60	\$60,000
7	Force Main State Highway Crossing	1 LS	\$35,000	\$35,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
9	General Conditions & Miscellaneous Work	15%		\$27,375
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$209,875

The final component is wastewater disposal. In order to access the Steel/Griswold site, a 400-foot long access road would need to be constructed.

DIS3 - On-Site Septic at Disposal Site No. 3 - Former Steele/Griswold Property (2,500 gpd)					
Item No.	Item Description	Unit	Quantity	Unit Cost	Total Cost
1	Access Road	400	LF	\$50	\$20,000
2	Clearing/Grubbing	1	LS	\$5,000	\$5,000
3	Site Work		LS		\$0
4	Sewer Manholes		EA		\$0
5	Distribution System		LS		\$0
6	Wastewater Disposal Field	2,500	gpd	\$10	\$25,000
7	Electrical/Controls		LS		\$0
8	General Conditions & Miscellaneous Work	15%			\$7,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =					\$57,500

The total estimated construction cost of this alternative is \$549,000.

- x) Advantages – This alternative provides the same benefit to the Village core property as alternative 1B-1, by providing water service from an off-site source of supply, while also increasing the availability of land for redevelopment.
- xi) Disadvantages – This option does not address properties with poor soil conditions on St. Armand road to be addressed.

Phase I – Initial Development

Scenario B – Serve Village Core Property Only

Alternative 1B-3 - Village Core - Wright Disposal

- a) Description** – This alternative provides off-site water and wastewater solutions for full development of the Village Core Property. It assumes the water supply would be developed on the Steel/Griswold property and wastewater disposal would be provided on the Wright Property. This alternative is depicted on **Figure 8**.
- b) Design Considerations**
 - i) Applicability** – This design alternative allows for full buildout of Village Core Property; however, it would not address any of the other items identified or allow for future development.
 - ii) Design Capacity** – The design capacity of this alternative is 2,500 gpd.
 - iii) Water Components** – This alternative consists of the following components:
 - (a) New drilled well on Steele/Griswold property
 - (b) 1,000 feet of water service line to Village Core.
 - iv) Wastewater Components** - This alternative consists of the following wastewater components:
 - (a) 2,500-gallon grease tank,
 - (b) 5,000-gallon septic tank with effluent filter,
 - (c) 250 linear feet of wastewater service,
 - (d) 4 wastewater manholes,
 - (e) Wastewater Pump Station,
 - (f) 2,000 feet of effluent force main,
 - (g) Wastewater disposal field (2,500 gpd).
 - v) Land Requirements** – This alternative would involve construction primarily on land owned by the Village, with exception of the water service occurring within existing highway rights of way. For wastewater disposal, the Town would need to acquire easements or land associated with the Wright Property. In addition, a private utility easement will be needed to access the Wright Property from Lamkin Street.
 - vi) Environmental Impacts** – This alternative is not anticipated to have any significant environmental impacts and involves construction in areas which have been previously disturbed/impacted by development.
 - vii) Assumptions** – For this alternative, we have assumed that 5 gpm well (+/-) can be developed on the Steele/Griswold property which will not require significant water treatment to use as the source of supply for the Village Core. Should the well capacity or water quality not be achieved on lot, additional sources of supply may need to be investigated, as discussed under the other alternatives in this report.

- viii) Construction – Construction of this alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.
- ix) Cost Estimate – The construction cost estimate for this alternative is broken down into four major components, consisting of water source, distribution, wastewater collection, and wastewater disposal. The first component is the water source, which would involve the development of a +/- 5 gpm well on the Steele/Griswold property, and consist of the following:

WS2 - Drill New Well for Village Core Property on Steele/Griswold Property				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	350 LF	\$50	\$17,500
2	Clearing/Grubbing	1 EA	\$2,500	\$2,500
3	Power	300 LF	\$20	\$6,000
4	Well Pump and Drop Piping	1 LS	\$10,000	\$10,000
5	General Conditions & Miscellaneous Work	15%		\$5,400
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$41,400

The next component is distribution, which would involve the extension of a water service from the newly developed well to the Village Core Property, and consist of the following:

WD4 - Water Service from New Well on Steele/Griswold to Village Core				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2-Inch Water Service Piping	1,000 LF	\$100	\$100,000
2	2-Inch Water Service in 8-Inch Sleeve - Highway Crossing	1 EA	\$10,000	\$10,000
3	General Conditions & Miscellaneous Work	15%		\$16,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$126,500

The next major component is the wastewater collection system, which would consist of the following:

CS2 - Septic/PS at Village Core, Force Main to Wright Property

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	1 EA	\$10,000	\$10,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$40,000	\$40,000
6	Effluent Force Main	2,000 LF	\$60	\$120,000
7	Force Main State Highway Crossing	1 LS	\$35,000	\$35,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
9	General Conditions & Miscellaneous Work	15%		\$37,875
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$290,375

The final component is wastewater disposal. We have estimated that in addition to the disposal field, a roughly 600 foot long access road will need to be constructed.

DIS4A - On-Site Septic at Wright Property for Village Core only (2,500 gpd)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	600 LF	\$25	\$15,000
2	Clearing/Grubbing	LS		\$0
3	Site Work	LS		\$0
4	Sewer Manholes	Each		\$0
5	Distribution System	Each		\$0
6	Wastewater Disposal Field	2,500 gpd	\$10	\$25,000
7	Electrical/Controls	LS		\$0
8	General Conditions & Miscellaneous Work	15%		\$6,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$46,000

The total estimated construction cost of this alternative is \$504,000.

- x) Advantages – This alternative provides the same benefit to the Village core property as alternative 1B-1 and 1B-2 by providing water service from an off-site source of supply, while also increasing the availability of land for redevelopment.
- xi) Disadvantages – This option does not address properties with poor soil conditions on St. Armand road to be addressed.

Phase I – Initial Development

Scenario C – Serve Village Core Property and Properties with Soil Limitations

Alternative 1C - Village Core - Decentralized Wastewater

- a) Description** – This alternative provides off-site water to the Village Core Property, and an off-site wastewater solution for the village core property. The Wright property wastewater disposal site has the capacity to also serve as a replacement system for approximately 15 additional neighboring single-family homes on Saint Armand Road, which have soils generally unsuitable for wastewater systems. This alternative is depicted as **Figure 9**.
- c) Design Considerations**
 - i) Applicability – This design alternative allows for full buildout of Village Core Property and addresses the need for wastewater capacity on St. Armand Road. In addition, this alternative can be considered the first phase of development associated with a decentralized wastewater solution, allowing for additional expansion / development to accommodate other streets in the future.
 - ii) Design Capacity – The design capacity of this alternative is 6,499 gpd.
 - iii) Water Components – This alternative consists of the following components:
 - (a) 2,000 feet of water service line from the Highgate Sports Arena.
 - (b) Interconnection to existing water system
 - iv) Wastewater Components - This alternative consists of the following wastewater components:
 - (a) 1,200 linear feet of 8-inch gravity sewer main and appurtenances.
 - (b) 15 wastewater service connections on St. Armand Road.
 - (c) 9 wastewater manholes
 - (d) 2,500-gallon grease tank
 - (e) 5,000-gallon septic tank with effluent filter
 - (f) 250 linear feet of 4-inch SDR 35 PVC wastewater service
 - (g) Wastewater pump station
 - (h) 2,000 feet of effluent force main
 - (i) Force main highway crossing
 - v) Land Requirements – This alternative would involve construction primarily on land owned by the Village, with exception of the water service connection occurring within existing highway rights of way. The expectation is that the Town would acquire land on the Wright property for wastewater disposal. So that the action is not limiting in the future, for other wastewater disposal alternatives in future phases, the Town should consider purchasing a larger area of land, to accommodate up to a 30,000 gpd wastewater disposal field under this scenario.

In addition to the disposal area land purchase, a permanent utility easement will be needed to construct the sewer line from Lamkin Street to the Wright property.

- vi) Environmental Impacts – This alternative is not anticipated to have any significant environmental impacts.
- vii) Assumptions – None.
- viii) Construction – This alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.
- xii) Cost Estimate - The construction cost estimate for this alternative is broken down into three major components, consisting of water distribution, wastewater collection, and wastewater disposal. The first component is the water distribution, which would involve the extension of a water service connection from the Highgate Sports Arena to the Village Core Property, and consist of the following:

WD3 - Water Service Connection from Highgate Sports Area for Village Core Site Only				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2-Inch Water Service Piping	2,000 LF	\$90	\$180,000
2	Interconnection with Sports Arena Piping	1 LS	\$5,000	\$5,000
3	General Conditions & Miscellaneous Work	15%		\$27,750
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$212,750

The next major component is the wastewater collection system, which would consist of the following:

CS3 - Sewer on St. Armand Road, Septic/PS at Village Core, Force Main to Wright Property

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
	<i>St. Armand Road</i>			
1	4" SDR35 PVC Sewer Service Connections (ROW to Sewer Main)	15 EA	\$3,000	\$45,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	1,200 LF	\$100	\$120,000
3	Sewer Manhole	5 Each	\$5,000	\$25,000
	<i>Village Core Property</i>			
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	3 EA	\$10,000	\$30,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$100,000	\$100,000
6	Effluent Force Main	2,000 LF	\$60	\$120,000
7	Force Main State Highway Crossing	1 LS	\$35,000	\$35,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
	General Conditions & Miscellaneous Work	15%		\$78,375
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$600,875

The final component is associated with the wastewater disposal, which would involve the construction of a 6,499 gpd wastewater disposal system on the Wright property, as follows:

DIS4B - On-Site Septic at Wright Property for Village Core and Select Properties with Poor Soils (6,500 gpd)				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	600 LF	\$25	\$15,000
2	Clearing/Grubbing	LS		\$0
3	Site Work	LS	\$15,000	\$0
4	Sewer Manholes	EA		\$0
5	Distribution System	EA	\$15,000	\$0
6	Wastewater Disposal Field	6,500 gpd	\$10	\$65,000
7	Electrical/Controls	0 LS		\$0
8	General Conditions & Miscellaneous Work	15%		\$12,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$92,000

The total estimated construction cost of this alternative is \$906,000

- ix) Advantages – This alternative provides the greatest immediate need and allows the Village with the greatest amount of flexibility in the future, as it pertains to wastewater disposal, and when compared with all other scenarios and alternatives discussed as "Phase I".
- x) Disadvantages – This option does not provide a community water system solution to properties which abut the Village core property on Gore Road or Vermont Route 78.

Phase II – Full Buildout

Alternative 2A – Expanded Wastewater Capacity on the Wright Property

- a) Description** – This alternative provides a potential future centralized wastewater collection and disposal system for all properties in the developed village center, expanded from alternative 1C. In general, all wastewater will be collected and routed to the Wright property for treatment and disposal. Refer to **Figure 10**.
- b) Design Considerations**
 - i) Applicability** – This design alternative would occur under phase 2 and allow for the developed village center to be connected to a community wastewater disposal system which consists of approximately 56 properties.
 - ii) Design Capacity** – The design capacity of this alternative is 30,000 gpd.
 - iii) Land Requirements** – This alternative would involve construction of wastewater mains within existing highway rights of way.
 - iv) Environmental Impacts** – This alternative is not anticipated to have any significant environmental impacts and involves construction in areas which have been previously disturbed / impacted by development.
 - v) Assumptions** – For this alternative, we have assumed that a combination of gravity sewer and septic tank effluent pumping (STEP) mains would be provided.
 - vi) Construction** – Construction of this alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.
 - vii) Cost Estimate** – The construction cost estimate for this alternative is broken down into two major components consisting of additional wastewater collection and wastewater disposal.

CS4 - Collection System for Village Center Area to Wright Property				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
	<i>STEP Systems for Gore Road, Decatur St., Lamkin St to Wright Property</i>			
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	25 EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	25 EA	\$3,000	\$75,000
3	2" PVC Effluent Force Main	2,500 LF	\$60	\$150,000
	<i>STEP Systems for Route 78 (east of Village Core) to Wright Property</i>			
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	20 EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	20 EA	\$3,000	\$60,000
3	2" PVC Effluent Force Main	1,600 LF	\$60	\$96,000
	<i>Gravity Sewer for Route 78 (east of Village Core) to Village Core Pump Station</i>			
1	4" SDR35 PVC Sewer Service Connections	6 EA	\$3,000	\$18,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	500 LF	\$80	\$40,000
3	Sewer Manhole	3 Each	\$5,000	\$15,000
	<i>Lamkin Street</i>			
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	10 EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	10 EA	\$3,000	\$30,000
	<i>St. Armand Road</i>			
1	4" SDR35 PVC Sewer Service Connections	10 EA	\$3,000	\$30,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	1,200 LF	\$80	\$96,000
3	Sewer Manhole	5 Each	\$5,000	\$25,000
	<i>Village Core Property</i>			
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	3 EA	\$10,000	\$30,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$150,000	\$150,000
6	Effluent Force Main	2,000 LF	\$60	\$120,000
7	Force Main State Highway Crossing	1 LS	\$25,000	\$25,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
	General Conditions & Miscellaneous Work	15%		\$151,125
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST =			
				\$1,158,625

The final component is wastewater disposal. We have estimated that in addition to the disposal field, a roughly 600-foot-long access road will need to be constructed.

DIS4C - On-Site Septic at Wright Property, Full Buildout (30,000 gpd)				
Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	600 LF	\$25	\$15,000
2	Clearing/Grubbing	LS		\$0
3	Site Work	LS		\$0
4	Sewer Manholes	EA		\$0
5	Distribution System	1 EA	\$30,000	\$30,000
6	Wastewater Disposal Field	30,000 gpd	\$20	\$600,000
7	Electrical/Controls	1 LS	\$15,000	\$15,000
8	General Conditions & Miscellaneous Work	15%		\$99,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$759,000

The total estimated construction cost of this alternative is \$1,918,000.

- viii) Advantages – This alternative provides a community wastewater solution to the entire developed center, with an opportunity for reasonable growth and expansion within the defined service area.
- ix) Disadvantages – This option has a significant capital investment, when compared with other alternatives.

Phase II – Full Buildout

Alternative 2B – Decentralized Disposal w/ STEP systems

- a) Description** – This alternative provides a potential future decentralized wastewater collection and disposal systems for all properties in the developed village center, expanded from alternative 1C. In general, this alternative involves collecting sewer in specific portions of the service area and discharging to designated, decentralized treatment systems. Refer to **Figure 11**.
- b) Design Considerations**
 - i) Applicability – This design alternative would occur under phase 2 and allow for the developed village center to be connected to a community wastewater disposal system which consists of approximately 56 properties. The primary difference between this alternative and 2A is that the constructed wastewater systems would be less than 6,500 gpd and not subject to the requirements of the indirect discharge permitting process.
 - ii) Design Capacity – The design capacity of this alternative is approximately 18,000 gpd, as the total capacity will be based on the capacity of the individual wastewater disposal systems.
 - iii) Land Requirements – This alternative would involve construction of wastewater mains within existing highway rights of way; however, it is anticipated that this alternative would involve the greatest amount of investment in land acquisition, through both purchase and easements. Each disposal site, currently listed as Wright, Gervais, and Cassidy Meadows would need to be acquired.
 - iv) Environmental Impacts – This alternative is not anticipated to have any significant environmental impacts and involves construction in areas which have been previously disturbed / impacted by development.
 - v) Assumptions – For this alternative, we have assumed that a combination of gravity sewer and septic tank effluent pumping (STEP) mains would be provided.
 - vi) Construction – Construction of this alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.
 - vii) Cost Estimate – The construction cost estimate for this alternative is broken down into two major components consisting of additional wastewater collection, and wastewater disposal.

CS5 - STEP Collection System for Gore Road, Rt 78 Properties

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
	<i>STEP System for Gore Road</i>			
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	15 EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	15 EA	\$3,000	\$45,000
3	2" PVC Effluent Force Main	2,200 LF	\$60	\$132,000
	<i>STEP System for Route 78</i>			
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	25 EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	25 EA	\$3,000	\$75,000
3	2" PVC Effluent Force Main	2,700 LF	\$60	\$162,000
	<i>St. Armand Road</i>			
1	4" SDR35 PVC Sewer Service Connections	10 EA	\$3,000	\$30,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	1,200 LF	\$80	\$96,000
3	Sewer Manhole	5 Each	\$5,000	\$25,000
	<i>Village Core Property</i>			
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	3 EA	\$10,000	\$30,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$150,000	\$150,000
6	Effluent Force Main	2,000 LF	\$60	\$120,000
7	Force Main State Highway Crossing	1 LS	\$25,000	\$25,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
	General Conditions & Miscellaneous Work	15%		\$140,625
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$1,078,125

The final component is wastewater disposal.

DIS5 - Decentralized On-Site Septics at Multiple Properties (6,500 gpd each)

Item No.	Item Description	Unit	Quantity	Unit Cost	Total Cost
<i>Cassidy Meadows Site</i>					
1	Access Road	400	LF	\$50	\$20,000
2	Site Work		LS		\$0
3	Distribution System		EA		\$0
4	Wastewater Disposal Field	6,500	gpd	\$10	\$65,000
<i>Potential Disposal Location No. 6 (Gervais Properties, LLC)</i>					
1	Access Road	400	LF	\$50	\$20,000
2	Site Work		LS		\$0
3	Distribution System		EA		\$0
4	Wastewater Disposal Field	6,500	gpd	\$10	\$65,000
3	Site Work		LS		\$0
4	Sewer Manholes		EA		\$0
5	Distribution System		EA		\$0
6	Wastewater Disposal Field		gpd		\$0
7	Electrical/Controls	0	LS		\$0
8	General Conditions & Miscellaneous Work	15%			\$25,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =					\$195,500

The total estimated construction cost of this alternative is \$1,274,000.

- viii) Advantages – This alternative provides a community wastewater solution to the entire developed center, with an opportunity for reasonable growth and expansion within the defined service area.
- ix) Disadvantages – This option has a significantly higher operation and maintenance expenses, associated with the pump stations when compared to gravity collection and treatment.

Phase II – Full Buildout

Alternative 2C – Public Community Water System, No Wastewater

- a) Description** – This alternative provides for a public community water system for all properties in the developed village center, to remove potential overlapping well shields and the potential for drinking water contamination because of the existing dense development and proximity of on-site inground wastewater disposal systems. This alternative is depicted on **Figure 12**.
- c) Design Considerations**
 - i) Applicability** – This design provides an alternative means to wastewater within the Village. By developing and constructing a community water system, each property will have full access to the existing on-site soil for redevelopment and/or maintenance of the existing wastewater system.
 - ii) Design Capacity** – For the purpose of this report, the assumed design capacity is 40,000 gallons per day, which would be the full buildout of the developed Village Center.
 - iii) Land Requirements** – This alternative would involve construction water mains and infrastructure within existing highway rights of way. Land acquisition would be required for the source. A requirement of current Drinking Water Source permits is that the water system own and control a 200-foot radius centered on the drilled water supply. For this study, we have presumed that this could be negotiated with the Owner of Cassidy Meadows. As shown on **Figure 4**, alternative sites for supply are available.
 - iv) Environmental Impacts** – This alternative is not anticipated to have any significant environmental impacts and involves construction in areas which have been previously disturbed / impacted by development.
 - v) Assumptions** – For this alternative, we have assumed that a single water source could be developed, which would have excellent water quality (requiring only standby chlorination) and enough yield that additional sources of supply are not necessary.
 - vi) Construction** – Construction of this alternative would involve simple construction techniques which are commonly used throughout Vermont on utility infrastructure projects. There aren't any unique technical aspects associated with this alternative.
 - vii) Cost Estimate** – The construction cost estimate for this alternative is broken down into two major components consisting water source and water distribution. The water source would be constructed in an area of undeveloped land, a minimum of 200-feet from any known Potential Sources of Contamination (PSOCs). In general, supply for a public community system would require finished water storage equivalent to the Average Day Demand (ADD) of the system, or 40,000 gpd. A small control building for the chemical feed system, and booster pumps would be constructed adjacent to the finished water storage. Refer to the detailed estimate below.

WS3- Drill New Public Community Supply Well near Cassidy Meadows Project

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Temp Access	1 EA	\$5,000	\$5,000
2	Clearing/Grubbing	1 EA	\$2,500	\$2,500
3	Well Drilling	1 LS	\$15,000	\$15,000
4	Permanent Access Road	1,000 LF	\$50	\$50,000
5	Pump, Drop Pipe, and Appurtenances	1 LS	\$15,000	\$15,000
6	Electrical Service	1,000 LF	\$20	\$20,000
7	Water Storage Tank	40,000 gallons	\$3.00	\$120,000
8	Treatment Building and Booster Pumps	1 LS	\$400,000	\$400,000
9	General Conditions & Miscellaneous Work	15%		\$94,125
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$721,625

The final component is water distribution, consisting of mains, services and appurtenances throughout the developed Village Center. Without elevated storage, fire protection capacity has been excluded.

WD5 - New Transmission Main and Distribution Mains throughout Village Center

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
<i>Transmission Main from Cassidy Meadows Well to Village Center (at Sports Arena)</i>				
1	4-Inch Water Transmission Main	2,000 LF	\$100	\$200,000
2	Allowance for Ledge	100 CY	\$200	\$20,000
<i>Distribution Mains</i>				
1	Water Distribution Main - Gore Road	1,500 EA	\$120	\$180,000
2	Water Service Connections - Gore Road	14 EA	\$7,500	\$105,000
3	Water Distribution Main - St. Armand Road	1,200 LF	\$120	\$144,000
4	Water Service Connections - St. Armand Road	24 EA	\$7,500	\$180,000
5	Water Distribution Main - Route 78	2,000 LF	\$150	\$300,000
6	Water Service Connections - Route 78	22 EA	\$7,500	\$165,000
7	Water Distribution Main - Lamkin St	1,200 LF	\$120	\$144,000
8	Water Service Connections - Lamkin St	15 EA	\$7,500	\$112,500
9	General Conditions & Miscellaneous Work	15%		\$161,100
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$1,711,600

The total estimated construction cost of this alternative is \$2,433,000.

viii) Advantages – This alternative provides a community wastewater solution by constructing a community water supply and ensuring that each property within the designated Village Center is adequately served.

- ix) Disadvantages – This option does not provide a reasonable wastewater solution for properties with poor on-site soils, such as the homes in the St. Armand Road neighborhood.

8.0 SELECTION OF AN ALTERNATIVE

In selecting a recommended alternative, considerations of both monetary and non-monetary factors should be made. Factors considered included:

- a. **Capital Cost (Affordability)** – On the basis of capital cost alone, the least expensive, alternative would involve constructing alternative 1A. Capital cost is relative, however, because it should consider the number of properties which could benefit from that particular alternative. A summary of all the construction costs presented in section 6 of this report are included in **Appendix I**.
- b. **Reasonable Growth** – Vermont, and more specifically Northwest Vermont and Franklin County, have numerous qualities that entice people to move and/or stay within the region. The ability for the Town and Village to reasonably develop is critical in evaluating alternatives.
- c. **Operation & Maintenance** – Ease of operation and maintenance is critical to providing a long-term, cost effective solution. In general, pump stations and force mains involve more risk of failures, and result in more damaging consequences when a component does fail. Thus, they require more frequent maintenance, and more “hands on” operation, than gravity sewers.
- d. **Constructability** – For gravity sewer projects, construction considerations need to evaluate the number of utility conflicts, depth of excavation, depth to groundwater table, and complexity of the site constraints.
- e. **Easements** – Permanent easements will be required for infrastructure installed on private property. Consideration for the additional cost associated with purchasing these easements, as well as any difficulties in future O&M associated with infrastructure on multiple properties should be considered.
- f. **Life Cycle Analysis** – A life cycle cost analysis was developed for each alternative presented under section 7.0. The length of the analysis is 40-years. The individual life cycle calculations are included in **Appendix J**.

A summary of the wastewater collection and disposal options discussed in Section 6.0 of this report are presented in **Table 6**. A summary of the water source and Distribution options discussed are in Section 6.0 of this report are presented in **Table 7**.

In selecting an alternative, the monetary and non-monetary factors were reviewed and summarized in **Table 8**. These tables are included in the Tables Section following the report.

9.0 PROPOSED PROJECT

- a. **Preliminary Project Design** – The recommended alternative is to proceed with the design and permitting of a gravity collection system along St. Armand Road, with a pump station at the Village Core property and a disposal field at the Wright Property. At this time, based on the information compiled within this report, and the discussions with the Committee, it appears that the design of this first phase would include a wastewater disposal system at the Wright property of less than 6,500 gallons per day. This alternative is generally depicted as **Figure 9**. In order to provide a water source to the Village Core property, it is recommended that that the project explore the alternative of connecting the Village Core property, to the Town office well first, as it would be less expensive for addressing the water needs at the property, when compared to an extension of the Highgate Sports Arena well.
- b. **Project Schedule** – The project schedule is driven by the funding requirements and the desire of the Town of Highgate. The following is a list of key project milestones, over the next several months:

Preliminary Engineering Report Submission	June 2021
Preliminary Engineering Report Approval	July 2021
Final Design and Permitting	September 2021 thru November 2022
Bond Vote	March 2022
Bid Phase	Fall 2022 and/or Winter 2023*
Construction	Summer 2023

*Note: The schedule for bid and construction phases of this project will be based on receipt of funding authorization, the Town's readiness to proceed, and approval of engineering and construction documents by regulatory and funding agencies.

- c. **Permit Requirements** – The project is anticipated to disturb less than 10-acres, and is similar in size and scope to other municipal infrastructure improvement projects, therefore a State of Vermont Act 250 permit is not anticipated. The following permits are anticipated at this time:
 - Town of Highgate– Zoning Permit
 - State of Vermont – Construction General Permit (for more than 1 acre of earth disturbance)
 - State of Vermont – Labor and Industry Permits
 - State of Vermont – Water Supply and Wastewater Disposal Permit
- d. **Sustainability Considerations** – The construction of a gravity sewer main along St. Armand Road, and decentralized community wastewater disposal system is a more sustainable, long term solution for the Town than the current configuration of onsite septic systems.
- e. **Total Project Cost Estimate** – Beyond the construction cost of the proposed improvements, the total project cost includes:

- i. **Technical Services** - Over the years, the Agency of Natural Resources and United States Department of Agriculture (Rural Development) have developed a technical services eligible fee “curve” for wastewater projects which is used as a general guideline during the planning and preliminary engineering phases of a project for estimating the cost of professional and technical services associated with a State or Federally funded project. For this particular project, technical services will include funding assistance, detailed surveys, geotechnical investigations and design, engineering design, permitting, bidding, construction administration and construction review services.
- ii. **Legal/Fiscal/Administrative Expenses** - In addition to the technical costs, projects of this nature will incur modest costs for legal and accounting services. Also, based on the size and scope of the project, we anticipate that additional fiscal expenses for short-term (interim) financing will be required in order to bridge the gap between expenditures and the release of project funds.
- iii. **Contingency** - Given the early stage of this project, it is prudent to include a contingency in the overall budget to account for variability of construction, material and equipment costs, as well as unanticipated design considerations. An overall project contingency of 20% has been included at this phase in the project, and is consistent with industry standards for cost estimating.
- iv. **Land Acquisition** - For the recommended alternative, private easements will need to be obtained for portions of the collection / pump system, as well as the final location of the wastewater disposal area. Projects which receive federal funding are required to obtain a “fair-market” appraisal in order to receive funds to pay for land easements and acquisition. For this project, given the high capacity of the soil on the Wright property for disposal, we would strongly encourage the Town to purchase a larger portion of land, which could allow for expansion of the community disposal system on the Wright property in the future. The value included under this table accounts for that purchase.

The total project cost is shown as **Table 9**.

Table 9
Town of Highgate
Community Wastewater Feasibility Study
Total Project Cost Summary with Funding Options (CWSRF Funding with No Subsidies)

Alternative No.	Phase 1 to Serve Village Core Property						Future (Phase 2) Community Solutions		
	1A	1B-1	1B-2	1B-2 (SS)	1B-3	1C	2A	2B	2C
Wastewater Alternative	Holding Tanks (600 gpd)	On-Site Septic (Village Core) (2,500 gpd)	Off-Site Septic (Wright) (2,500 gpd)	Off-Site Septic (Steele/ Griswold) (2,500 gpd)	Off-Site Septic (Wright) (2,500 gpd)	Off-Site Septic (Wright) (6,500 gpd)	Centralized Community Wastewater (30,000 gpd)	Decentralized Community Wastewater (3 separate 6,500 gpd systems)	
Water Alternative	Connect to Neighboring TNC	Sports Arena (PCWS)	Sports Arena (TNC)	Sports Arena (TNC)	New Well on Griswold	Sports Arena (TNC)			Community Water System (60-75 gpm well)
Construction Costs	\$72,000	\$768,000	\$549,000	\$480,000	\$504,000	\$906,000	\$1,918,000	\$1,274,000	\$2,433,000
Other Project Costs	\$18,000	\$247,000	\$162,250	\$120,000	\$186,000	\$285,074	\$541,153	\$368,724	\$652,496
Contingency (20%)	\$14,400	\$153,600	\$109,800	\$96,000	\$100,800	\$181,200	\$383,600	\$254,800	\$486,600
Total Initial Costs	\$104,400	\$1,168,600	\$821,050	\$696,000	\$790,800	\$1,372,274	\$2,842,753	\$1,897,524	\$3,572,096
Projected Subsidy (Grant or Loan Forgiveness)									
Subsidy (Loan Forgiveness)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Loan	\$104,400	\$1,168,600	\$821,050	\$696,000	\$790,800	\$1,372,274	\$2,842,753	\$1,897,524	\$3,572,096
Amount Borrowed	\$104,400	\$1,168,599	\$821,050	\$695,999	\$790,799	\$1,372,273	\$2,842,752	\$1,897,523	\$3,572,096
Interest Rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Loan Term	30	30	30	30	30	30	30	30	30
Annual Debt Service Payment	\$4,661	\$52,178	\$36,660	\$31,076	\$35,309	\$61,272	\$126,929	\$84,724	\$159,494
Projected Annual O&M Expenses	\$9,939	\$18,325	\$4,325	\$4,325	\$4,325	\$4,325	\$17,325	\$5,325	\$35,000
Total Annual Costs	\$14,600	\$70,503	\$40,985	\$35,401	\$39,634	\$65,597	\$144,254	\$90,049	\$194,494
PROJECTED COSTS AS A GRAND LIST TAX FOR VILLAGE CORE PROJECT									
Increase in Tax Rate (\$ per hundred of valve)	\$0.0034	\$0.0166	\$0.0096	\$0.0083	\$0.0093	\$0.0154	\$0.0339	\$0.0212	\$0.0458
Annual Cost for \$250,000 property	\$8.59	\$41.47	\$24.11	\$20.82	\$23.31	\$38.59	\$84.86	\$52.97	\$114.41
PROJECTED COSTS AS EQUIVALENT RESIDENTIAL UNITS (ERUs)									
Capacity of System -	2	10	10	10	10	26	120	80	175
Total Number of ERUs Served	2	10	10	10	10	26	120	80	175
Annual Cost per ERU at Full Buildout	\$ 7,300	\$ 7,050	\$ 4,098	\$ 3,540	\$ 3,963	\$ 2,523	\$ 1,202	\$ 1,126	\$ 1,111

Notes:

1. Clean Water State Revolving Fund (CWSRF) loans are issued at 2% for 20 years, with a potential to extend to 30 years provided the useful life of the equipment is at least 30 years. Eligibility is determined from an Intended Use Plan based on a yearly Priority List.
2. Loan Subsidies of up to 40% have been provided in the past, but is not guaranteed. No subsidy is presented here to estimate a "realistic" cost basis for alternatives.
3. The cost per year "at full buildout" assumed the maximum number of ERUs are connected to the system. First Year costs will be higher than presented and will depend on the level of interest and actual number of connections.
4. Estimates of tax rates are based on an estimated Grand List Value of \$425,000,000.

There are several items to note from the above Table. The most important is that the cost per ERU of any alternative goes down, with the connection of more properties. This is critical, as it reinforces that providing community solutions is reasonable, given the density of development.

- f. **Annual Operating Budget** – The Town of does not currently have a community water or wastewater system, however, the expectation is that if the project proceeds, the Town will develop a public works commission who will be responsible for setting the annual operating budget.
 - i. **Income** – Since the Town does not currently have a water system, and the installation of water meters for billing based on usage is not practical, the

expectation is that the Town will set a base fee for connecting customers, per Equivalent Residential Unit (ERU) as defined by the State Rules.

- ii. **Annual O&M Costs** – Annual O&M expenses will include Administrative Support, Insurance, Pump Station O&M, and costs associated with contract wastewater operations as required.
- iii. **Debt Repayments** – Currently, there are not any annual debt payments.
- iv. **Reserves** – There are no current reserves. The expectation is that capital reserve fund will be developed by obtaining “connection fees” in advance of the project from prospective connections, and that additional reserves (or set assides) will be included in the annual operating budget for the wastewater system.

10.0 FUNDING OPTIONS

Funding for the publicly owned wastewater systems in Vermont is available from a variety of programs such as:

- The Vermont Agency of Natural Resources Clean Water State Revolving Fund: low interest (up to 2%) loans, with additional subsidy available for disadvantaged communities.
- USDA Rural Development (RD): grants and loans.
- Vermont Bond Bank: loans.

A goal of any public infrastructure improvement project is to make the necessary improvements at the lowest resultant cost to the user without compromising quality and longevity. By optimizing grant funding, and minimizing the local share of the project, less debt retirement will be passed on to the individual system users.

The Town is eligible for funding from the first two programs listed. These funding sources are described in detail below.

- a. **Clean Water State Revolving Fund for Water Supply Project (CWSRF)** - The State of Vermont Drinking Water and Groundwater Protection Division (DWGPD) administers a combined Federal (EPA) and State Revolving Loan Program for community wastewater system improvements. Various aspects of these programs are described as follows:
 - i. **Funding Priority List** - For a project to be eligible for CWSRF funding, it must be placed upon the Project Priority List. Projects are ranked to ensure that the most critical needs receive first consideration in awarding available dollars. Projects are funded based on their priority and ability to proceed. If a project is not ready to proceed, it must reapply for the next year's funding.
 - ii. **Funding Limitations** – The CWSRF program is limited by State Statutes (24 V.S.A. Chapters 76A and 117) and the system rule (Chapter 2) limit the ability to fund sewer extension projects. Essentially, the program can only fund sewer extensions or new construction when it is the only reasonable alternative available to correct a significant health or environmental hazard. Historically, the program has also considered emergent conditions, like the overlapping of isolation distances between water supplies and wastewater disposal systems as a significant potential health threat.
 - iii. **Planning Assistance** - Planning for most improvement projects requires investments in engineering services before actual construction of any improvements can occur. To help offset the "front end" burden on the system, the State can provide a CWSRF planning loan. CWSRF planning loans are not grants; they are 0% interest loans that must be paid back within 5 years or when the project goes to construction, whichever comes first.

Planning advances are typically available for preliminary studies, final design, surveys, and the development of plans, specifications and bid documents. Such funding has been utilized for this preliminary study and may be used for final design, if the project proceeds. This project has been deemed eligible for a 50% design subsidy by CWSRF, which would reduce the value of the current planning loan by 50%, upon completion of the project.

iv. **CWSRF Construction Loans** - CWSRF is available for construction of wastewater improvements for both public systems. This fund provides low interest loans for all project costs associated with a wastewater improvement project. Interest rates vary between 2% for a 20 year loan term.

Disadvantaged communities may be eligible for additional subsidy, subject to review and approval of the program.

b. **Rural Development** - Funding for municipally owned wastewater projects is available through Rural Development (formerly known as the Farmer's Home Administration). To be eligible for funding, an applicant must be:

- A public entity (such as a Town, Village, or Fire District).
- Non Profit.
- Located in a community of less than 10,000 people.
- Unable to afford commercial credit.

There are also several requirements for a project to be eligible for Rural Development funding, specifically:

- The project must be financially feasible.
- It must be modest in size, cost, and design.
- The completed system must primarily serve residential users.
- The project should contain reasonable growth capacity.

Funding through Rural Development can take the form of either loans, grants or both. Loan rates are based upon financial need as determined by the municipalities (or systems) median household income (MHI). Interest rates are fixed for the life of the loan, which can range between 20 and 40 years for project and are subject to fluctuation until a funding commitment is provided, and accepted by the municipality.

Grant funding is based upon a variety of factors, including the number of projects requesting funding for that particular fiscal year and economic need. To be eligible for RD grants, the project must:

- Service a community whose median family income is less than the State's 2015 non-metropolitan median household income (\$56,204) and,
- Result in "reasonable user fees" upon completion of the project.

Reasonable user fees are defined as:

- The debt service portion of the annual user fee does not exceed 1% of the median household income (MHI).

As indicated above, both loan and grant eligibility is based upon determination of the median household income for the Town or service area, whichever is most advantageous to the applicant.

As discussed, the proposed project will benefit all customers currently connected to the Town's wastewater system, by reducing O&M expenses.

- c. **Vermont Bond Bank** - Financing for municipal infrastructure projects is available from the Vermont Bond Bank. The term for water projects is 30 years and the interest rate is fixed at the time of the bond sale. Current municipal rates are between 4% and 5%. Funding through State and Federal programs often provides the most advantageous route for municipalities throughout Vermont.
- d. **Financing and Estimated User Rates** – At this time, it is recommended that the Town pursue both CWSRF and Rural Development funding for this project and select the funding source most advantageous to the users. **Table 9** should be considered a worst case funding option, as it outlines the cost assuming no grant would be available. Different funding scenarios, based on the source, loan term, and interest rate for the recommended alternative are presented in **Table 10 and Table 11** as depicted below. **Table 10** assumes a grant package of approximately 45%, which is common for many community projects when all funding sources are considered. In this case, we have presumed that the grant package would come from the Rural Development Program for simplicity. **Table 11** depicts a 75% grant for the same project type.
- e. **Funding Alternatives** – There are numerous ways for municipally owned water and wastewater utilities to be developed, and an infinite number of solutions for how they can be paid for. Often, in Vermont especially, utility fees for water and wastewater are paid directly by the customers (and connections) who utilize that service. This is shown in **Tables 9, 10 and 11** as the “Projected Cost Per ERU”. Alternatively, some communities consider the importance of municipal water and wastewater service to maintaining and developing their Village and Growth centers. As such, they assess a tax on the entire Town, as a way of ensuring that water and wastewater service can be provided at an affordable rate. This is shown as “Projected Costs as a Grandlist Tax” in **Tables 9, 10 and 11**.

There is no right or wrong way to collect fees, and in fact, there can be an infinite amount of funding alternatives and scenarios for collecting the fees. These tables are intended to provide an “order of magnitude” perspective on how grant funding can impact the total project cost.

Table 10
Town of Highgate
Community Wastewater Feasibility Study
Total Project Cost Summary with Funding Options (Rural Development Funding with 45% Grant)

Alternative No.	Phase 1 to Serve Village Core Property						Future (Phase 2) Community Solutions		
	1A	1B-1	1B-2	1B-2 (SS)	1B-3	1C	2A	2B	2C
Wastewater Alternative	Holding Tanks (600 gpd)	On-Site Septic (Village Core) (2,500 gpd)	Off-Site Septic (Wright) (2,500 gpd)	Off-Site Septic (Steele/Griswold) (2,500 gpd)	Off-Site Septic (Wright) (2,500 gpd)	Off-Site Septic (Wright) (6,500 gpd)	Centralized Community Wastewater (30,000 gpd)	Decentralized Community Wastewater (3 separate 6,500 gpd systems)	
Water Alternative	Connect to Neighboring TNC	Sports Arena (PCWS)	Sports Arena (TNC)	Sports Arena (TNC)	New Well on Griswold	Sports Arena (TNC)			Community Water System (60-75 gpm well)
Construction Costs	\$72,000	\$768,000	\$549,000	\$480,000	\$504,000	\$906,000	\$1,918,000	\$1,274,000	\$2,433,000
Other Project Costs	\$18,000	\$247,000	\$162,250	\$120,000	\$186,000	\$285,074	\$541,153	\$368,724	\$652,496
Contingency (20%)	\$14,400	\$153,600	\$109,800	\$96,000	\$100,800	\$181,200	\$383,600	\$254,800	\$486,600
Total Initial Costs	\$104,400	\$1,168,600	\$821,050	\$696,000	\$790,800	\$1,372,274	\$2,842,753	\$1,897,524	\$3,572,096
Projected Subsidy (Grant)	45%	45%	45%	45%	45%	45%	45%	45%	45%
Total Project Grants	\$46,980	\$525,870	\$369,473	\$313,200	\$355,860	\$617,523	\$1,279,239	\$853,886	\$1,607,443
Net Loan	\$57,420	\$642,730	\$451,578	\$382,800	\$434,940	\$754,751	\$1,563,514	\$1,043,638	\$1,964,653
Amount Borrowed	\$57,420	\$642,729	\$451,577	\$382,799	\$434,939	\$754,750	\$1,563,513	\$1,043,637	\$1,964,653
Interest Rate	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%
Loan Term	40	40	40	40	40	40	40	40	40
Annual Debt Service Payment	\$2,008	\$22,478	\$15,793	\$13,387	\$15,211	\$26,395	\$54,679	\$36,498	\$68,708
Projected Annual O&M Expenses	\$9,939	\$18,325	\$4,325	\$4,325	\$4,325	\$4,325	\$17,325	\$5,325	\$35,000
Total Annual Costs	\$11,947	\$40,803	\$20,118	\$17,712	\$19,536	\$30,720	\$72,004	\$41,823	\$103,708
PROJECTED COSTS AS A GRAND LIST TAX FOR VILLAGE CORE PROJECT									
Increase in Homestead Tax Rate (\$ per hundred of valve)	\$0.0028	\$0.0096	\$0.0047	\$0.0042	\$0.0046	\$0.0072	\$0.0169	\$0.0098	\$0.0244
Annual Cost for \$250,000 property	\$7.03	\$24.00	\$11.83	\$10.42	\$11.49	\$18.07	\$42.36	\$24.60	\$61.00
PROJECTED COSTS AS EQUIVALENT RESIDENTIAL UNITS (ERUs)									
Capacity of System -									
Total Number of ERUs Served	2	10	10	10	10	26	120	80	175
Annual Cost per ERU at Full Buildout	\$ 5,973	\$ 4,080	\$ 2,012	\$ 1,771	\$ 1,954	\$ 1,182	\$ 600	\$ 523	\$ 593
Notes:									
1. Based on 2010 Census, Town of Highgate is eligible for USDA Rural Development funding with eligibility of up to 45% grant. The maximum grant is presented for a "best case" scenario.									
2. The Town is eligible for RD's Intermediate Interest Rate, which currently is 1.75%. Rates are subject to change quarterly and the rate is not secured until a funding offer is provided.									
3. Rural Development's loan program allows a term to be extended to 40 years, which is presented here to provide the lowest annual debt service.									
4. Rural Development accepts funding applications for project twice yearly, in April and December.									
5. The cost per year "at full buildout" assumed the maximum number of ERUs are connected to the system. First Year costs will be higher than presented and will depend on the level of interest and actual number of connections.									
6. Estimates of tax rates are based on an estimated Grand List Value of \$425,000,000.									

Table 11
Town of Highgate
Community Wastewater Feasibility Study
Total Project Cost Summary with Funding Options (with 75% Grant)

Alternative No.	Phase 1 to Serve Village Core Property						Future (Phase 2) Community Solutions		
	1A	1B-1	1B-2	1B-2 (SS)	1B-3	1C	2A	2B	2C
Wastewater Alternative	Holding Tanks (600 gpd)	On-Site Septic (Village Core) (2,500 gpd)	Off-Site Septic (Wright) (2,500 gpd)	Off-Site Septic (Steele/ Griswold) (2,500 gpd)	Off-Site Septic (Wright) (2,500 gpd)	Off-Site Septic (Wright) (6,500 gpd)	Centralized Community Wastewater (30,000 gpd)	Decentralized Community Wastewater (3 separate 6,500 gpd systems)	
Water Alternative	Connect to Neighboring TNC	Sports Arena (PCWS)	Sports Arena (TNC)	Sports Arena (TNC)	New Well on Griswold	Sports Arena (TNC)			Community Water System (60-75 gpm well)
Construction Costs	\$72,000	\$768,000	\$549,000	\$480,000	\$504,000	\$906,000	\$1,918,000	\$1,274,000	\$2,433,000
Other Project Costs	\$18,000	\$247,000	\$162,250	\$120,000	\$186,000	\$285,074	\$541,153	\$368,724	\$652,496
Contingency (20%)	\$14,400	\$153,600	\$109,800	\$96,000	\$100,800	\$181,200	\$383,600	\$254,800	\$486,600
Total Initial Costs	\$104,400	\$1,168,600	\$821,050	\$696,000	\$790,800	\$1,372,274	\$2,842,753	\$1,897,524	\$3,572,096
Projected Subsidy (Grant)	75%	75%	75%	75%	75%	75%	75%	75%	75%
Total Project Grants	\$78,300	\$876,450	\$615,788	\$522,000	\$593,100	\$1,029,206	\$2,132,065	\$1,423,143	\$2,679,072
Net Loan	\$26,100	\$292,150	\$205,263	\$174,000	\$197,700	\$343,069	\$710,688	\$474,381	\$893,024
Amount Borrowed	\$26,100	\$292,149	\$205,262	\$173,999	\$197,699	\$343,068	\$710,687	\$474,380	\$893,024
Interest Rate	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%
Loan Term	40	40	40	40	40	40	40	40	40
Annual Debt Service Payment	\$913	\$10,217	\$7,178	\$6,085	\$6,914	\$11,998	\$24,854	\$16,590	\$31,231
Projected Annual O&M Expenses	\$9,939	\$18,325	\$4,325	\$4,325	\$4,325	\$4,325	\$17,325	\$5,325	\$35,000
Total Annual Costs	\$10,852	\$28,542	\$11,503	\$10,410	\$11,239	\$16,323	\$42,179	\$21,915	\$66,231
PROJECTED COSTS AS A GRAND LIST TAX FOR VILLAGE CORE PROJECT									
Increase in Homestead Tax Rate (\$ per hundred of valve)	\$0.0026	\$0.0067	\$0.0027	\$0.0024	\$0.0026	\$0.0038	\$0.0099	\$0.0052	\$0.0156
Annual Cost for \$250,000 property	\$6.38	\$16.79	\$6.77	\$6.12	\$6.61	\$9.60	\$24.81	\$12.89	\$38.96
PROJECTED COSTS AS EQUIVALENT RESIDENTIAL UNITS (ERUs)									
Capacity of System -	2	10	10	10	10	26	120	80	175
Total Number of ERUs Served	5,426	2,854	1,150	1,041	1,124	628	351	274	378
Notes:									
1. Based on 2010 Census, Town of Highgate is eligible for USDA Rural Development funding with eligibility of up to 45% grant. The maximum grant is presented for a "best case" scenario.									
2. The Town is eligible for RD's Intermediate Interest Rate, which currently is 1.75%. Rates are subject to change quarterly and the rate is not secured until a funding offer is provided.									
3. Rural Development's loan program allows a term to be extended to 40 years, which is presented here to provide the lowest annual debt service.									
4. Rural Development accepts funding applications for project twice yearly, in April and December.									
5. The cost per year "at full buildout" assumed the maximum number of ERUs are connected to the system. First Year costs will be higher than presented and will depend on the level of interest and actual number of connections.									
6. Estimates of tax rates are based on an estimated Grand List Value of \$425,000,000.									

f. **Short Lived Asset Reserve** – As a condition of funding from CWSRF to Rural Development, and as good practice, the Town will need to show the annual budget includes a set aside line item for repair and/or replacement of short-term assets, such as equipment at pump stations. The values of these assets can be better determined during final design and permitting (Step 2) of this process.

11.0 CONCLUSIONS/RECOMMENDATIONS/NEXT STEPS

The following actions are recommended regarding community-type water and/or wastewater solutions for the Village Center and Growth Center Concept Area.

1. The VCMP Committee should engage with residents about to determine if the community would support an acknowledgement that the small lots and overlapping water and wastewater systems in the Village Center constitute an “emergent condition”.
2. It is the opinion of Otter Creek Engineering that a combination of both a public community water supply for the village, and decentralized wastewater solution will provide the greatest long-term benefit to the Village, address this emergent condition, and be completed with both reasonable capital and operations expenses with adequate grant funding.
3. Perform a survey and inventory of existing water supplies in the area around the Village Core site, to identify opportunities for shared water system and confirm the source isolation zones around the Village Core property. Consider offering these properties the water quality testing of their wells to identify if any bacteriological contamination is prevalent.
4. Evaluate the suitability of the Town Office Well to supply the Village Core property. The first step would involve completing a detailed water quality analysis of the well, in addition to verifying that the well meets all of the required isolation distances.
5. Approach the owners of the following properties to determine their interest in granting or negotiating an agreement for a permanent easement, right of first refusal, or an option for portions of land that could be utilized for current and/or future needs for water and wastewater facilities.
 - a. Wright – OCE would recommend securing the ability to ultimately retain 10-20 acres for a large scale system with an Indirect Discharge Permit. This would provide the Town with the greatest amount of flexibility in the future, related to expansion of the recommended decentralized wastewater solution.
 - b. Cassidy – Would recommend siting a well, and securing an option to purchase. Should the Town decide to proceed with the development of a community water system, we would recommended owning a controlling as much of the land as practical. The minimum amount of land required to be under the Town’s direct control is 200-feet, centered on the source well.
6. The Town should consider providing public outreach and information to residents on the benefits of septic system maintenance, including periodic pumping of septic tanks, and encourage installation and maintenance of effluent filters in septic tanks to keep solids from overflowing, and increase the useful life of the existing systems.

7. With community interest, the Town should consider applying for Step II funds through the Cleanwater State Revolving Fund and/or Drinking Water State Revolving Fund for the design and permitting of community-based water and wastewater solutions.
8. Provide a copy of this report (when approved by the CWSRF program) to the USDA Rural Development Engineering Section for review and comment.
9. Apply for construction funding through the Rural Development Program. Application enrollment has historically occurred two times per year, with the close of applications occurring in November and April. Given that the Town has completed planning, submitting an application for construction funding in November is reasonable.
10. OCE recommends additional public outreach, through the use of mailings, open forum discussions and Selectboard meetings to discuss whatever project moves forward.

Table 1
Town of Highgate
Community Wastewater Feasibility Study
Population Trends

Year	State of Vermont		Franklin County		Town of Highgate	
1970	444,330		31,282		1,936	
1980	511,456	15%	34,788	11%	2,493	29%
1990	562,758	10%	39,980	15%	3,020	21%
2000	608,827	8%	45,417	14%	3,397	12%
2010	625,741	3%	47,746	5%	3,535	4%
2019*	623,989	-0.3%	49,402	3%	3,608	2%

Source: 2010 U.S. Census

Data presented include population and relative growth rate over previous 10-year period.

Table 2
Town of Highgate
Community Wastewater Feasibility Study
Regulatory Summary

Category of System	Regulatory Authority	Description	Applicability to Highgate Community WW Study	Notes
Wastewater				
Small-Scale	EPR, Ch. 1, WW Rules	For soil-based systems with capacities less than 6,500 gpd		
Indirect Discharge	EPR, Ch. 14, IDR	For soil-based systems with capacities at or greater than 6,500 gpd	If soil conditions allow for larger systems, these system	
Direct Discharge	Title 40 CFR, Section 122, NPDES	For systems with point source discharges to waterways	Not applicable	
Water Supply				
Non-Public	EPR, Ch. 1, WW Rules	Covers all water systems that are not considered "Public" including single family residences with private wells, to 9 lot developments with a shared water system		
Public Transient Non-Community (TNC)	EPR, Ch. 21 (WSR)			
Public Non-Transient Non-Community (NTNC)	EPR, Ch. 21 (WSR)			
Public Community (PCWS)	EPR, Ch. 21 (WSR)	For systems serving at least 10 residential connections or 25 year-round residential population	Would provide safe, reliable water to all properties	

Abbreviations:

EPR = Environmental Protection Rules

WW Rules = Wastewater System and Potable Water Supply Rules

IDR = Indirect Discharge Rules

WSR = Water Supply Rule

CFR = Code of Federal Regulations (Title 40 is "Protection of Environment")

NPDES = U.S. Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System

Table 3
Town of Highgate
Community Wastewater Feasibility Study
Existing Uses in Potential Service Area

Table 4
Town of Highgate
Community Wastewater Feasibility Study
Potential Large-Scale Community Wastewater Disposal Sites

Area#	Property Owner	Parcel Address	SPAN #	Existing Use	Total Acreage of Parcel (ac)	Distance from Village Core Property (ft)	Recommend Further Study/ Test Pits?	Notes
1	Vermont Transco, LLC	Route 78	291-092-12053	Electric Utility	34	4,000		
	Town of Highgate (formerly Casella Waste Management, Inc.)	442 Transfer Station Road	291-092-11850	Municipal	185 +/-			
2	Vermont Transco, LLC	Route 78	291-092-12053	Electric Utility	34	2,000		Potential issue with easement across electrical transmission mains; Potential issue with unstable steep slopes
3	Town of Highgate	Mill Hill Road	291-092-10782	Empty Lot	3.50	1,000	YES	Mostly wooded; Difficult site access; unable to obtain approval from neighboring properties for site access
							YES	Open space adjacent to Town-owned property
4	WRB, LLC (Wright Property)	Lamkin Street	291-092-11747	Sand & Gravel Pit	98	2,500	YES	Potential for large capacity site
5	Marcel & Theresa Begnoche, Trustees/M & T Sand & Gravel	Ladimi Circle	291-092-11068	Unimproved Lot	60	3,500		Well drilled on property, for future subdivision/development?
6	Gervais Properties, LLC	Route 78	291-092-12235	Unimproved Lots (2 separate parcels)	32	3,000		Western parcel is of interest; includes driveway for 1.56 ac parcel (Laroche);
7	Richard Cassidy	917 Gore Road	Not Available (Map # 0013-207-362)	Unimproved Lot	7.6	2,000		Property has an existing permit for a 5,500 gpd wastewater system

Table 5 Town of Highgate Community Wastewater Feasibility Study Potential Community Water Supply Source Sites								
Site#	Property Owner	Parcel Address	SPAN #	Existing Use	Total Acreage of Parcel (ac)	Approx. Distance from Edge of Distribution System (ft)	Recommend Further Review/ Landowner Contact?	Notes
1	Jaques & Jean Rainville	1159 Gore Road	291-092-11416	Farm	244	5,000		
2	Estate of Phyllis Cassidy	917 Gore Road	291-092-10329	Farm (3 contiguous parcels)	127	2,000	YES	Drilled well for proposed Cassidy Meadows Development (34 ERUs) on parcel
3	Borderview Farm II SAR LLC	St. Armand Road	291-092-12087	Open Lot (Agricultural)	49	2,000	YES	
4	Borderview Farm II SAR LLC	St. Armand Road	291-092-12086	Farm	88	1,000	YES	
5	Trustees of Gemma & Gilbert A. Boucher	292 Carter Hill Road	291-092-10176	SFH	193	5,000		
6	Vermont Transco, LLC	Route 78	291-092-12053	Electric Utility	34	3,000		Potential issue with easements across electric transmission corridor
7	WRB, LLC	Lamkin Street	291-092-11747	Sand & Gravel Pit	98	750		Same site as Potential Wastewater Disposal Site
8	WRB, LLC	Lamkin Street	291-092-11747	Sand & Gravel Pit	98	2,500		
9	Adam B. Locke	1158 Lamkin Street	291-092-11043	SFH	24	5,000		
10	David G. & Cora Baker	Highgate Road	291-092-10031	Misc	118	> 5,000		Would require Mississquoi Bridge crossing;

Table 6
Town of Highgate
Community Wastewater Feasibility Study
Summary of Wastewater Options Considered

Option ID	Reference Figure #	Description	Opinion of Probable Construction Cost (OPCC)	Advantages	Disadvantages	Notes
Wastewater Disposal Options						
DIS1		Holding Tank at Village Core Property, with Limited Capacity only for Municipal Uses (600 gpd capacity)	\$51,750	Low initial cost No collection system or pumping required Tanks could be designed for future use as septic tanks/pump station	Limited to municipal uses only Subject to increasing disposal costs from vendors No expansion capacity	
DIS2		On-Site Septic at Village Core Property (2,500 gpd capacity)	\$92,000	No collection system or pumping required	Requires elimination of individual well isolation shields; Requires land that may be needed for other	
DIS3		Former Steele/ Griswold Property (2,500 gpd capacity)	\$57,500	Town-owned site	Very difficult site access Site located near unstable slope Landowners in area are expected to oppose project	
DIS4A		Wright Property (2,500 gpd capacity)	\$46,000	Site would be available for future expansion	Farther distance from Village Core property requires higher initial investment	
DIS4B		Expand Capacity at Wright Property (6,499 gpd capacity)	\$92,000	Site would be available for future expansion; Site would provide some additional capacity for further economic development or replacement for a select group of properties		
DIS4C		New Septic Tanks and Distribution System at Wright Property, Expand Disposal Capacity (30,000 gpd capacity)	\$759,000	Provides significant disposal capacity and the most flexibility for infill development in Highgate Center		
DIS5		Multiple Smaller/ Decentralized Sites (6,500 gpd or less)	\$195,500	Avoids the need to obtain an Indirect Discharge Permit	Requires negotiations with multiple landowners	
Wastewater Collection System Options						
CS1		Septic Tank at VC Site, Effluent Pump Station and Force Main to Steele/Griswold Property	\$209,875			
CS2		Septic Tank at VC Site, Effluent Pump Station and Force Main to Wright Property	\$290,375			
CS3		New Septic Tank Effluent Gravity Sewer on St. Armand Rd to VC Site; Add Septic Tanks at VC Site	\$600,875			
CS4		New Septic Tank Effluent Collection North and West of VC Site, Upgrade Pump Station at VC Site, Provide New (Separate) Gravity Sewers South and West to Wright Property. Refer to Figure [#]	\$1,158,625			
CS5		Decentralized Collection System including New Septic Tank Effluent Pump Systems for Gore Road and Rt. 78 Service Areas,, Refer to Figure [#]	\$1,078,125			

Table 7
Town of Highgate
Community Wastewater Feasibility Study
Summary of Water System Options Considered

Option ID	Reference Figure #	Description	Opinion of Probable Construction Cost (OPCC)	Advantages	Disadvantages	Notes
Water Source Options						
WS1		Convert Highgate Sports Arena to Public Community Water System	\$296,125	Well capacity is known; Utilize existing Town-owned resource	Well does not meet all permitting setbacks; Requires easement on neighboring property (with use restrictions) for source isolation	
WS2		Drill and Permit New Well (5 gpm) for VC Site Only; Assume location is on Steele/Griswold property	\$41,400	Site is Town-owned	A new well would need to be drilled and permitted, without certainty of water quantity and quality;	This option is provided for representative purposes to provide costs for drilling a new off-site well only for the Village Core property.
WS3		Drill and Permit New Public Community Water Supply Well near Cassidy Meadows Project (Potential Source Location No. 2)	\$721,625		A new well would need to be drilled and permitted, without certainty of water quantity and quality;	
Water Distribution System Options						
WD1		Interim Connection of Village Core Site to an Existing Neighboring System. Potential Options: - Elem School - Highgate Village Market - Post Office	\$20,125			
WD2		Water Transmission Main from Sports Arena to VC Site and Properties Needed to Remove Well Shields	\$379,500			
WD3		Extend water service from Highgate Sports Arena to VC Site Only	\$192,050			Obtain Small Scale W/WW Permit amendment for connection of VC Site to Highgate Sports Arena
WD4		Water Service Piping from Steele/Griswold property to Village Core Property	\$126,500			
WD5		New Transmission Main throughout Village Center	\$1,711,600	Eliminates all conflicts between overlapping well shields and septic system	High capital costs; would need high subscriber rate to provide reasonable user costs	

Table 8
Town of Highgate
Community Wastewater Feasibility Study
Summary of Alternatives Considered

				Wastewater		Water		Initial Capital Needed for Project	Present Worth Cost of Alternative	Total Number of ERUs Served	Potential Annual Costs per ERU Served at Full Buildout (Depending on Available Funding)	Notes		
				WW Collection System Options		WW Disposal Options								
Phase 1 (Development of Village Core Property)	Scenario A - Limited Capacity at Village Core Property	Alternative 1A	None	DIS1	Holding Tank at Village Core Property, with Limited Capacity only for Municipal Uses (600 gpd capacity)	None	WD1	Interim Connection of Village Core Site to an Existing Neighboring System. Potential Options: - Elem School - Highgate Village Market - Post Office	\$104,400	\$276,400	2	\$5,973 - \$7,300	This alternative would need to be presented as an interim wastewater solution; Only municipal uses (such as a Library) would be allowed; Providing a water connection for the VC site to a neighboring property may require a variance from the WW Rules; existing Town Library is currently connected to Highgate Village Market.	
	Scenario B - Serve Village Core (VC) Site Only	Alternative 1B-1	None	DIS2	On-Site Septic at Village Core Property (2,500 gpd capacity)	WS1	Convert Highgate Sports Arena to Public Community Water System	WD2	Water Transmission Main from Sports Arena to VC Site and Properties Needed to Remove Well Shields	\$1,168,600	\$1,486,600	10	\$4,080 - \$7,050	Approximately 8-10 properties in the vicinity of the VC site would need to be provided with an off-site water supply for on-site septic to be feasible; Water option requires source testing and permitting, and would likely need a variance from Water Supply Rules due to location of existing well (proximity to buildings, driveways)
		Alternative 1B-2	CS1	DIS3	Septic Tank at VC Site, Effluent Pump Station and Force Main to Steele/Griswold Property	Former Steele/ Griswold Property (2,500 gpd capacity)	WD3	Obtain Small Scale W/WW Permit amendment for connection of VC Site to Highgate Sports Arena	\$665,550	\$740,550	10	\$1,713 - \$3,404	Test pits are needed at Steele/Griswold property to confirm feasibility; based on site conditions, this location would not be suitable for increased wastewater capacity beyond the VC site; Site access for construction and maintenance activities is a significant challenge; Water option assumes the existing permitted capacity would allow for a connection to VC site uses	
		Alternative 1B-3	CS2	DIS4A	Septic Tank at VC Site, Effluent Pump Station and Force Main to Wright Property	Wright Property (2,500 gpd capacity)	WS2	Drill and Permit New Well (5 gpm) for VC Site Only; Assume location is on Steele/Griswold property	WD4	Water Service Piping from Steele/Griswold property to Village Core Property	\$790,800	\$852,800	10	\$1,876 - \$3,886
	Scenario C - Serve Village Core and Properties with Soil Limitations on St. Armand Road	Alternative 1C	CS3	DIS4B	New Septic Tank Effluent Gravity Sewer on St. Armand Rd to VC Site; Add Septic Tanks at VC Site	Expand Capacity at Wright Property (6,499 gpd capacity)	WD3	Obtain Small Scale W/WW Permit amendment for connection of VC Site to Highgate Sports Arena	\$1,342,234	\$1,417,234	26	\$1,159 - \$2,471	This alternative may be realized with any of the Water Source Alternatives WS1-WS4	
Future/ Full Buildout (To Serve Entire Village Center)	Alternative 2A		CS4	DIS4C	New Septic Tank Effluent Collection North and West of VC Site, Upgrade Pump Station at VC Site, Provide New (Separate) Gravity Sewers South and West to Wright Property. Refer to Figure [#]	New Septic Tanks and Distribution System at Wright Property, Expand Disposal Capacity (30,000 gpd capacity)			\$2,842,753	\$3,142,753	120	\$600 - \$1,202	This option assumes collection system Alternative CS5 to serve the Village Core Property and St. Armand Rd area. Potential options for new wastewater collection on Gore Rd, Rt. 78, Decatur St. and Lamkin Road include: Traditional Gravity Sewer, Septic Tank Effluent Gravity (STEG), or Septic Tank Effluent Pumping (STEP) Systems. Effluent Force Main. Due to long runs and flat terrain, assumed STEP System for this analysis.	
	Alternative 2B		CS5	DIS5	Decentralized Collection System including New Septic Tank Effluent Pump Systems for Gore Road and Rt. 78 Service Areas, Refer to Figure [#]	Multiple Smaller/ Decentralized Sites (6,500 gpd or less)			\$1,897,524	\$1,989,524	80	\$523 - \$1,126	This option assumes collection system Alternative CS5 to serve the Village Core Property and St. Armand Rd area. Assumes STEP Systems for Gore Road area and disposal on a prior permitted wastewater disposal site, requiring a negotiated agreement depending on fate of planned development. Assumes a STEP System for Route 78 area to Potential Disposal Site No. 6, which would require test pits for viability.	
	Alternative 2C			WS3	Drill and Permit New Public Community Water Supply Well near Cassidy Meadows Project (Potential Source Location No. 2)		WD5	New Transmission Main throughout Village Center	\$3,572,096	\$4,179,096	175	\$593 - \$1,111	Potential Water Source Location No. 2 is adjacent to property which has existing permit for 34-unit development; Cost to develop other potential source locations (such as Source Location Nos. 2 or 3) would be similar, aside from the cost of transmission from the well site to the Village Center boundary.	

Table 9
Town of Highgate
Community Wastewater Feasibility Study
Total Project Cost Summary with Funding Options (CWSRF Funding with No Subsidies)

Table 10
Town of Highgate
Community Wastewater Feasibility Study



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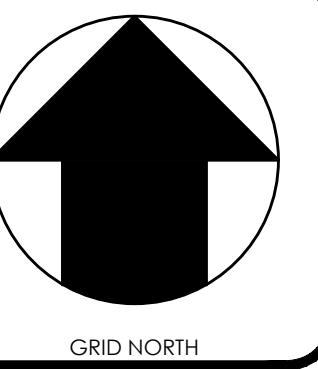
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**TOWN OF HIGHGATE
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FEASIBILITY STUDY
HIGHGATE, VERMONT**

PRELIMINARY

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TITLE: GENERAL
LOCATION MAP

FIGURE NO.



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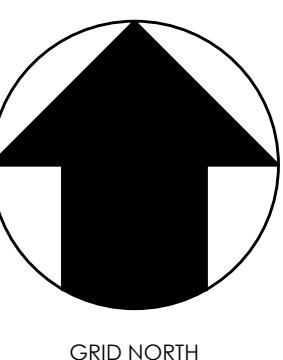
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TITLE: EXISTING
WATER AND
WASTEWATER
SYSTEMS
FIGURE NO.



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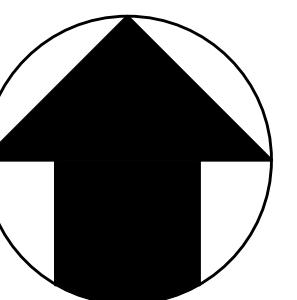
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HIGHGATE, VERMONT

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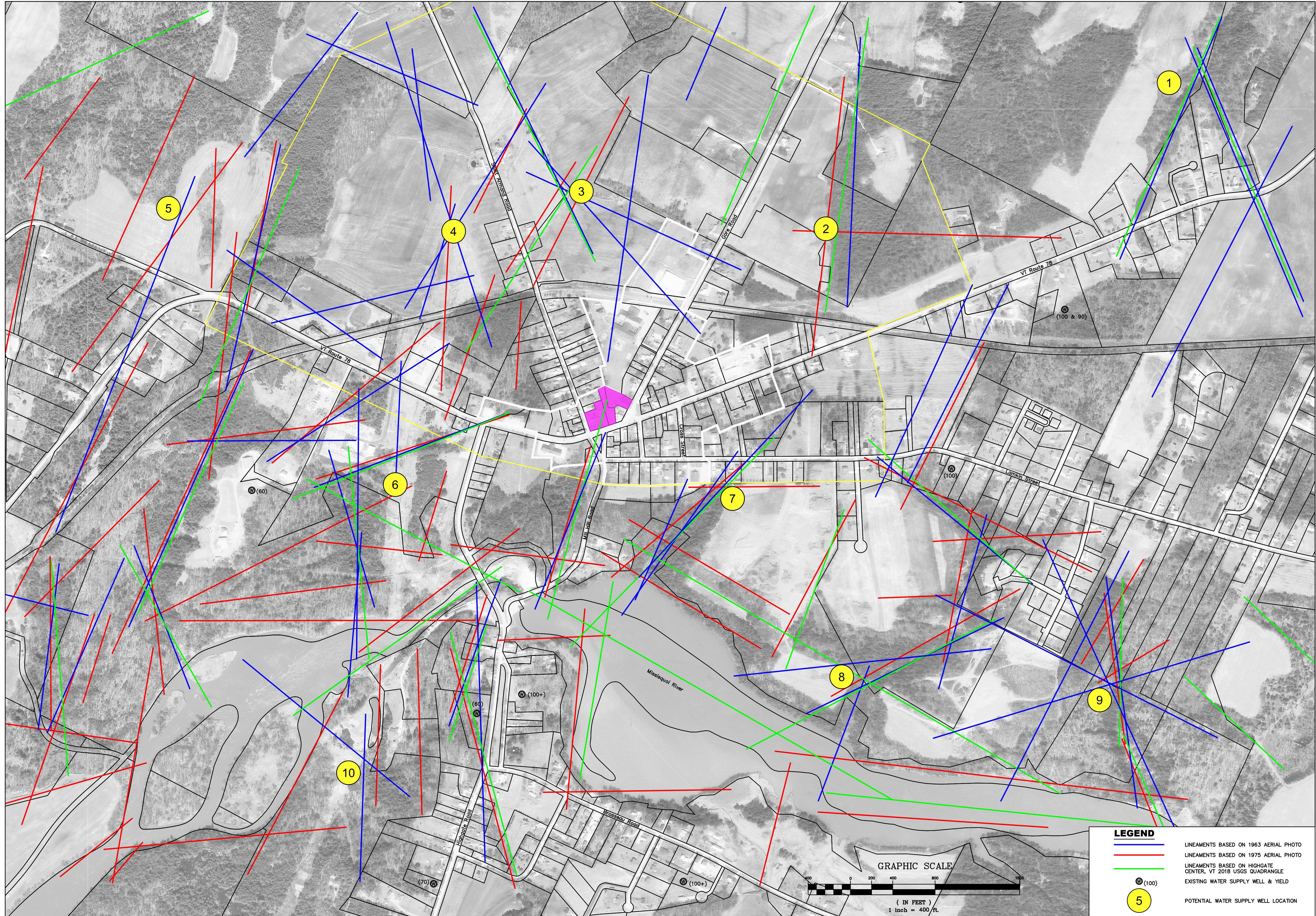
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POTENTIAL WASTEWATER DISPOSAL LOCATIONS

RE NO.





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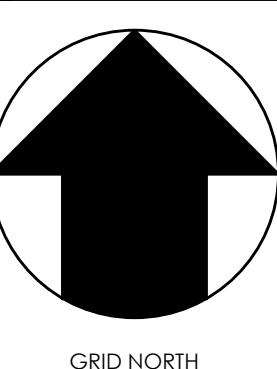
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HIGHGATE, VERMONT**

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TITLE: POTENTIAL
WATER SOURCE
LOCATIONS

FIGURE NO.



GRID NORTH

ALTERNATIVE 1A PROVIDES AN INTERIM OFF-SITE WATER SOLUTION AND A LIMITED WASTEWATER SOLUTION FOR ONLY THE VILLAGE CORE PROPERTY. IN THIS ALTERNATIVE, WASTEWATER CAPACITY IS LIMITED AND ONLY MUNICIPAL USES WOULD BE ALLOWED. FULL BUILDOUT OF THE PROJECT IS NOT FEASIBLE.



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FEASIBILITY STUDY
HIGHGATE, VERMONT

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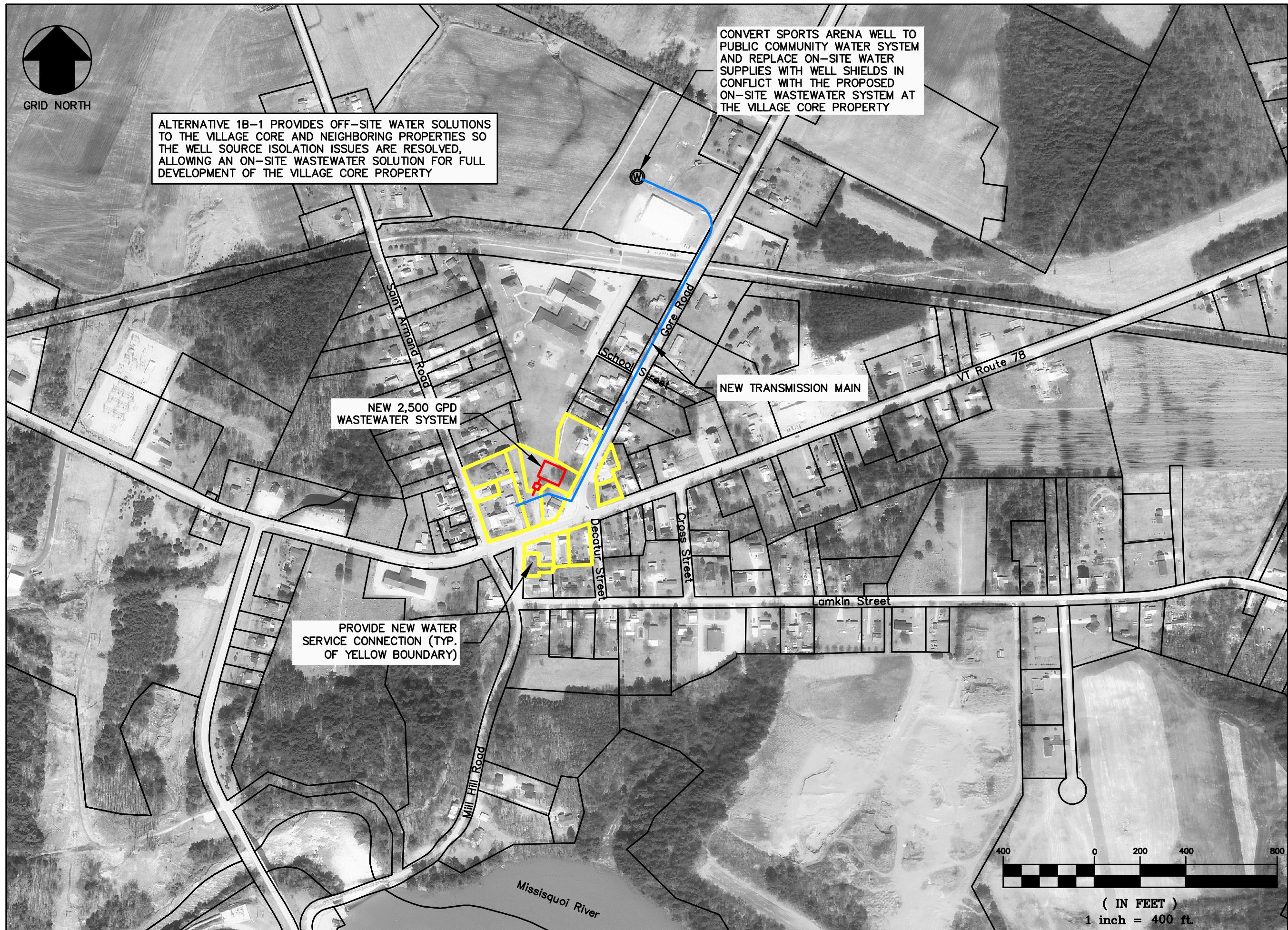
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1A**

FIGURE NO.

5



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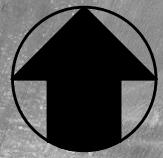
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TITLE: ALTERNATIVE
1B-1

FIGURE NO.

6



GRID NORTH

ALTERNATIVE 1B-2 PROVIDES OFF-SITE WATER AND WASTEWATER SOLUTIONS FOR FULL DEVELOPMENT OF THE VILLAGE CORE PROPERTY

CONNECT TO EXISTING SPORTS ARENA WELL AND NEW SERVICE CONNECTION TO VILLAGE CORE PROPERTY ONLY

Saint Armand Road

Cole Road

School Street

VT Route 78

Decatur Street

Cross Street

Lamkin Street

PUMP STATION

SEWER FORCE MAIN

NEW 2,500 GPD WASTEWATER DISPOSAL SYSTEM FOR VILLAGE CORE PROPERTY ONLY

POTENTIAL DISPOSAL SITE NO. 3 (FORMER STEELE/GRISWOLD)

Mill Hill Road

Missisquoi River

400 0 200 400 800
(IN FEET)
1 inch = 400 ft.



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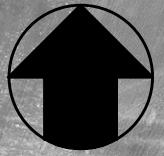
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1B-2

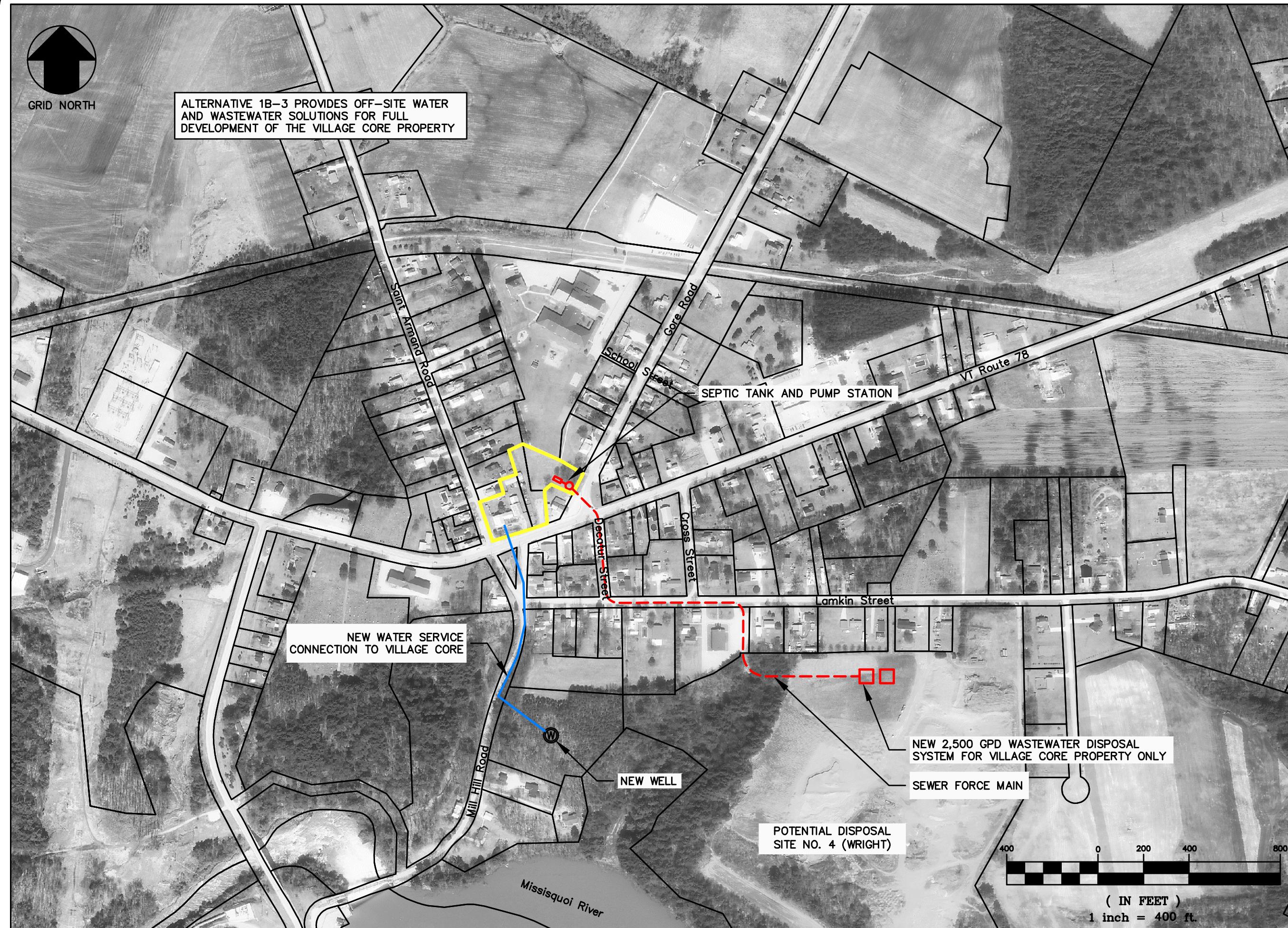
FIGURE NO.

7



GRID NORTH

ALTERNATIVE 1B-3 PROVIDES OFF-SITE WATER AND WASTEWATER SOLUTIONS FOR FULL DEVELOPMENT OF THE VILLAGE CORE PROPERTY



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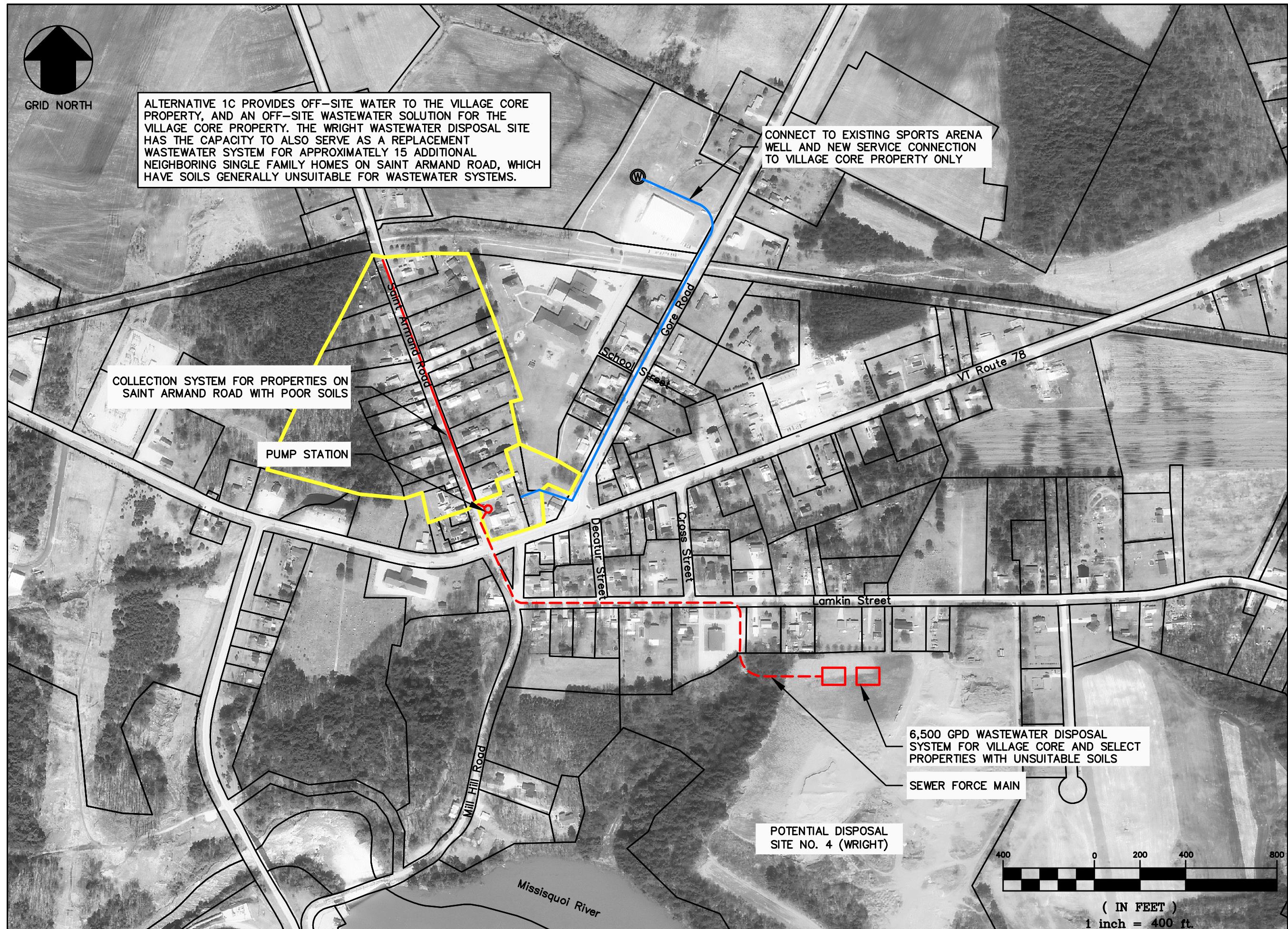
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FIGURE NO.



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ALTERNATIVE 1C	

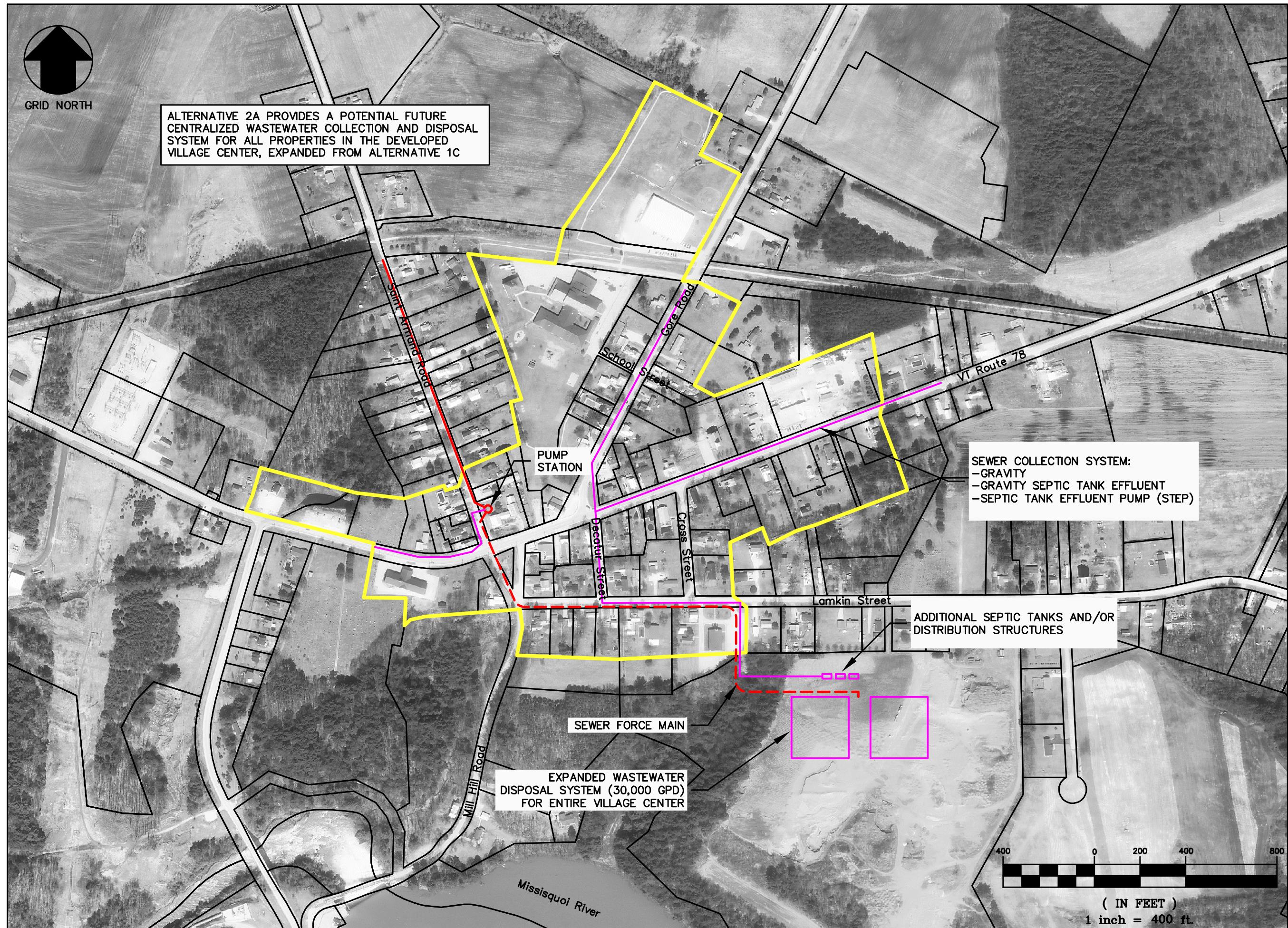
FIGURE NO.

9



GRID NORTH

ALTERNATIVE 2A PROVIDES A POTENTIAL FUTURE
CENTRALIZED WASTEWATER COLLECTION AND DISPOSAL
SYSTEM FOR ALL PROPERTIES IN THE DEVELOPED
VILLAGE CENTER, EXPANDED FROM ALTERNATIVE 1C



COMMUNITY WASTEWATER FEASIBILITY STUDY HIGHGATE, VERMONT

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ALTERNATIVE
2A

FIGURE NO.

10



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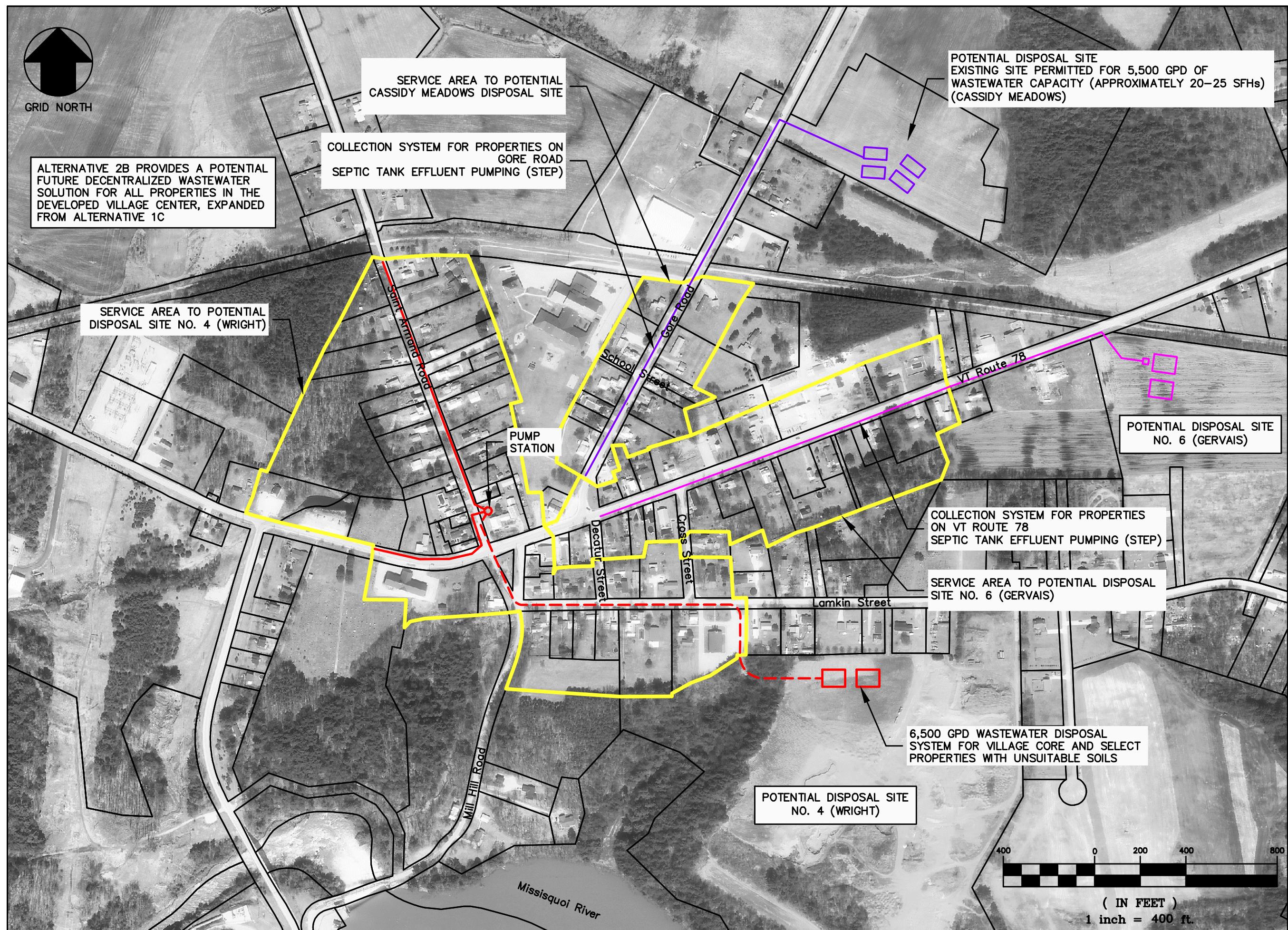
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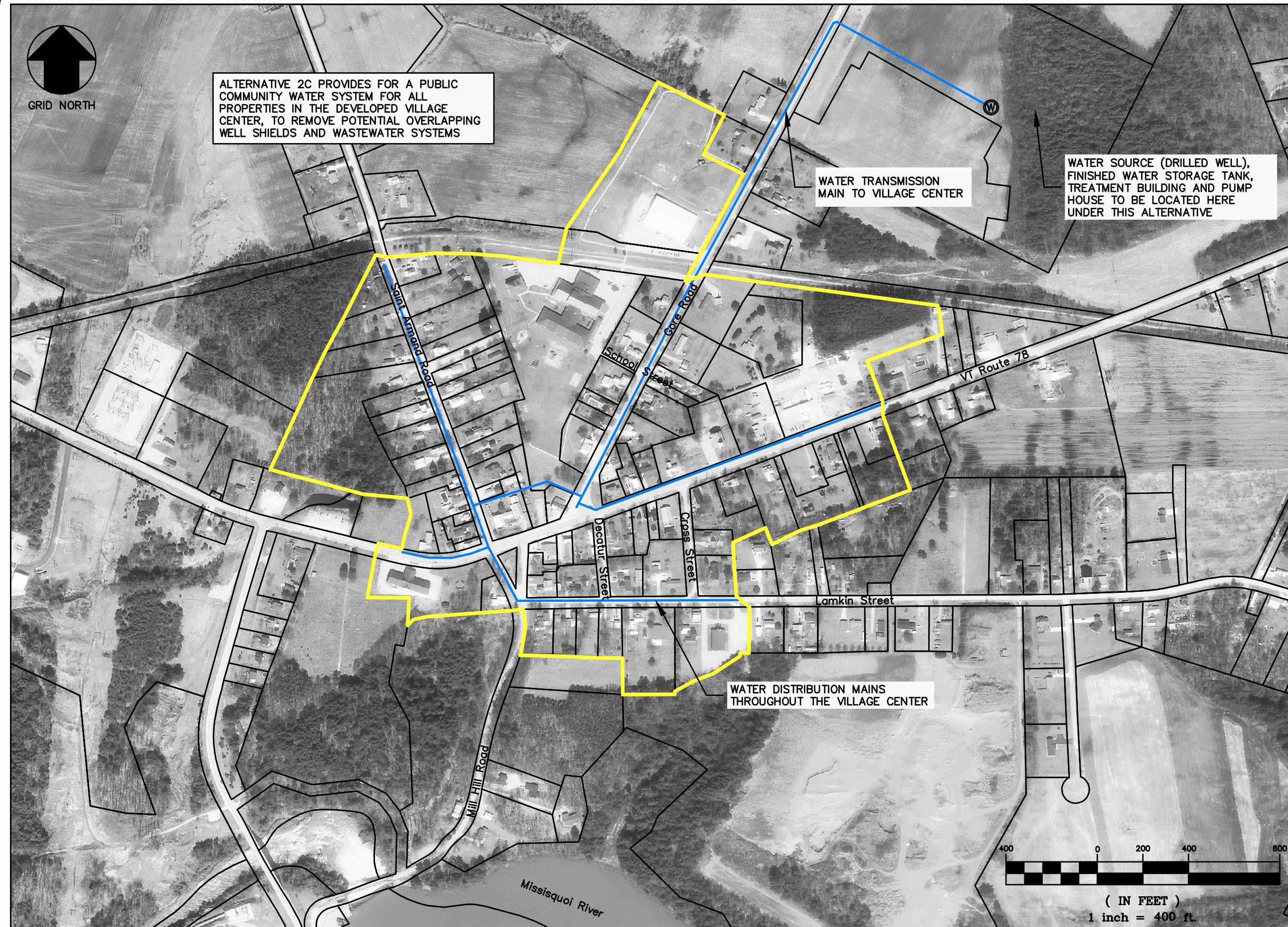


GRID NORTH

ALTERNATIVE 2C PROVIDES FOR A PUBLIC
COMMUNITY WATER SYSTEM FOR ALL
PROPERTIES IN THE DEVELOPED VILLAGE
CENTER, TO REMOVE POTENTIAL OVERLAPPING
WELL SHIELDS AND WASTEWATER SYSTEMS

WATER TRANSMISSION
MAIN TO VILLAGE CENTER

WATER SOURCE (DRILLED WELL),
FINISHED WATER STORAGE TANK,
TREATMENT BUILDING AND PUMP
HOUSE TO BE LOCATED HERE
UNDER THIS ALTERNATIVE



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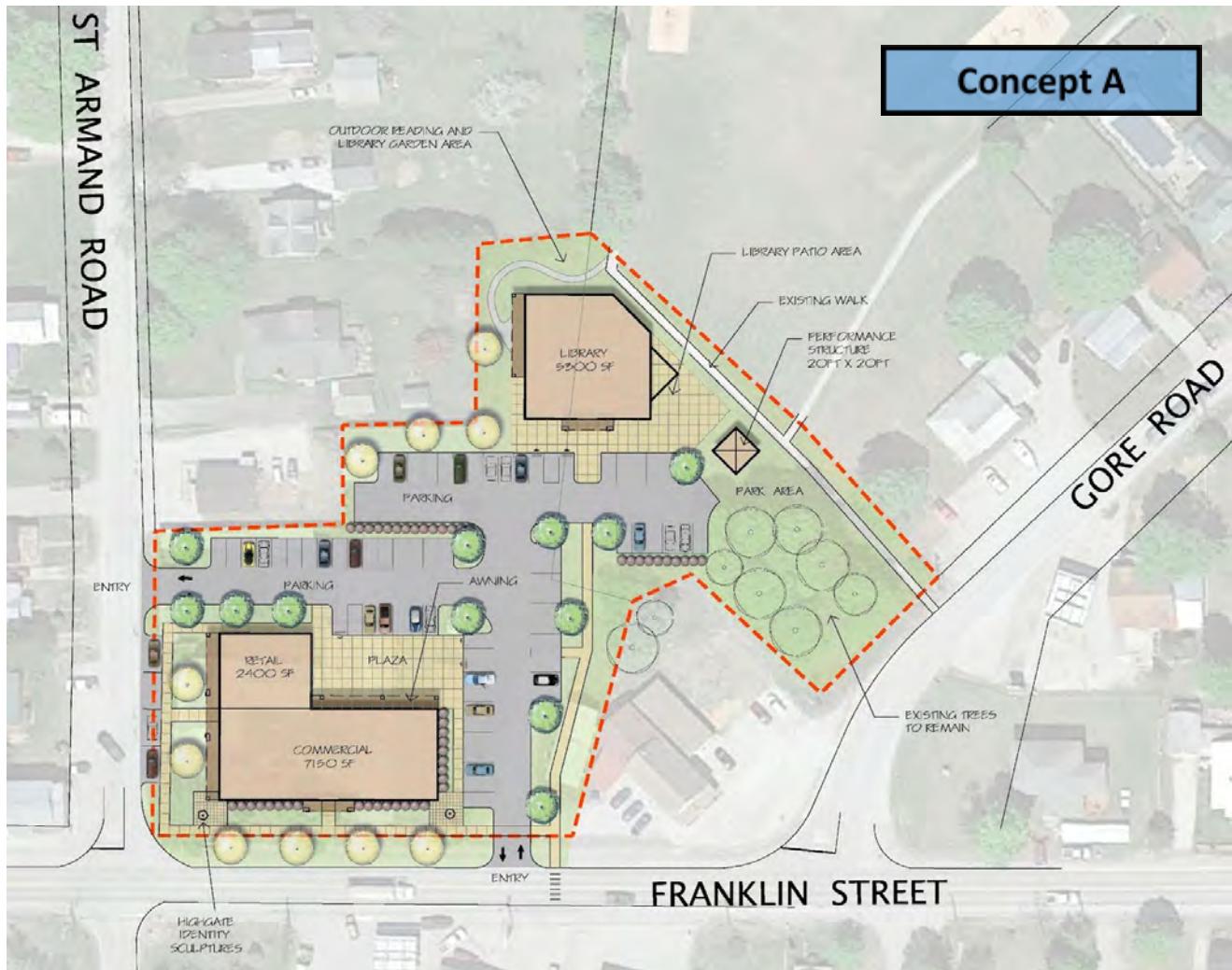
TITLE:
**ALTERNATIVE
2C**

FIGURE NO.

12

**APPENDIX A – ESTIMATED WASTEWATER DESIGN CAPACITY AND CONCEPTUAL PLANS, EXCERPTS
FROM IMPLEMENTATION PLAN FOR HIGHGATE TOWN CENTER, BY BUILD STRATEGIES
CONSULTING, CENTERLINE ARCHITECTS, AND THE HOUSING INITIATIVE, JANUARY 2019**

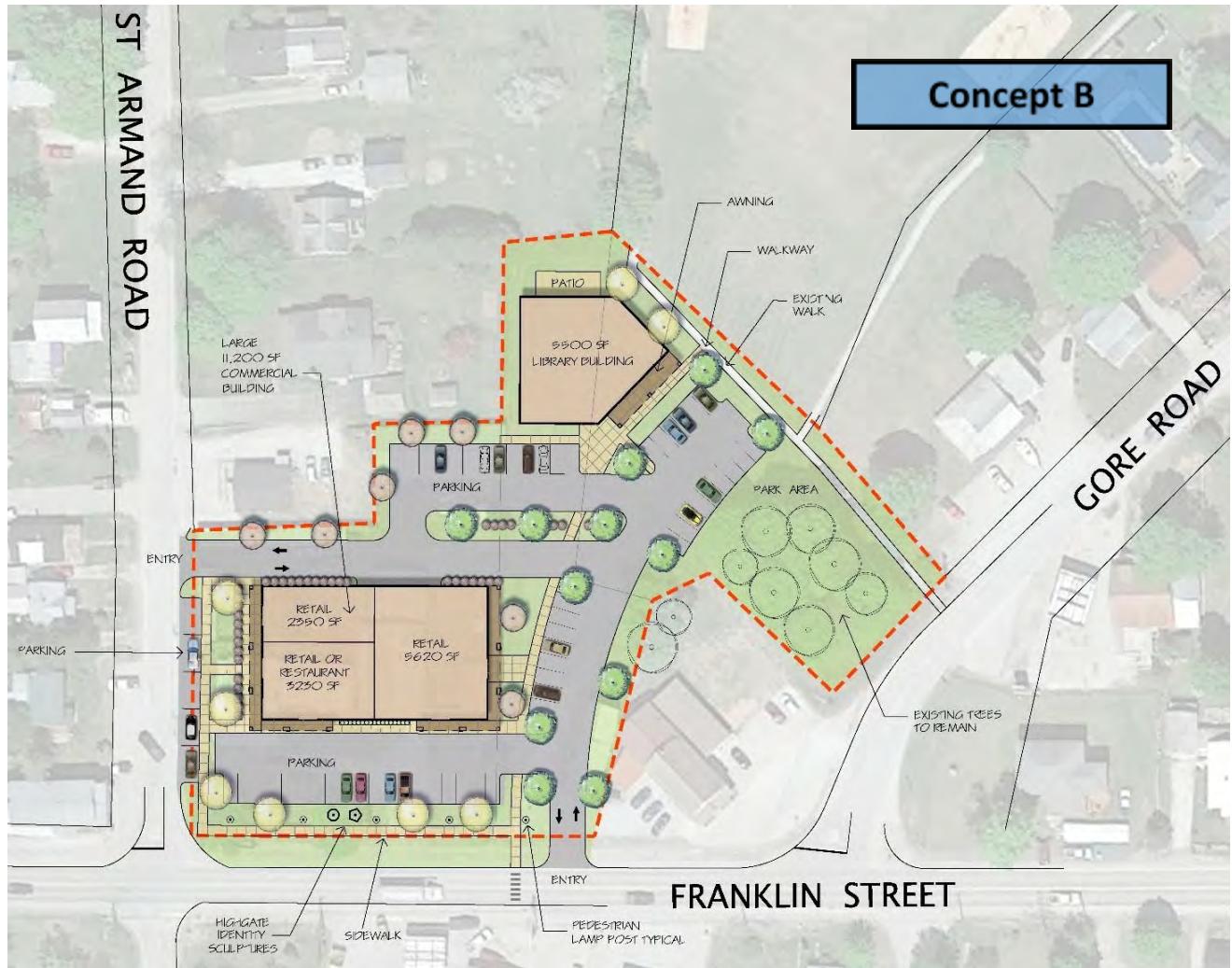
Concept Plan A



Concept A Description

Concept A is focused on the corner between St. Armand Road and Route 78. A corner building creates a sense of place and acknowledges that a visitor has reached the center of Highgate. For these reasons the retail building is placed close to RT 78 and a sidewalk in front of the retail building activates the street and the front of the building.

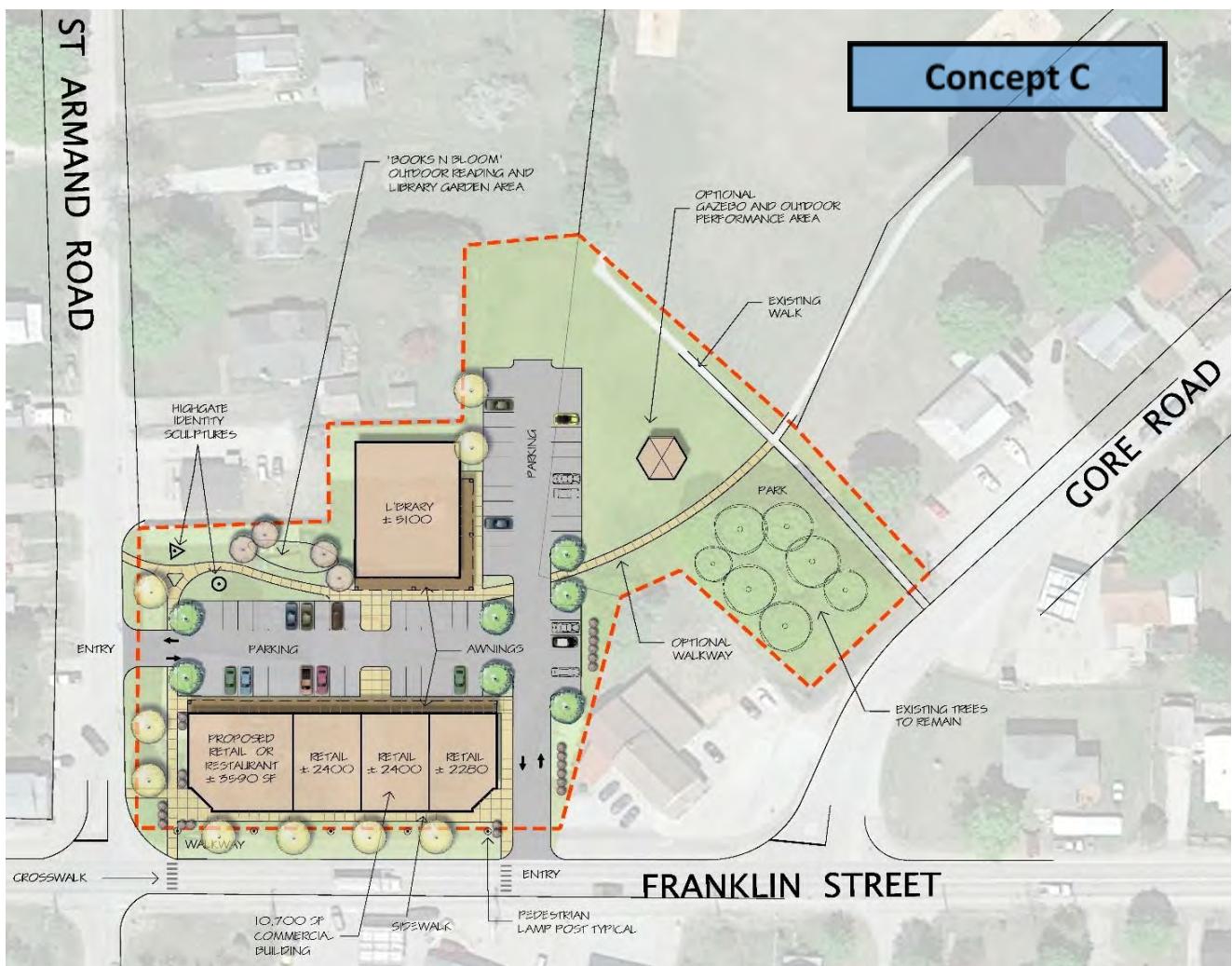
Concept Plan B



Concept B Description

The retail building in Concept B is set back from Route 78. The area between the RT 78 and retail building is occupied by a parking lot. The building's rectangular footprint is surrounded by parking and site access roads. There is slightly more parking in this scheme - 76 parking spots, spread throughout the site. The library, like in Concept A, is

Concept Plan C



Concept C Description

Concept C fits the Retail/Commercial and library buildings within the boundaries of just the Machia / former town garage site. Although both buildings have a smaller building

**APPENDIX B – HIGHGATE VILLAGE CORE WASTEWATER AND WATER FEASIBILITY STUDY:
PLANNING ANALYSIS, BY NORTHWEST REGIONAL PLANNING COMMISSION, FEBRUARY 2020**



Highgate Village Core Wastewater and Water Feasibility Study: Planning Analysis

February 26, 2020

Contents

Introduction	1
Current Conditions in Highgate.....	1
Population & Economy	1
Current Land Use	2
Patterns of Development.....	2
Highgate Center and Other Village Areas	2
Current Water and Wastewater Systems & Capacity.....	3
Future Development in Highgate.....	7
Future Growth of Population and Economy	7
Future Land Use	7
Housing Growth	7
Desired Pattern of Growth.....	7
Highgate Village Core Master Plan	7
Goals and Plans for Water/Wastewater in Highgate.....	10
Town Plan.....	10
Basin Plan	10
Highgate Airport Infrastructure Feasibility Study	10

List of Tables

Table 1: Private Industries in Highgate	1
Table 2: Highgate Town Plan Water & Wastewater Policies	10

List of Figures

Figure 1: Current Land Cover	2
Figure 2: Highgate Zoning Map.....	4
Figure 3: Highgate Center Designated Village Center.....	5
Figure 4: Highgate Center Municipally Owned Land	6
Figure 5: Village Growth Center.....	7
Figure 6: Highgate Village Core Site	8
Figure 7: Proposed Land Use in Highgate	9

Introduction

The Northwest Regional Planning Commission has prepared a planning analysis to assist the Town of Highgate and Otter Creek Engineering complete a Village Core Wastewater and Water Feasibility Study, funded by an FY20 Vermont Municipal Planning Grant and a Vermont Department of Environmental Conservation Wastewater Planning Advance. The planning analysis summarizes existing planning documents and planning efforts in the community as they relate to wastewater management and water supply planning. This analysis focuses on the town as a whole, with specific attention given to the Wastewater and Water Feasibility study area of Highgate Center.

Current Conditions in Highgate

Population & Economy

According to the 2010 U.S. Census, Highgate has a population of 3,535.¹ This represents an increase of 138 residents from the 2000 Census population of 3,397. Historically, the primary industry of the Town has been agriculture. Industrial and commercial growth has lagged behind residential growth.

In 2018, according to the U.S. Census American Community Survey, Highgate had 1,452 total housing units. Of those units, 1,277 were occupied and 175 were vacant.²

According to the Vermont Department of Labor, in 2019 Highgate had 33 private businesses employing 276 people.³ The industries which employed the largest number of people are summarized in Table 1 below.

Table 1: Private Industries in Highgate		
NAICS Industry	Number of Establishments	Number of Employees
Natural Resources & Mining	6	30
Construction	4	33
Retail Trade	6	29
Professional and Business Services	6	28

Highgate also has 9 government organizations, employing 370 individuals.⁴ Most of these individuals are employed by the local government in the field of education (231 individuals) or employed by the Federal government in the field of public safety (98 individuals).

¹ U.S. Census Bureau, "Total Population", 2010, <https://data.census.gov/cedsci/table?q=population&g=0600000US5001133025&tid=DECENNIALSF12010.P1&hidePreview=true>.

² U.S. Census Bureau, "DP04 Selected Housing Characteristics", 2018, <https://data.census.gov/cedsci/table?q=housing%20units&g=0600000US5001133025&tid=ACSDP5Y2018.DP04&t=Housing%20Units&hidePreview=true>.

³ Vermont Department of Labor, "Covered Employment & Wages", 2019, <http://www.vtmi.info/indareaaics.cfm?areatype=12&src=cew&base=ind20193&from=yrago&chgttype=percent&area=092>.

⁴ Vermont Department of Labor, "Covered Employment & Wages", 2019.

Current Land Use

Patterns of Development

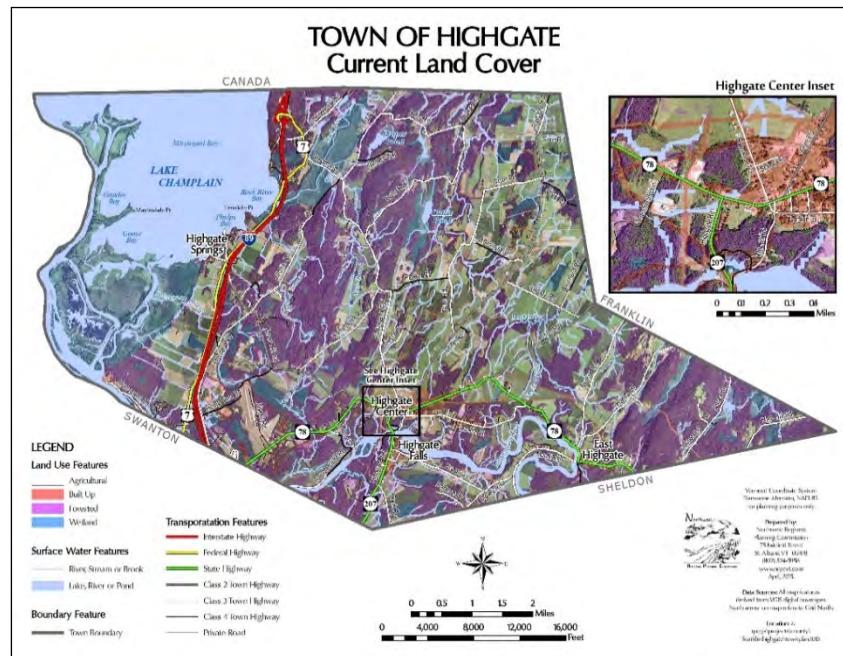
Overall, development in Highgate has typically occurred in both its historic villages and in the form of “strip” development along Route 78. Commercial development has primarily occurred along Route 78 and within Highgate Center. The greatest density of residential development has occurred within 2 miles of Highgate Center along Route 78 (see Figure 1). Residential development has also increased in Highgate Springs and East Highgate, with growing populations in both areas.

Highgate Center and Other Village Areas

The Town of Highgate’s Development Regulations identify 4 areas as Village Districts: Highgate Center, Highgate Falls, Highgate Springs & East Highgate (see Figure 2). Highgate Center is the focus of the Wastewater and Water Feasibility Study.

Three of these areas, Highgate Center, Highgate Falls, and Highgate Springs also have Agency of Commerce and Community Development (ACCD) designated Village Centers. In all three cases the amount of land considered as part of the designated village center is smaller than the area zoned as the overall Village District.

Figure 1: Current Land Cover



Highgate Center is the largest village center. All municipal buildings in Highgate are located in the Highgate Center including the Town Offices, the Highgate Library, and the Highgate Elementary School. The Town also owns 2 currently unused sites in Highgate Center, marked as 11 & 12 on Figure 2. There are 7 commercial properties within the designated Village Center and 2 churches. Residential development in Highgate Center largely consists of single-family homes (see Figure 3). The Town also owns additional land within 1 mile of Highgate Center (see Figure 4).

In the Village District, the Highgate Development Regulations require a minimum lot size of 1 acre regardless if the property were to have access to community or municipal water/sewer. A conditional use permit is required for all multifamily housing except duplexes. A conditional use permit is also required for most commercial enterprises, including restaurants, retail sales, lodging establishments, and office buildings. One factor the Development Review Board must take into account in approving these conditional uses is the capacity of existing and planned community facilities.

Highgate's Development Regulations do allow for the creation of Planned Unit Developments (PUDs) in all districts, including the Village District. PUDs allow for clustering of development closer than the minimum lot size, although the overall density of the entire development may not be greater than 1 primary structure per acre in the Village District.

[Current Water and Wastewater Systems & Capacity](#)

The Town of Highgate has no municipal water supply or sewer system. All wastewater is dealt with on an individual on-site basis. Similarly, individual wells are the primary source of water for the Town. The Town Offices and the Highgate Library share a septic system and water system. All wastewater and water supply systems are permitted through the Vermont Department of Environmental Conservation.

Figure 2: Highgate Zoning Map

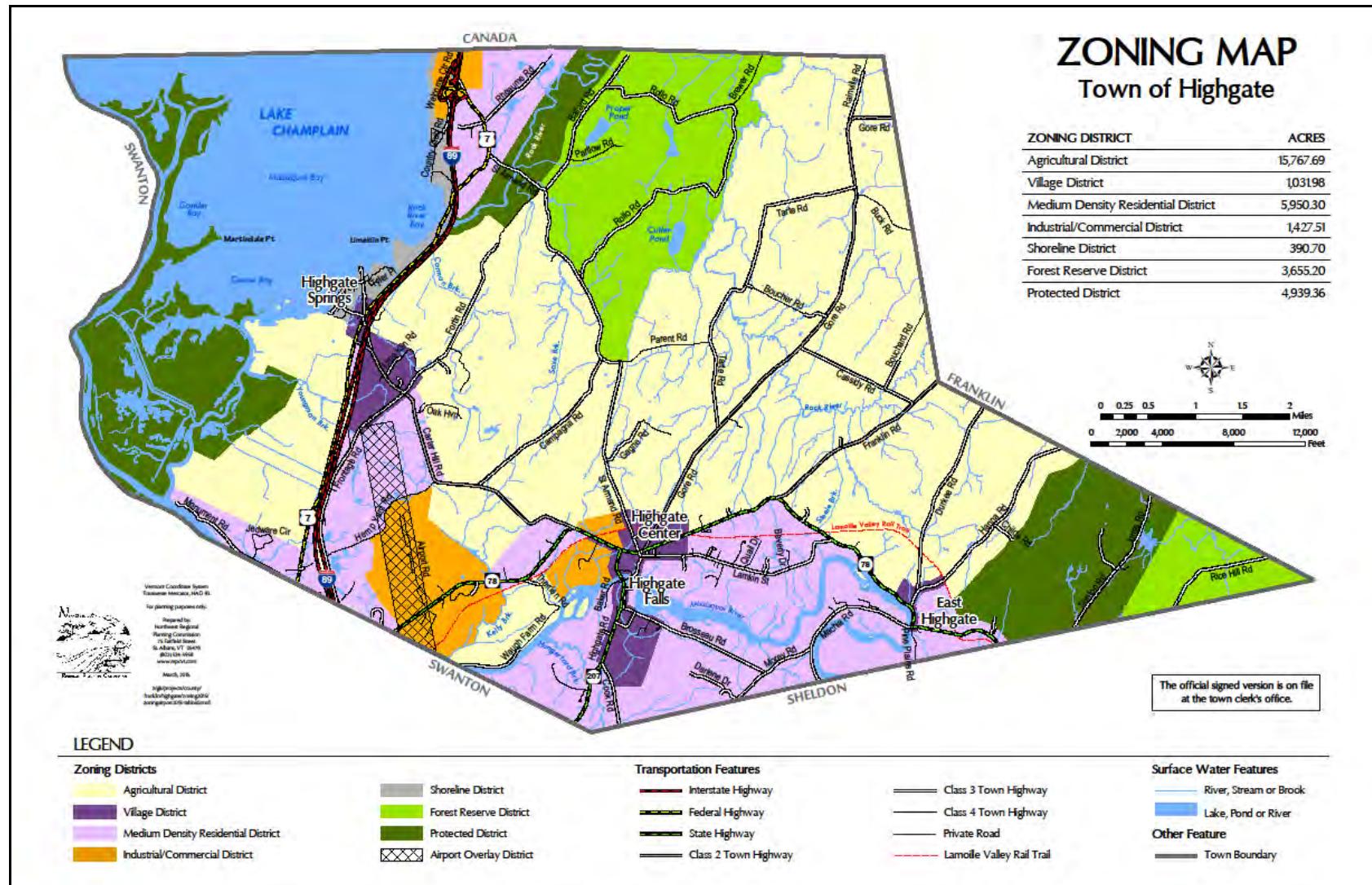


Figure 3: Highgate Center Designated Village Center

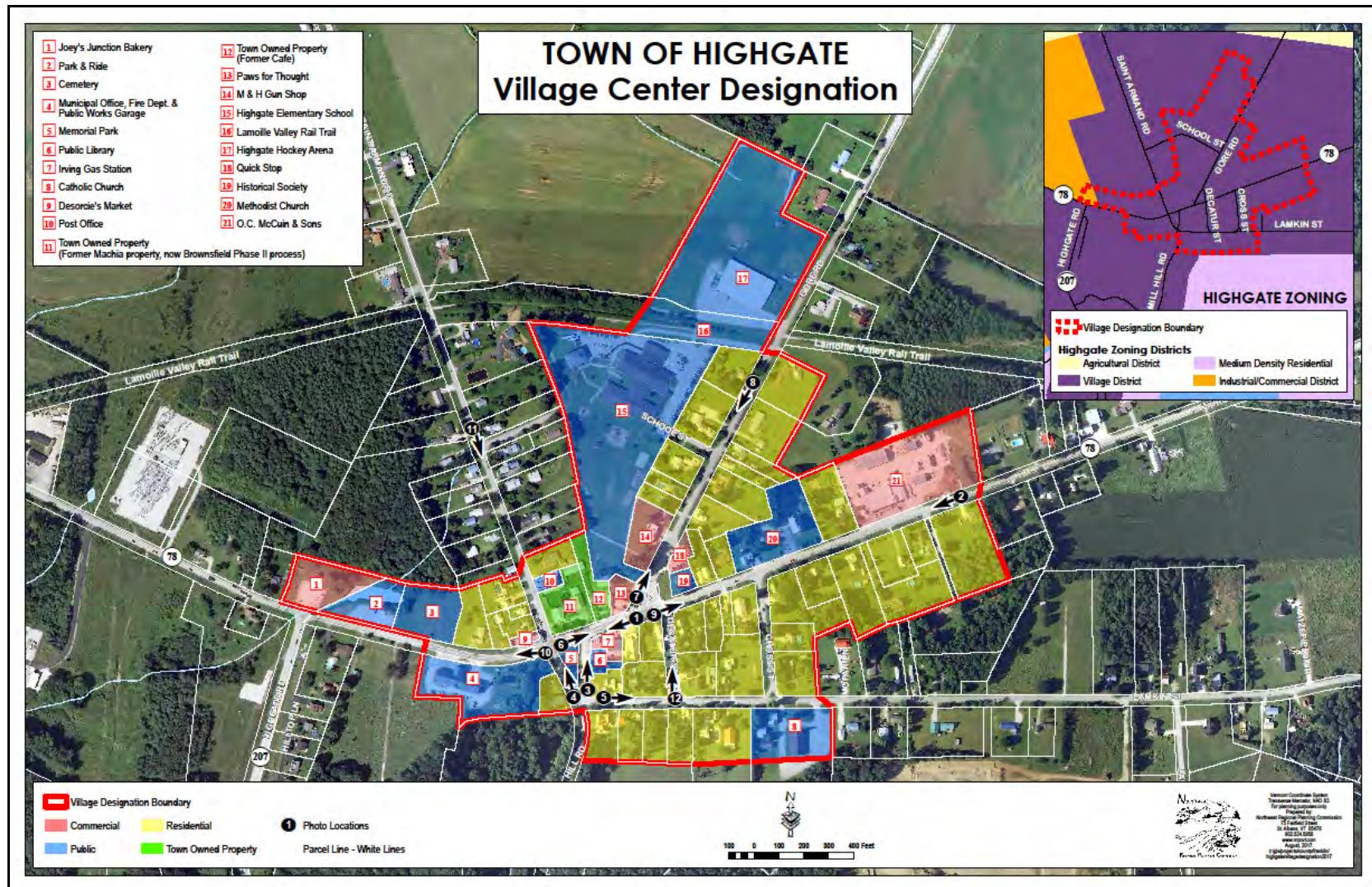
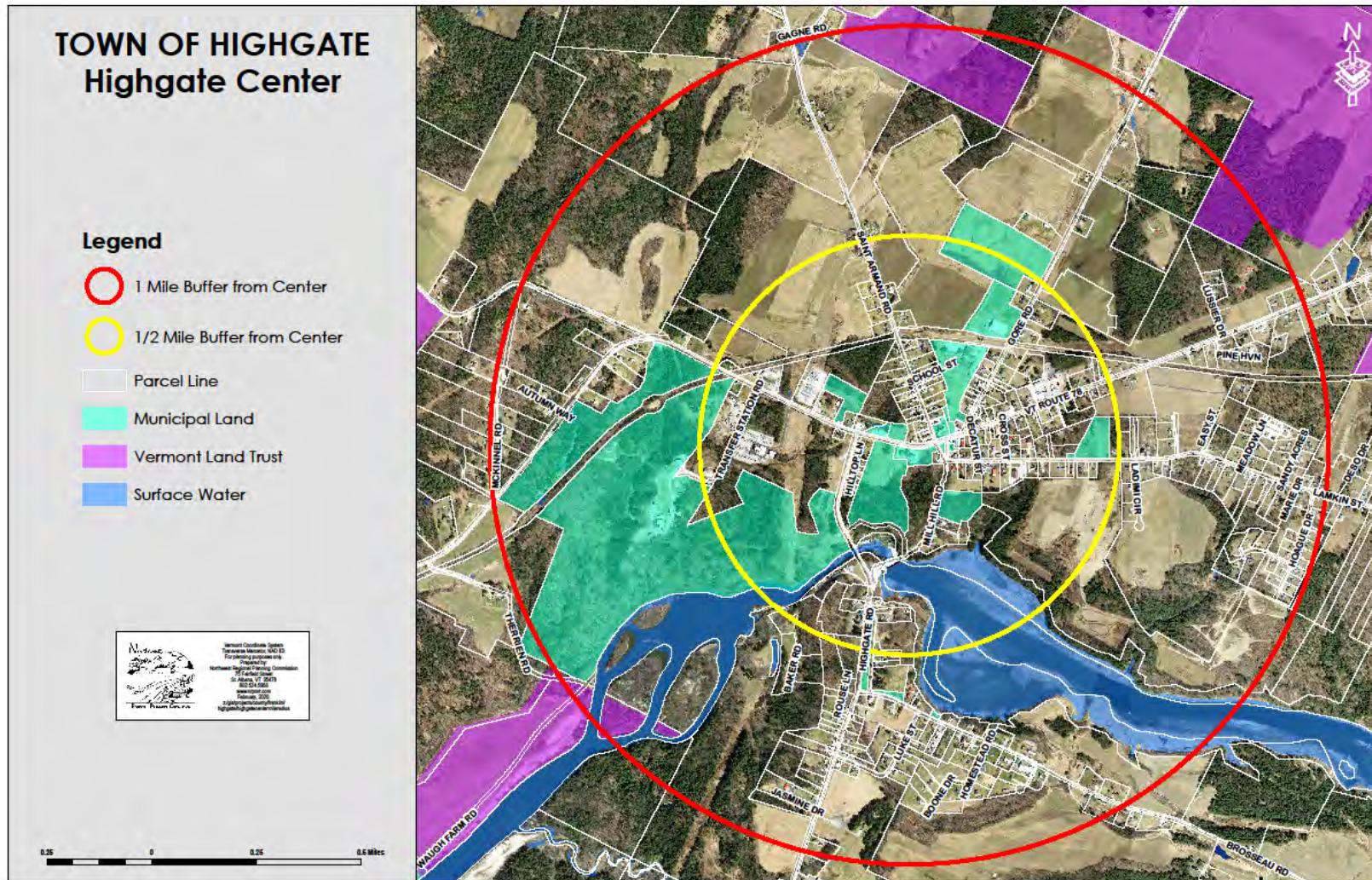


Figure 4: Highgate Center Municipally Owned Land



Future Development in Highgate

Future Growth of Population and Economy

According to population projections developed by ACCD, Highgate's population is projected to grow 2-7% from the 2010 Census figure by 2020 with an additional 2-6% growth by 2030. This would mean a projected 2030 population of 3,656 to 4,011 residents.⁵

Highgate's Town Plan reflects a desire for growth in commercial and light industrial development. According to the Plan, commercial density should be increased in the Highgate Village Center. Additionally, infill and reuse of older, centrally located buildings should be encouraged in order to concentrate development in the villages of Highgate. While the plan supports commercial & light industrial development, all development must increase the tax base enough to cover the increase in municipal services.

Future Land Use

Housing Growth

Population growth and decreasing household sizes will drive demand for new housing units in Highgate. Based on the 2010 average household size and the ACCD population projections, the Town will need approximately 40 new housing units by 2020, and an additional 23-85 new housing units by 2030.⁶ That is, by 2020 the Town will need 1,492 total housing units, while by 2030 the Town will need between 1,515 and 1,577 total housing units.

Desired Pattern of Growth

According to the Highgate Town Plan, the desired pattern of future growth in Highgate is one of denser village areas and open agricultural and forest lands (see Figure 7). To preserve open land, water and wastewater services will be needed to ensure higher density residential development. The primary area targeted for this denser growth is Highgate Center (see Figure 5).

Additionally, the Plan identifies the area north and west of Highgate Center as an area for industrial growth, which would also require water/wastewater infrastructure in this area.

Highgate Village Core Master Plan

In 2018-2019, the Town of Highgate examined potential development options for two adjacent brownfield parcels located in Highgate Center at the intersection of Route 78, St. Armand Road and

Figure 5: Village Growth Center



⁵ Vermont Agency of Commerce and Community Development, "Vermont Population Projections- 2010 – 2030", 2013, <https://accd.vermont.gov/sites/accdnew/files/documents/CD/CPR/ACCD-DED-VTPopulationProjections-2010-2030.pdf>.

⁶ Town of Highgate, Highgate Town Plan, 2015, https://6eade072-06b3-4cb0-b552-9093f98282cd.filesusr.com/ugd/cf375c_3cfa411ee1ec43869776120c6fd8eee7.pdf.

Gore Road. The properties make up what is known as the Village Core site and are the impetus for the Wastewater and Water Feasibility Study (see Figure 6). The site is municipally-owned, although it also includes adjacent land owned by the school district and managed by a trust for municipal use. Proposed designs for the site include commercial space (retail, restaurant or other commercial) and a new library/community center. Some form of dine in prepared food establishment is a highly desired end use for the site. The master plan provides a detailed implementation plan, of which examining wastewater and water supply options is a top priority.

The community is currently evaluating the costs and benefits of restoring the former Stinehour Hotel located on the property versus demolishing the building for new construction. The former Stinehour Café was razed in 2018 (the building adjacent to Paws for Thought on Figure 6).

Prior to completion of the Village Core Master Plan, the Highgate Library completed a Library and Community Center Feasibility Study in 2017-2018 also funded by a Municipal Planning Grant. This study determined the feasibility of remodeling the current library building or constructing a new building. The project determined that a new building is needed and developed conceptual plans and cost estimates for a new library on the Village Core property.

Figure 6: Highgate Village Core Site

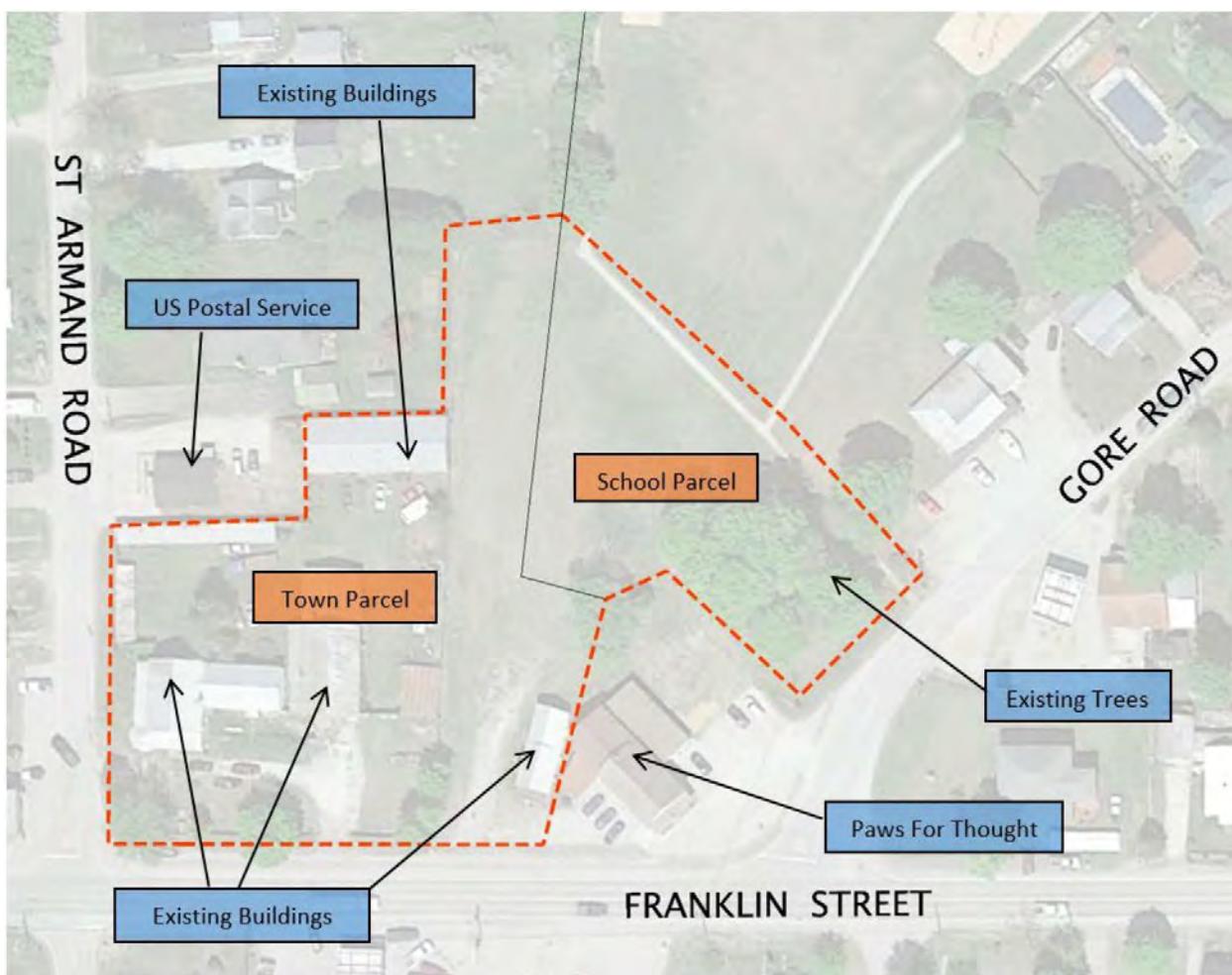
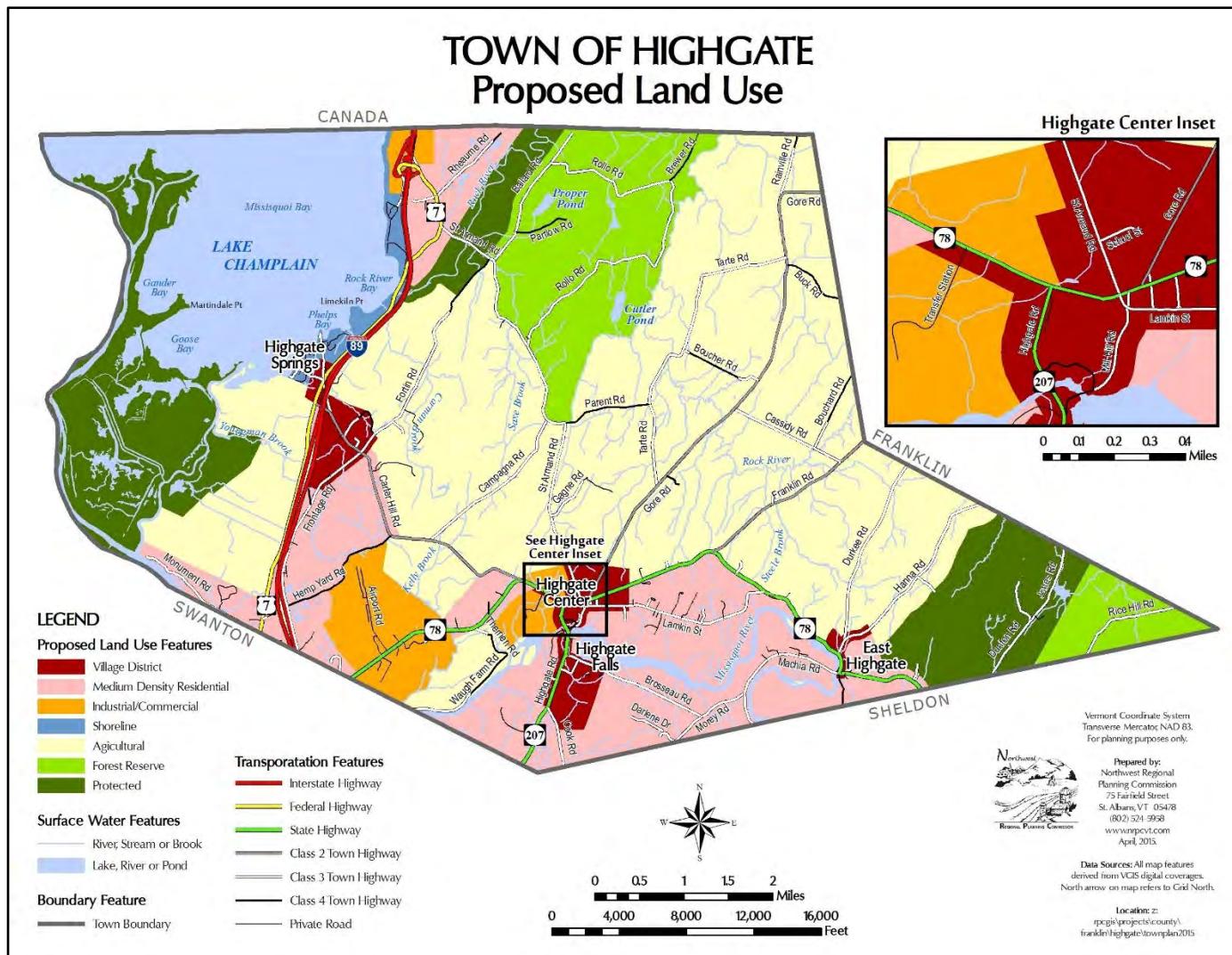


Figure 7: Proposed Land Use in Highgate



Goals and Plans for Water/Wastewater in Highgate

Town Plan

The Highgate Town Plan identifies the development of water and wastewater infrastructure as important goals for the Town. The Plan's main goal for water infrastructure is that the Town should consider the creation of a municipal water system. The Plan's main goal for wastewater is to reduce the environmental impact of current wastewater disposal systems, especially in densely settled and/or environmentally sensitive areas. Geographically, both Highgate Center and the industrial area north and west of Highgate Center are identified as possible locations for water/wastewater infrastructure.

Additional relevant Town Plan policies related to water/wastewater are summarized in Table 2 below.

Table 2: Highgate Town Plan Water & Wastewater Policies
1) Consider developing a long-range plan that creates municipal water systems, particularly in areas where services would be beneficial for development such as Highgate Center.
3) Include gauging water/wastewater development costs in future budgets/plans, consider implementing an impact fee on new development.
4) Promote clustered development with shared wastewater facilities.
5) Promote the use of alternative treatment systems to ensure safe disposal of wastewater on lots with substandard soil conditions.
6) Any public investment in wastewater disposal should be plan to minimize development pressure on agricultural and forestry lands.

Basin Plan

The Missisquoi Tactical Basin Plan addresses the quality of surface waters in the Missisquoi Bay and its drainage basin. The main water quality issue in the Basin is phosphorous run-off. Any proposed wastewater facility or other infrastructure should be designed and sited so as to minimize phosphorous run-off.

Highgate Airport Infrastructure Feasibility Study

In 2018-2019, The Town of Highgate conducted a study of the feasibility of water/wastewater in the area around the Franklin County Airport⁷. This feasibility study did not include Highgate Center.

Highgate Airport Infrastructure Proposed Solutions

The analysis was based around the idea of extending existing water/wastewater services from the Village of Swanton to this area. To accomplish this goal, the study examined three possible alternative options for extending water/wastewater.

1. Constructing a new pump station on the property of the Franklin County Airport and using a gravity sewer collection system.
2. Constructing a gravity sewer running cross-country from the airport to a connection with Swanton's collection system near the Missisquoi Valley Union High School.
3. Constructing a gravity sewer collected system in the Phase II service area, as well as a pump service station to serve the northernmost portion of the service area.

⁷ The project examined two areas: Phase I, which extends from near I-89, along Vermont Route 78 to the south end of Airport Road, then north along Airport Road to include the Franklin County Airport and surrounding properties and Phase II which extends from the south end of Airport Road, east along Vermont Route 78 for approximately ¼ of a mile.

Highgate Airport Infrastructure Property-Owner & Tenant Survey

The study also included a survey of property-owners and tenants in the proposed service area which had 24 responses. Thirty-three percent of respondents were interested in water/wastewater services and, on average, they were willing to spend \$500 a year on water/wastewater services. In general, there was a greater demand for water services than wastewater services.

In terms of existing wastewater infrastructure, most of the wastewater disposal systems were from the 1970s & 1980s, and none had failed. In terms of water infrastructure, of those with wells 92% had individual wells while 4% used a shared/community well. Seventeen percent of those with wells had water supply failures or problems.

These survey results are likely to be very different from conditions in Highgate Center because the areas have very different uses. Nearly half of all parcels in the service area for this study were used for aircraft storage, and less than a quarter of parcels were residential. In contrast, most parcels in Highgate Center are residential, with some municipal and light commercial uses.

APPENDIX C - ANR ATLAS ENVIRONMENTAL MAPS AND FLOOD INSURANCE RATE MAP



Highgate Center - Location Map

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Roads**
 - Interstate
 - US Highway: 1
 - State Highway
 - Town Highway (Class 1)
 - Town Highway (Class 2,3)
 - Town Highway (Class 4)
 - State Forest Trail
 - National Forest Trail
 - Legal Trail
 - Private Road/Driveway
 - Proposed Roads
- Stream/River**
 - Stream
 - Intermittent Stream
- Town Boundary

1: 13,677

1in = 1140 ft.
1cm = 137 meters



695.0 0 348.00 695.0 Meters

WGS_1984/Web/Mercator/Auxiliary_Sphere

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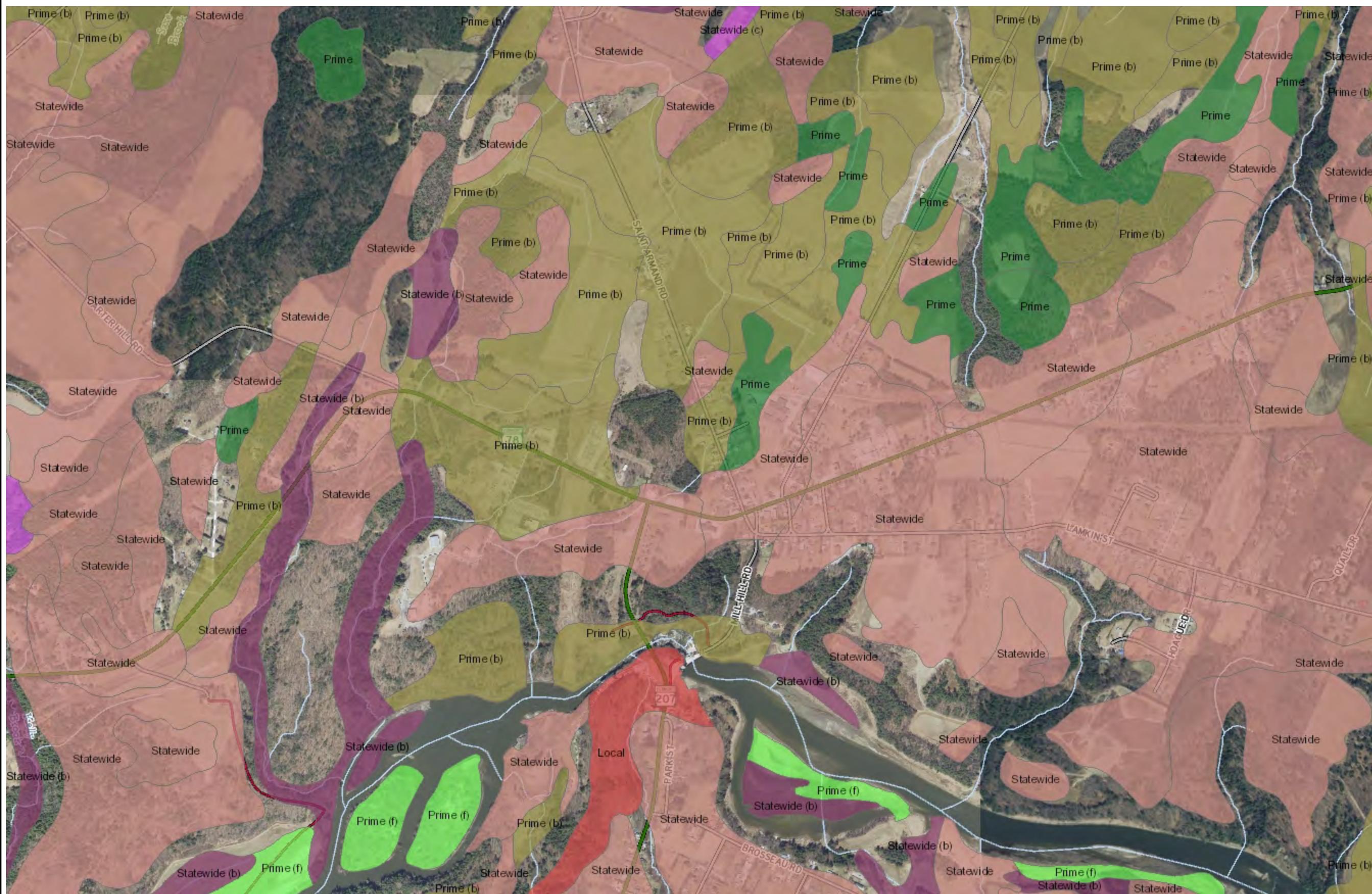
Map created using ANR's Natural Resources Atlas



Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov



LEGEND	
Soils - Prime Agricultural	
Local	Red
Local (b)	Light Red
Not rated	Light Blue
Prime	Dark Green
Prime (b)	Light Green
Prime (f)	Bright Green
Statewide	Pink
Statewide (a)	Light Pink
Statewide (b)	Purple
Statewide (c)	Magenta
Roads	
Interstate	Dark Blue
US Highway 1	Red
State Highway	Dark Green
Town Highway (Class 1)	Medium Green
Town Highway (Class 2,3)	Light Green
Town Highway (Class 4)	Yellow-Green
State Forest Trail	Dotted Green
National Forest Trail	Dotted Blue
Legal Trail	Dark Red
Private Road/Driveway	Dotted Red
Proposed Roads	Dashed Red
Stream/River	
Stream	Solid Light Blue
Intermittent Stream	Dashed Light Blue
Town Boundary	Thin Black Line

□ Town Boundary

1: 13,174

1in = 1098 ft.
1cm = 132 meters



669.0 0 334.00 669.0 Meters

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Highgate Center - River Corridor Map

Vermont Agency of Natural Resources

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LEGEND	
River Corridors (Aug 27, 2019)	
.5 - 2 sqmi.	
.25-5 sqmi.	
Roads	
Interstate	
US Highway; 1	
State Highway	
Town Highway (Class 1)	
Town Highway (Class 2,3)	
Town Highway (Class 4)	
State Forest Trail	
National Forest Trail	
Legal Trail	
Private Road/Driveway	
Proposed Roads	
Stream/River	
Stream	
Intermittent Stream	
Town Boundary	

1: 13,677

1in = 1140 ft.
1cm = 137 meters



695.0 0 348.00 695.0 Meters

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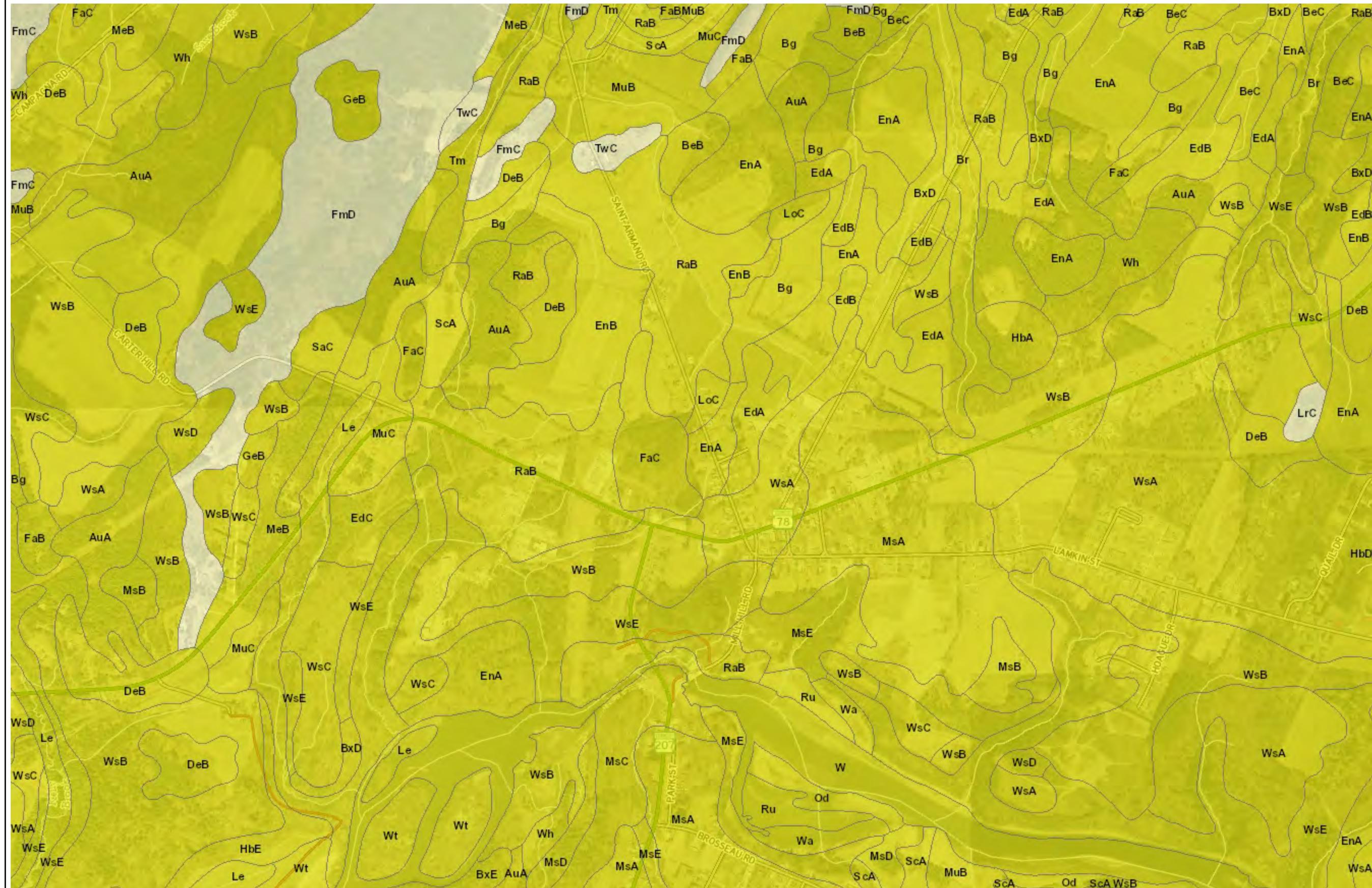
NOTES

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Highgate Center - Soil Map

vermont.gov



1: 13,677

$$\begin{array}{l} 1\text{in} = 1140 \text{ ft.} \\ 1\text{cm} = 137 \text{ meters} \end{array}$$



695.0 0 348.00 695.0 Meter

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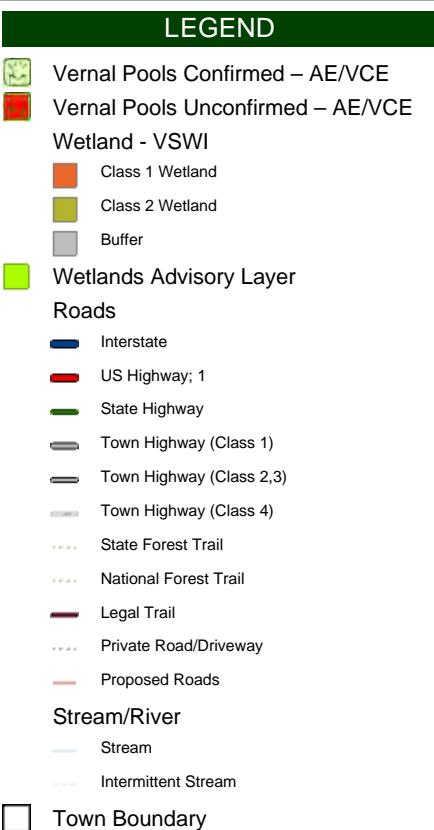
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Highgate Center - Wetland Map

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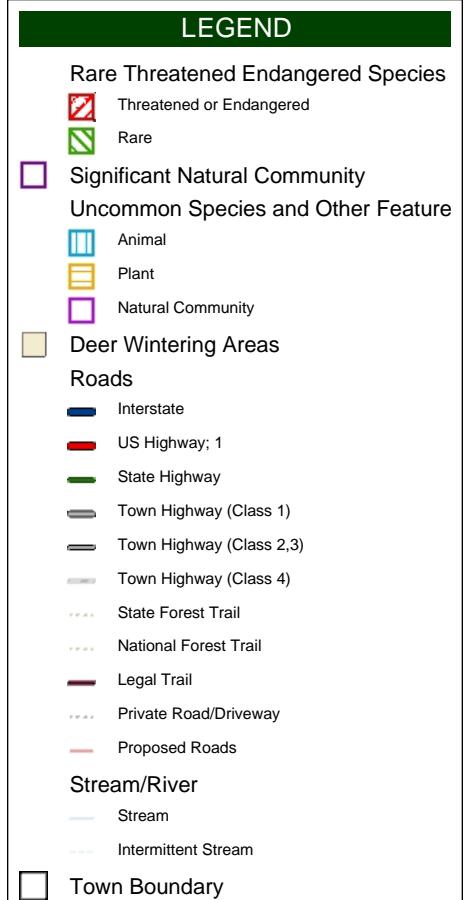
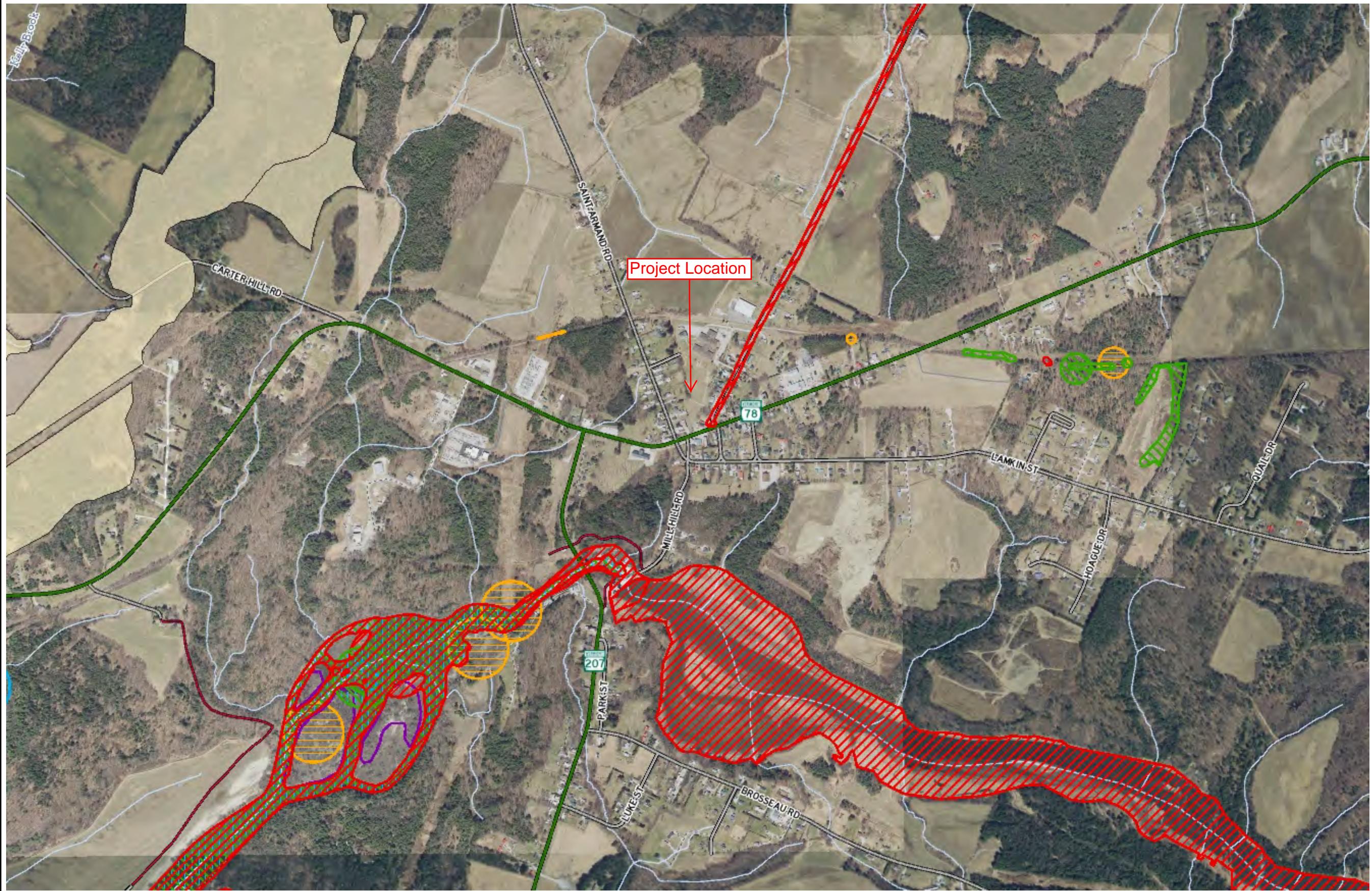
NOTES
Map created using ANR's Natural Resources Atlas



Highgate Center - Wildlife Resources Map

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vermont.gov



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1in = 1140 ft.
1cm = 137 meters



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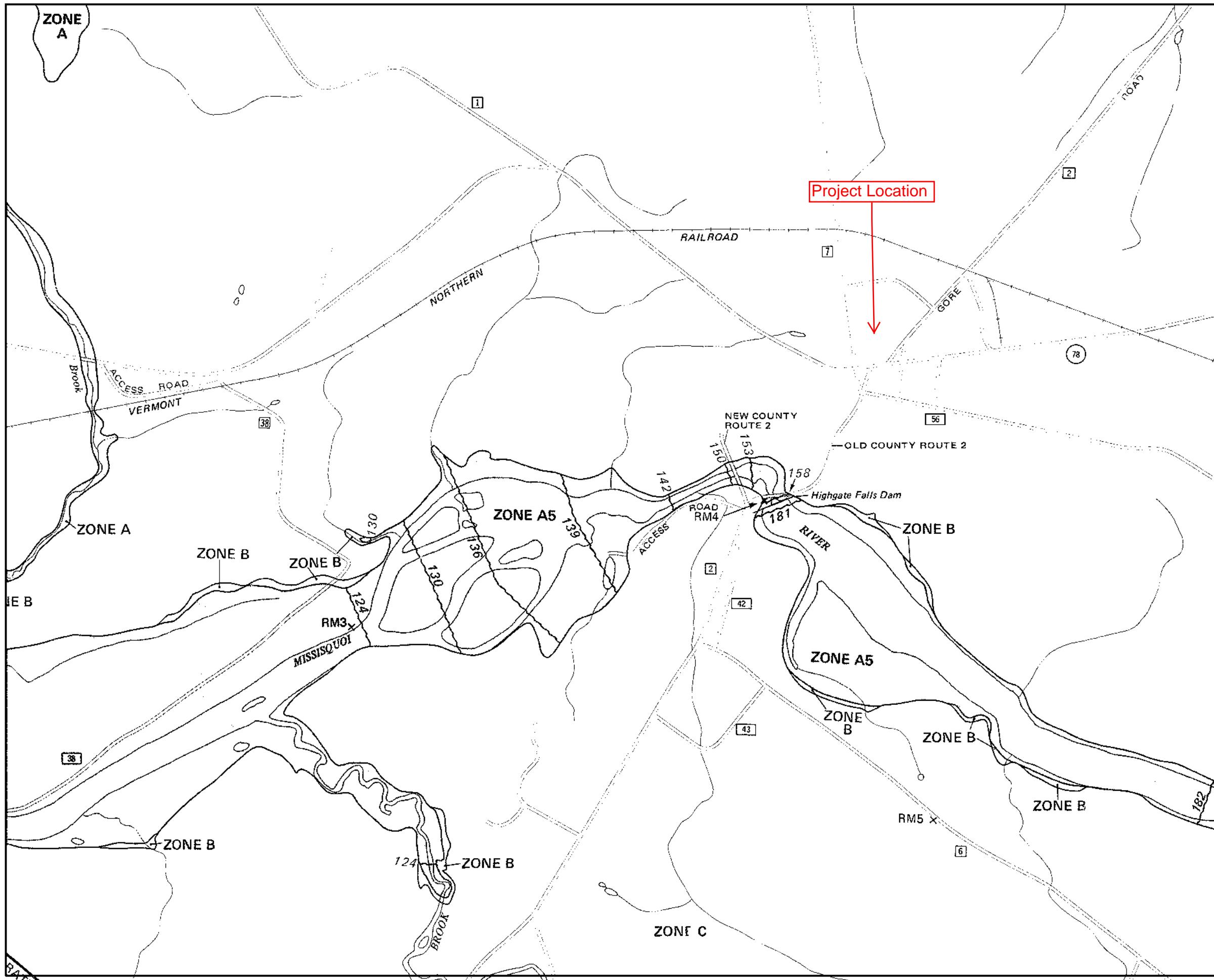
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NOTES

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APPROXIMATE SCALE
1000 D 1000 FEE

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

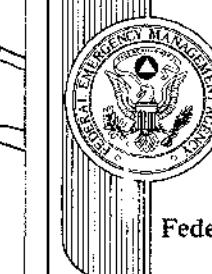
**TOWN OF
HIGHGATE, VERMONT
FRANKLIN COUNTY**

PANEL 15 OF 20
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER

500055 0015 B

**EFFECTIVE DATE:
APRIL 4, 1983**



Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msfc.fema.gov

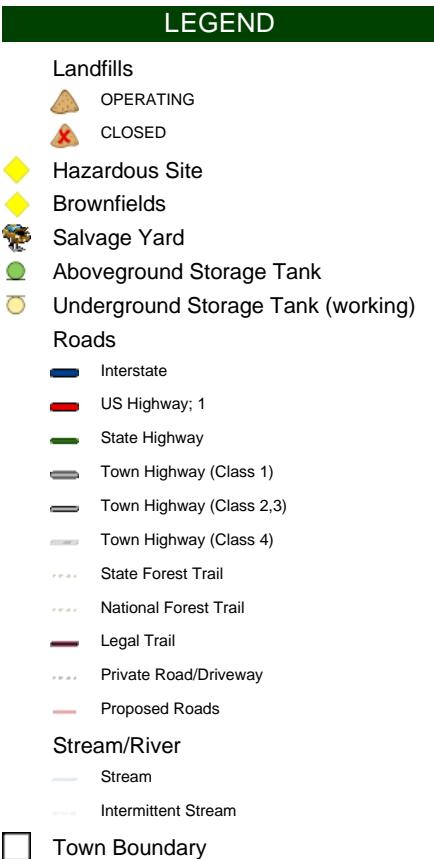
APPENDIX D – HAZARDOUS WASTE INFORMATION



Highgate Center - Hazardous Waste Map

Vermont Agency of Natural Resources

vermont.gov



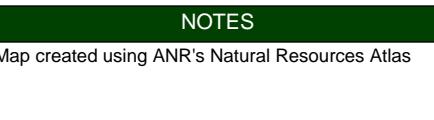
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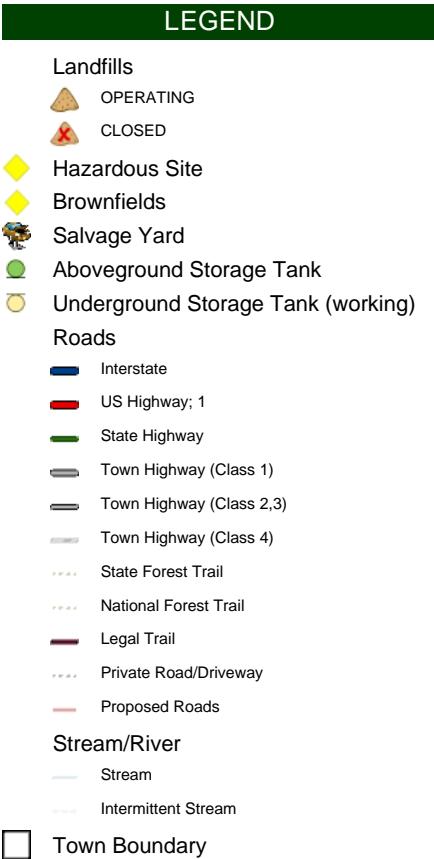
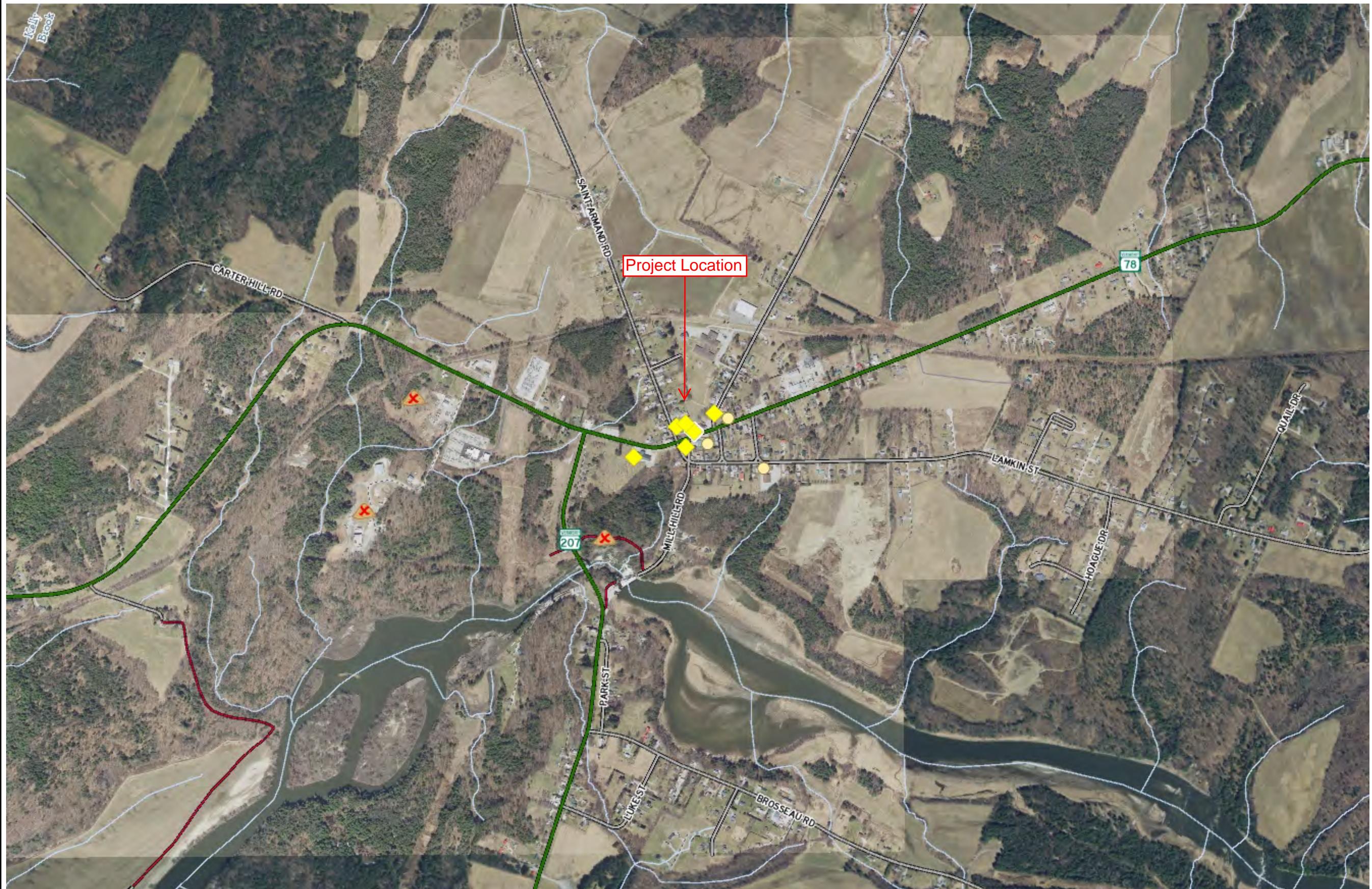




Highgate Center - Hazardous Waste Map

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APPENDIX E – ARCHEOLOGICAL RESOURCE ASSESSMENT



The University of Vermont

August 27, 2020

Greta Brunswick
Senior Planner
Northwest Regional Planning Commission
75 Fairfield Street
St. Albans, VT 05478

RE: Desk Review of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont

Dear Greta,

Attached, please find a Desk Review of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.

A Desk Review of Wastewater Disposal Areas #3-5 identified Areas #3 and #5 as sensitive for pre-Contact Native American sites, while Area #4 is not sensitive due to heavy soil disturbances throughout resulting from historic sand extraction activities. A Phase I site identification survey is recommended in the two archaeologically sensitive areas before project construction occurs as part of the Section 106 permitting process, unless these areas can be avoided.

Please feel free to contact me if you have any questions.

Sincerely,

Charles Knight, Ph.D.
Assistant Director

**Desk Review of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin
County, Vermont**

Submitted to:

**Greta Brunswick
Senior Planner
Northwest Regional Planning Commission
75 Fairfield Street
St. Albans, VT 05478**

Submitted by:

**Charles Knight, Ph.D.
University of Vermont
Consulting Archaeology Program
111 Delehanty Hall
180 Colchester Ave.
Burlington, VT 05405**

Report No. 1282

August 27, 2020

Desk Review of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont

Project Description

The Town of Highgate, with assistance from the Northwest Regional Planning Commission (NRPC) proposes the Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont (Figure 1). The proposed project will study the feasibility of the wastewater system and its disposal system within the town core of Highgate, Vermont (Figure 2). Specifically, two general areas containing three potential wastewater disposal zones are being considered south of Lamkin Road. In the west, Disposal Area #3 is located just east of Mill Hill Road, while Disposal Areas #4 and #5 are located on either side of Ladimi Circle, off of Lamkin Street in the east.

The University of Vermont Consulting Archaeology Program (UVM CAP) conducted a Desk Review of the proposed project alignment as part of the Section 106 permitting process and identified Disposal Areas #3 and #5 as containing intact soils and therefore, sensitive for pre-Contact Native American archaeological sites.

Study Goal

The goal of the archaeological Desk Review is to identify portions of a specific project's APE that have the potential for containing precontact and/or historic sites, without having to conduct a field visit. The Desk Review is to be accomplished through a "background search" of the project area. For this study, reference materials were reviewed following established guidelines. Resources examined included the National Register of Historic Places (NRHP) files; the Historic Sites and Structures Survey; and the USGS master archaeological maps that accompany the Vermont Archaeological Inventory (VAI). Relevant town histories and nineteenth-century maps also were consulted. Based on the background research, general contexts were derived for precontact and historic resources in the study area.

Archaeological Site Potential

The proposed project area is located adjacent to the limits of the Highgate Falls Prehistoric Archaeological District, which was determined to be eligible for listing on the National Register of Historic Places in 1982. The Highgate Falls Prehistoric Archaeological District consists of 18 pre-Contact Native American archaeological sites identified along the banks of the Missisquoi River within the limits of the impoundment for the Highgate Falls Dam (Thomas et al. 1996). The proposed wastewater areas are located on high terraces that overlook the Missisquoi River system. In addition to the 18 known sites along its banks from Highgate Falls to East Highgate, much of the banks and lower terraces have been identified as archaeologically sensitive for pre-Contact Native American sites. The University of Vermont Consulting Archaeology Program (UVMCAP) recently conducted an Archaeological Resources Assessment (ARA) of the dam impoundment and these areas of archeological sensitivity (Knight 2020). In addition, the UVMCAP have conducted numerous archaeological studies along Lamkin Road and adjacent parcels for a variety of municipal and residential development projects over the last 10 years, reflecting the general archaeological sensitivity of the area.

For instance, in 2015, the UVMCAP conducted a Phase I site identification survey on a similar landform as the proposed wastewater disposal areas, 780 m to the southeast from Disposal Area #5. In total, 82 test pits were excavated along 15 transects to test the area. Intact soils were identified throughout, yet no pre-Contact Native American sites were identified as a result of that Phase I survey (Mandel and Knight 2016)

Neither the historic 1857 Wallings Map (Figure 3), nor the historic 1871 Beers Atlas (Figure 4) depict any structures within the limits of the three specific disposal areas. Any development in the general area has been relatively recent, with the areas either used for early agricultural purposes or remaining wooded. As a result, no historic period sites are expected to be encountered within the limits of the disposal areas under study in this report. In addition, no properties within or adjacent to the proposed disposal areas under study are listed on the National or State Registers of Historic Places, with the exception of the above mentioned Highgate Falls Prehistoric Archaeological District.

Desk Review

As part of the desk review, the UVM CAP utilized the Vermont Division of Historic Preservation's (VDHP) predictive model for identifying precontact Native American archaeological sites. The Highgate Wastewater Feasibility Study area scores 50 on the Predictive Model, due to its location within 180 m the Missisquoi River (6), located on a major alluvial terrace of the Missisquoi River (32), and located adjacent to a natural travel corridor (12). In addition to the paper-based predictive model, the desk review uses a Geographical Information System (GIS) developed jointly by the UVM CAP, and its consultant Earth Analytic, Inc., which operationalizes the paper-based model. It does this by applying the VDHP's sensitivity criteria to all lands within the State of Vermont. In these maps, archaeological sensitivity is depicted by the presence of one or more overlapping factors, or types of archaeological sensitivity (i.e. proximity to water, etc.). The Highgate Wastewater Feasibility Study area contains seven overlapping sensitivity factors, which are: Drainage, Waterbody, Stream-Water Confluence, Head-of-Draw, Stream-confluence, Kame terrace, and Floodplain (see Figure 1).

An oblique Google Earth view shows the location of Disposal Area #3 on a level, major alluvial terrace of the Missisquoi, up upstream from the Highgate Falls (Figure 5). During the recent field inspection of the terrace just below for the Highgate Falls relicensing project, Knight identified the lower terraces as archaeologically sensitive (Knight 2020). Since the upper terraces were well outside of that project's Area of Potential Effects, they were not included in the study. However, if they were part of the relicensing project, they would have been considered archaeologically sensitive. The terrace upon which Disposal Area #3 will be situated on, is an ancient bank of the Missisquoi River from a much earlier river channel. For this reason, there is a heightened potential for older archaeological resources to be found on these higher terraces. As a result, the entire area under consideration for Disposal Area #3 is considered archaeologically sensitive for pre-Contact Native American sites.

Aerial photographs of Disposal Areas #4 and #5 show a history of sand extraction and other impacts to the area. For instance, Figure 6 is a 2008 aerial photograph of the disposal area,

showing extensive sand extraction occurring throughout the parcel west of Ladimi Circle. The extraction extends sufficiently north in the parcel to encompass the entirety of the limits of proposed Disposal Area #4. As a result, Disposal Area #4 is not archaeologically sensitive.

The history of land use in the parcel east of Ladimi Circle is more complicated. Figures 7, 8, and 9 show aerial photographs from 1985, 1995, and 2008, respectively. These show that in 1985 the field was used in agriculture, then in 1995 some form of north-south trenching or sand removal bisected the field, possibly for preparation for a future subdivision. Then in 2008 the field was pitted with perc tests which cored the soil, again likely ahead of some form of development. There is no evidence that the field has had sand extraction to the extent as the field west of Ladimi Circle, however, the surface does appear to have been levelled or filled. Nonetheless, the field appears sufficiently intact to have warrant subsurface testing as part of a Phase I site identification survey. If testing finds that the soil profiles reflect extensive disturbance, then no additional testing would be necessary in Area #5.

Conclusions

The Town of Highgate, with assistance from the Northwest Regional Planning Commission (NRPC) proposes the Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont. The UVM CAP conducted a Desk Review of the proposed project area as part of the Section 106 permitting process and identified Disposal Areas #3 and #5 as sensitive for pre-Contact Native American archaeological sites. Area #3 is on a level terrace that is primarily wooded and thus intact. It encompasses a large section of an upper alluvial terrace overlooking the Missisquoi River to the south. Disposal Area #5, to the east, is located on a similar alluvial terrace, but some parts of the area may have been disturbed by trenching and perc testing activities. Nonetheless, these disturbances were not extensive across the area and therefore Disposal Area #5 is considered archaeologically sensitive. Subsurface testing is recommended there to determine whether the soils are intact. If they are, then testing throughout the area can be carried out. Disposal Area #4 has been completely disturbed as a result of historic period sand extraction and is not archaeologically sensitive. As a result, a Phase I site identification survey is recommended in Disposal Areas #3 and #5, unless these areas can be avoided.

Thank you for working with us on this project. Please let me know if you have any questions or comments.

Charles Knight
UVMCAP

Bibliography

Mandel, Geoffrey A., and Charles Knight

2016 End of field letter Report for Archaeological Phase I Site Identification Survey for the Proposed Highgate PUD Development Project, Highgate, Franklin County, Vermont.
University of Vermont Consulting Archaeology Report #937

Knight, Charles

2020 Archaeological Resources Assessment for the proposed Highgate Falls Hydroelectric Project, Federal Energy Regulatory Commission Project No. 2547, Highgate Center, Franklin County, Vermont. University of Vermont Consulting Archaeology Report #1267

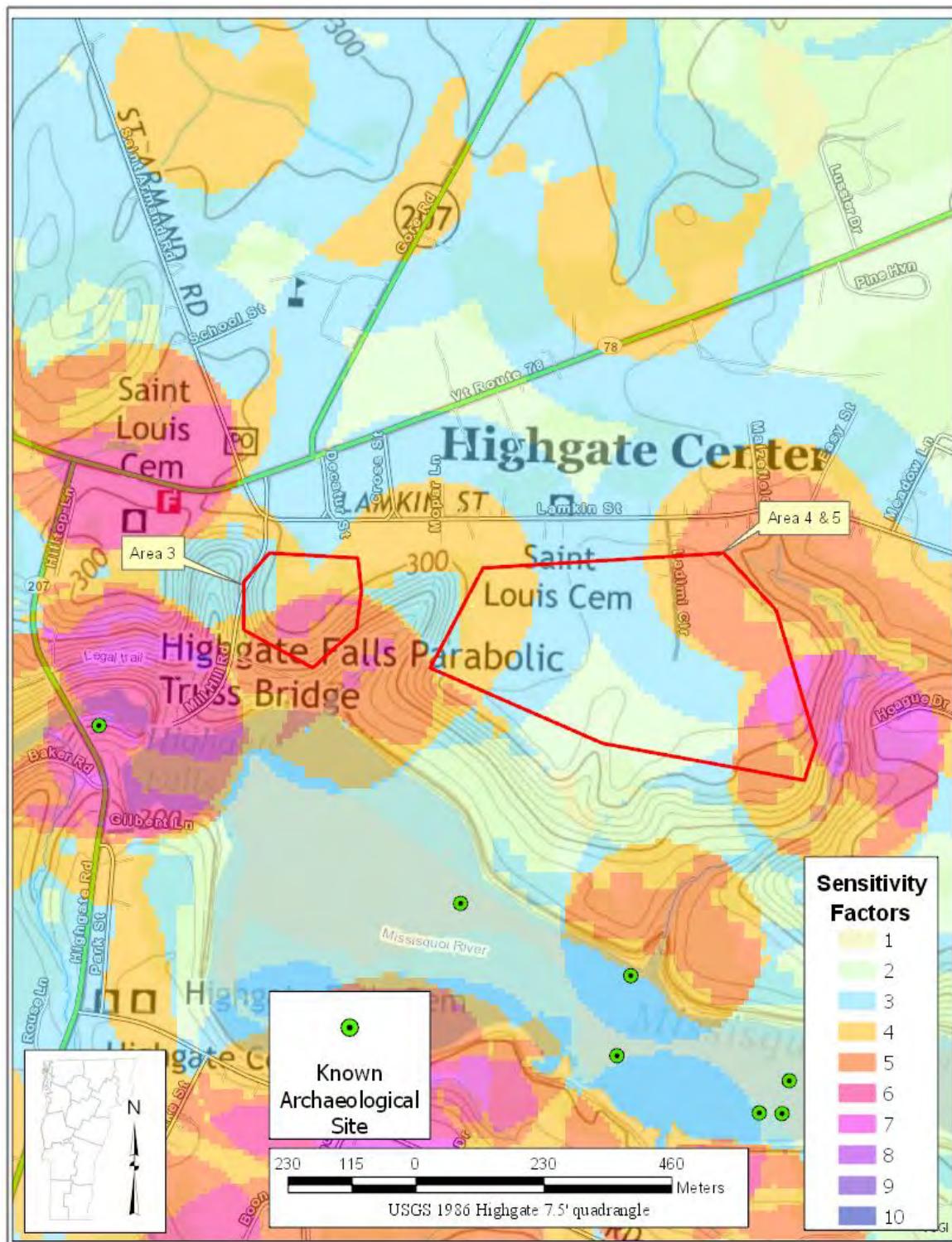


Figure 1. Map showing the location of the proposed Highgate Wastewater Feasibility Study, in relation to archaeological sensitivity factors and known archaeological sites, Highgate, Franklin County, Vermont.

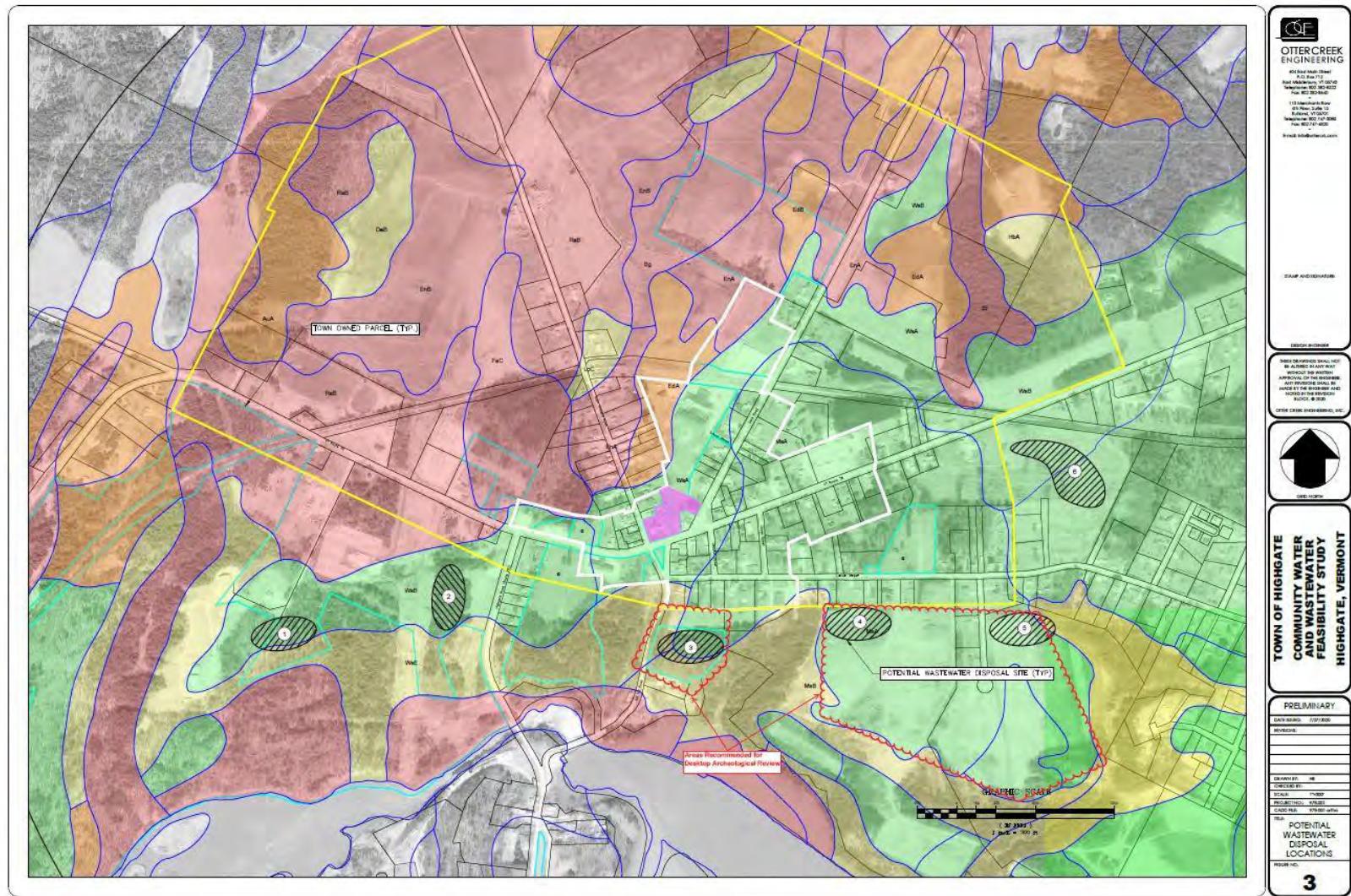


Figure 2. Map showing the study area of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.



Figure 3. Historic 1857 Wallings map showing the location of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.



Figure 4. Historic 1871 Beer's atlas showing the location of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.

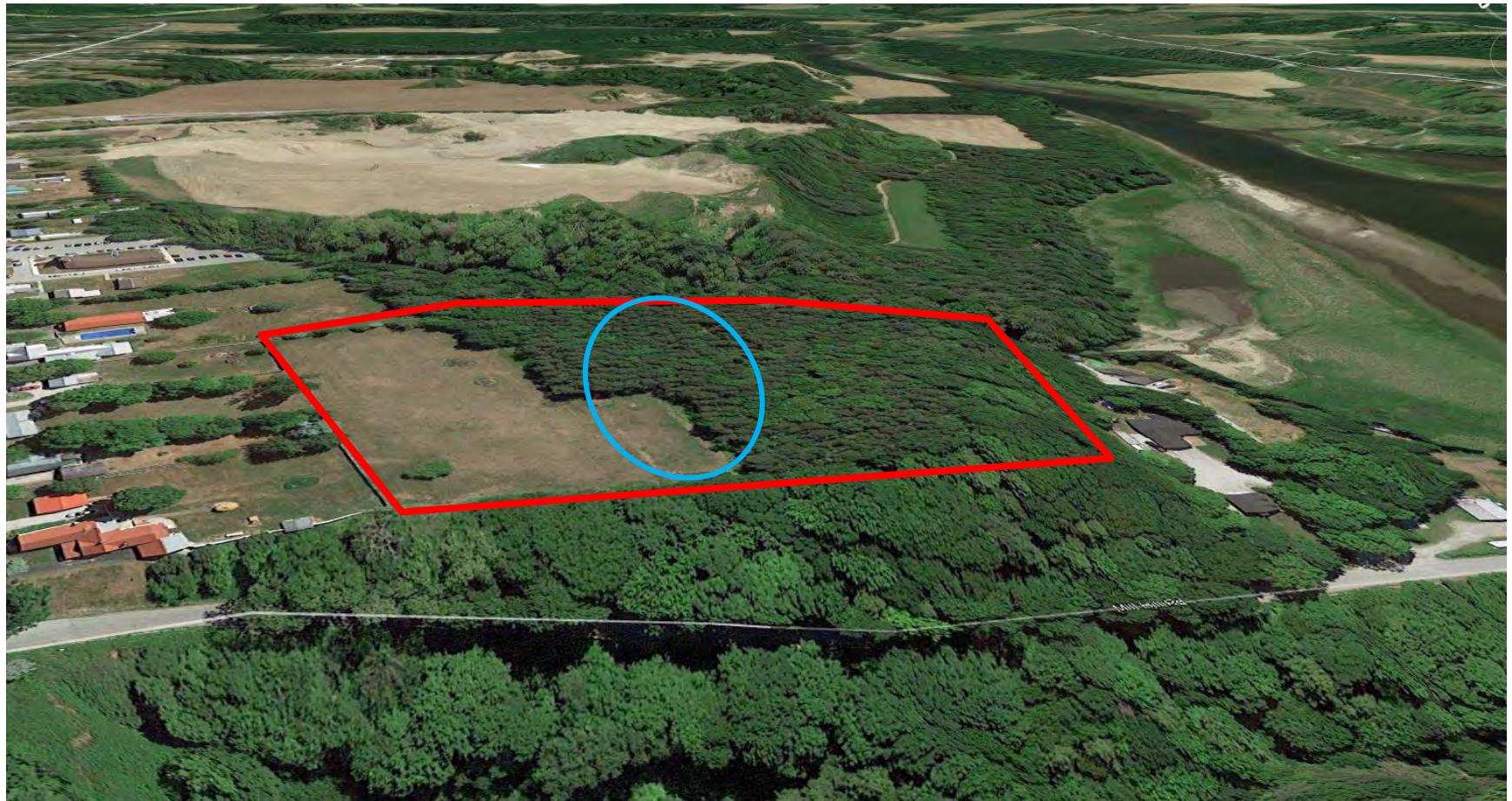


Figure 5. Oblique Google Earth view looking southeast across the elevated, level alluvial terrace that encompasses most of Disposal Area #3 of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.

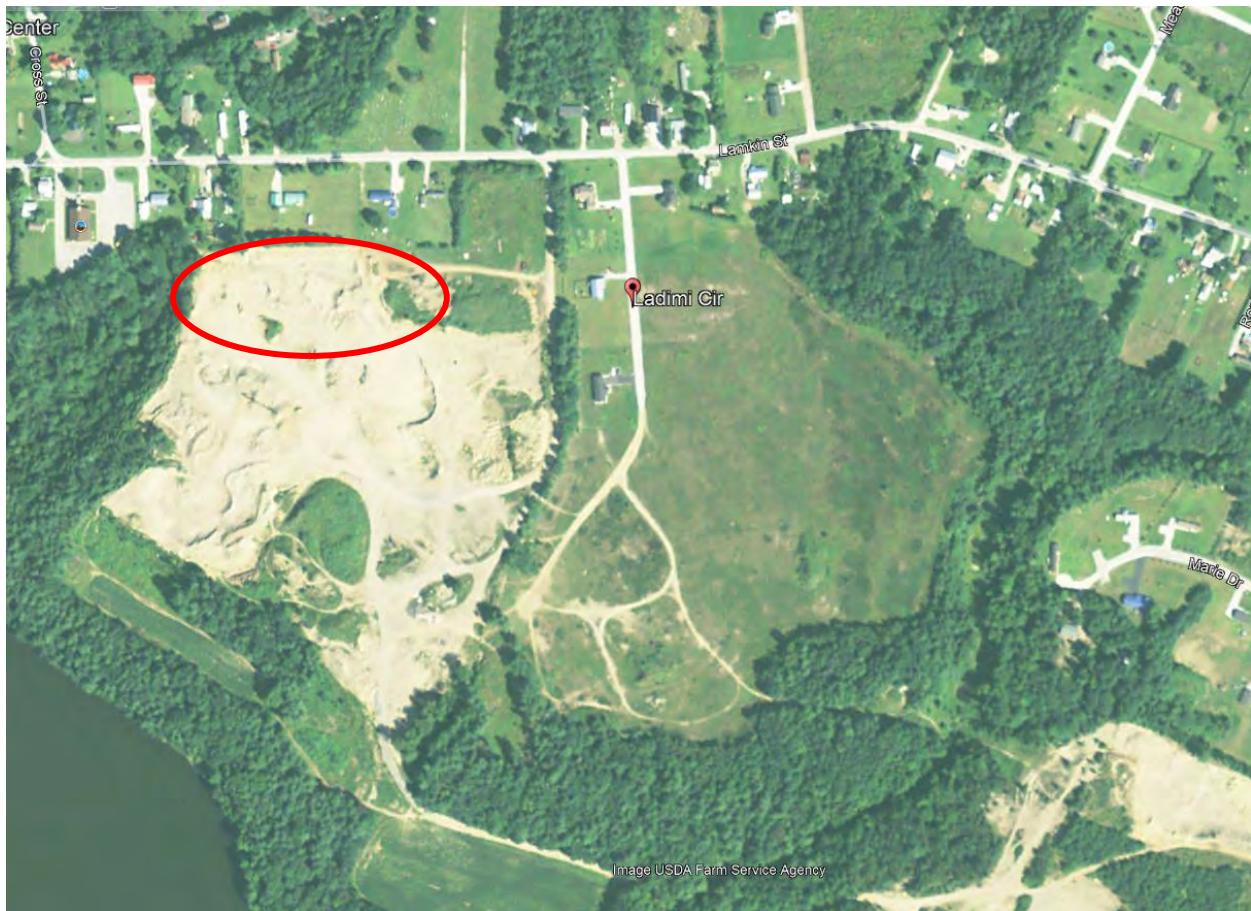


Figure 6. Historic 2008 aerial map showing the extensive sand extraction occurring within the limits of Disposal Area #4 of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.



Figure 7. Historic 1985 aerial photograph showing both Disposal Areas #4 and #5 as being used as agricultural fields, Highgate, Franklin County, Vermont.

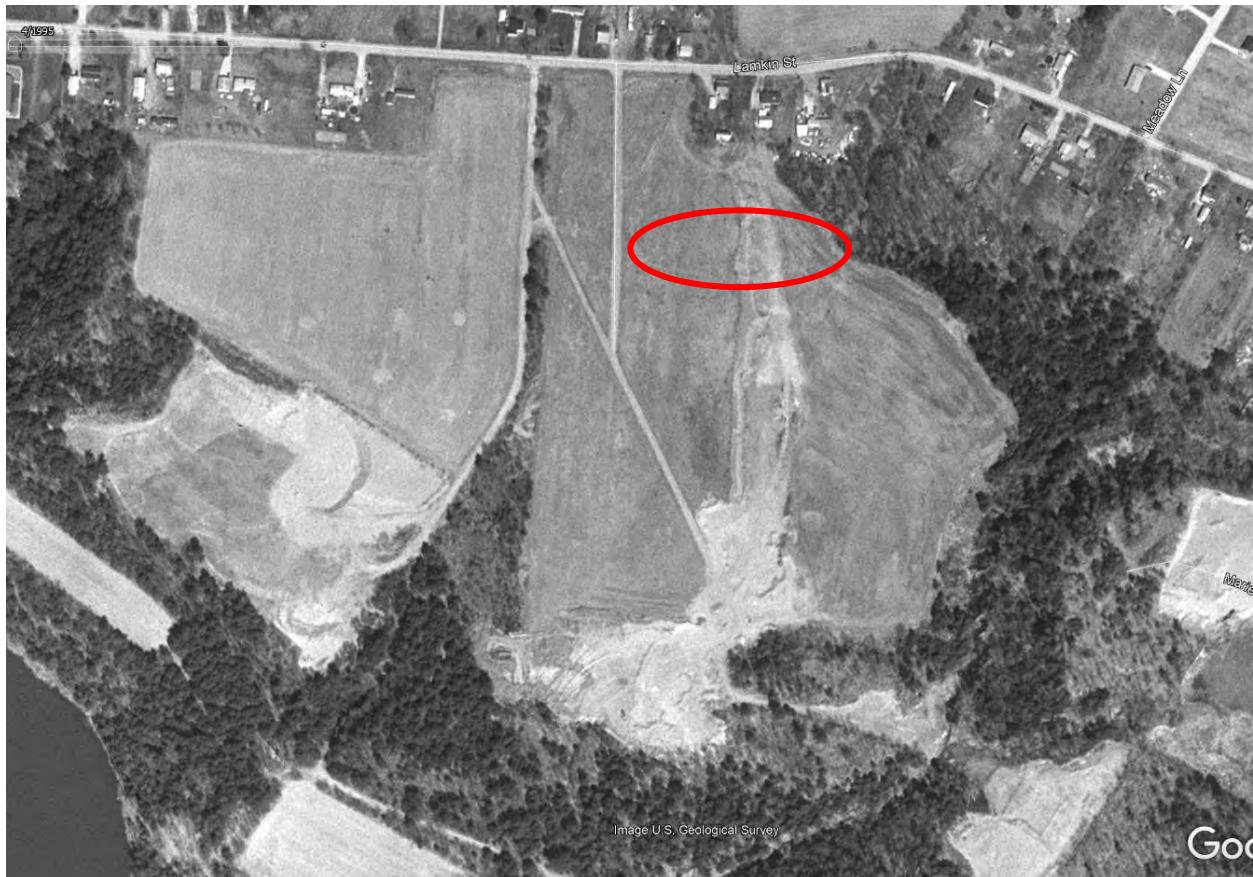


Figure 8. Historic 1995 aerial photograph showing some form of trenching or sand extraction bisecting the parcel that contains Disposal Area #5 of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.



Figure 9. Historic 2003 aerial photograph showing systematic coring within the limits of Disposal Area #5 of the proposed Highgate Wastewater Feasibility Study, Highgate, Franklin County, Vermont.

APPENDIX F – PROPERTY OWNER SURVEY RESULTS

Highgate Village Core Wastewater and Water Supply Needs Survey

What is your address combined with property type.

Address	Property Type
3031 Rte. 78, Highgate Ctr.	SF
153 Pine Haven	7 unit MHP
328 Gore Rd.	duplex
126 Hoague Dr. Highgate Center, VT 05459	No Resp
8489 Vt. Rt. 78, Highgate Ctr.	SF
91 Hilltop Lane	SF
37 Mill Hill Rd. Unit 1, Highgate	3 unit
73 Thak Blvd.	SF
14 School St. Highgate, VT	SF
145 St.Armand Rd. Highgate	SF
63 Meadow Lane	SF
144 Lamkin St.	SF
158 VT Route 78 D&H Housing	Com 1-2 empl
27 Meadow Lane	SF
2865 VT Route 78 Former Restaurant, current unkown	Com 1-2 empl
No address provided	25 responses

Responses by Property Type

Single Family

Commercial (1-2 empl)

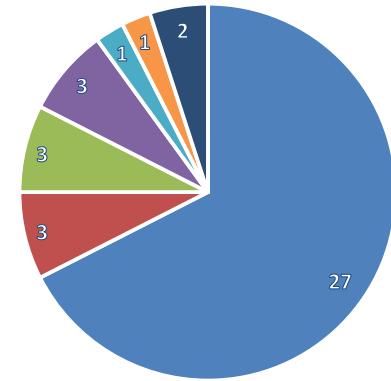
Duplex

3 Unit

7 unit (MHP)

Other Res

No Resp

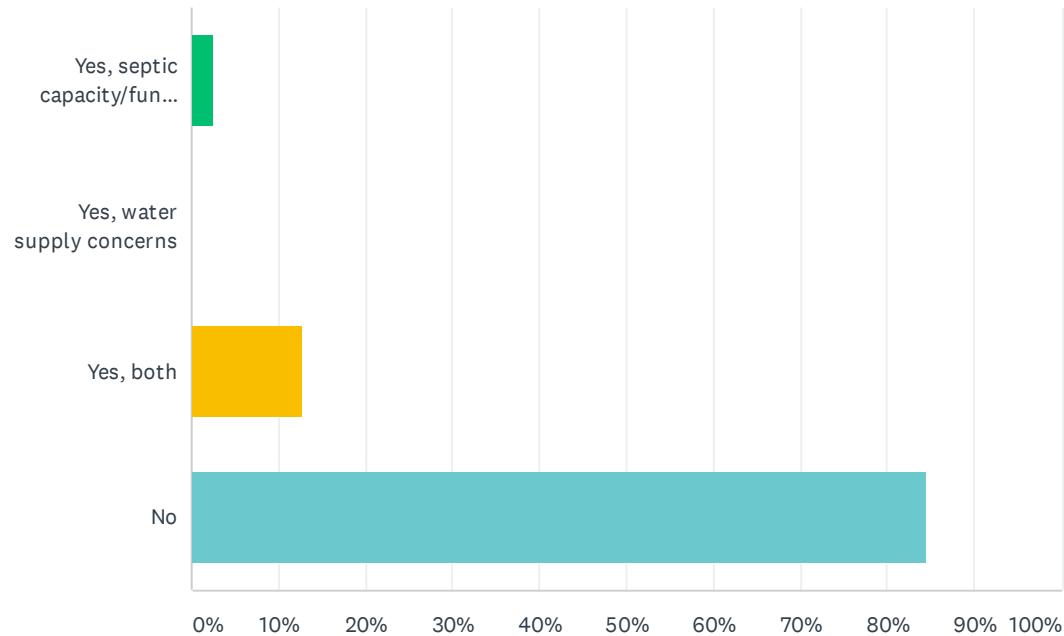


Response Rate = 15%

40 survey responses/262 surveys sent

Q6 Have septic capacity/function or water supply concerns limited what you can do with your property?

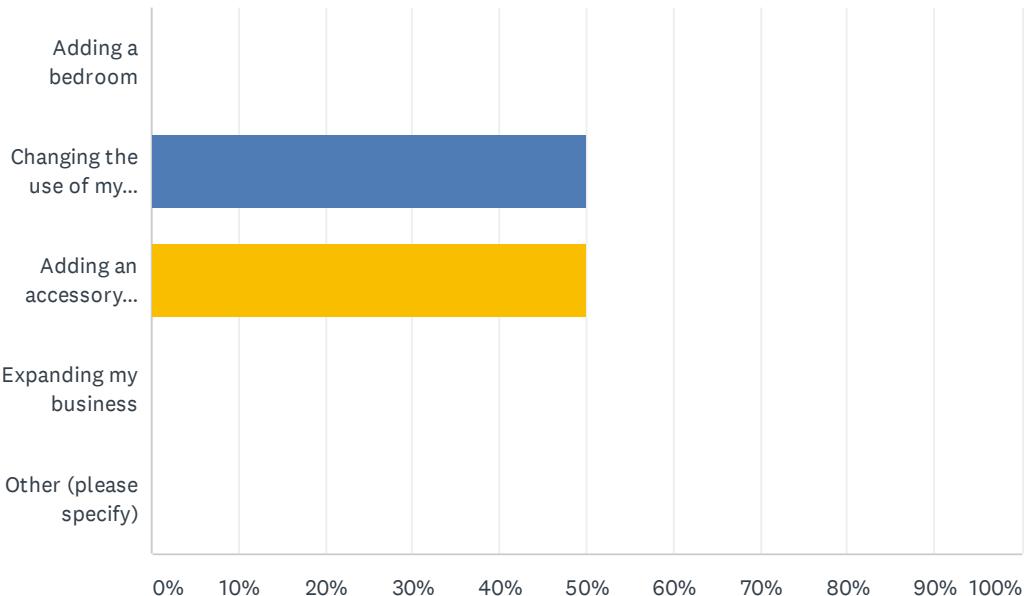
Answered: 39 Skipped: 1



ANSWER CHOICES	RESPONSES
Yes, septic capacity/function	2.56%
Yes, water supply concerns	0.00%
Yes, both	12.82%
No	84.62%
TOTAL	39

Q7 If septic capacity/function or water supply concerns have limited use of your property, please check any limitations that apply:

Answered: 2 Skipped: 38

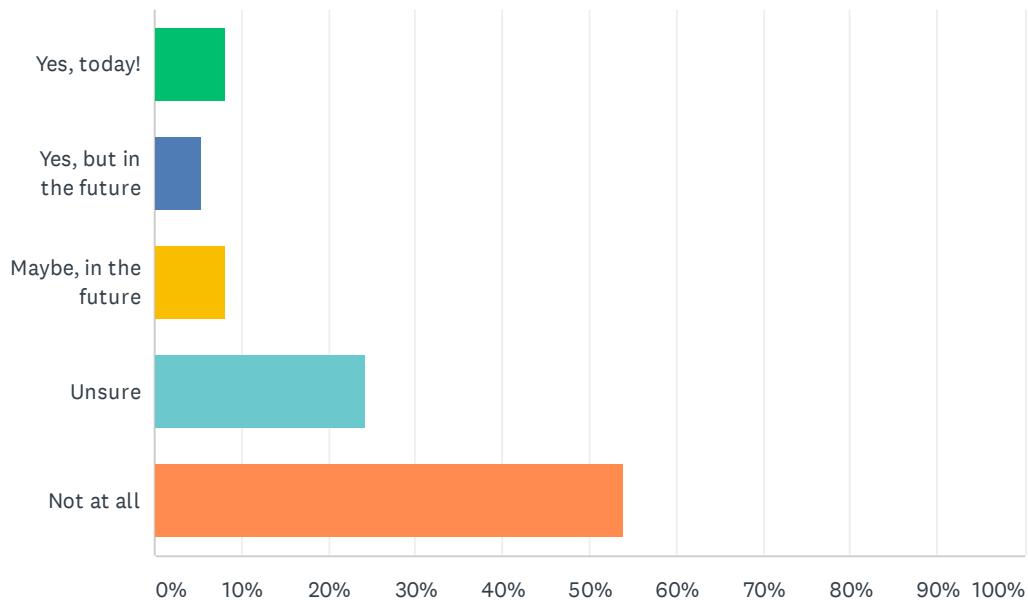


ANSWER CHOICES	RESPONSES	
Adding a bedroom	0.00%	0
Changing the use of my property	50.00%	1
Adding an accessory ("in-law") apartment	50.00%	1
Expanding my business	0.00%	0
Other (please specify)	0.00%	0
Total Respondents: 2		

#	OTHER (PLEASE SPECIFY)	DATE
There are no responses.		

Q8 Would a better septic system, or additional septic system capacity, benefit you or your business?

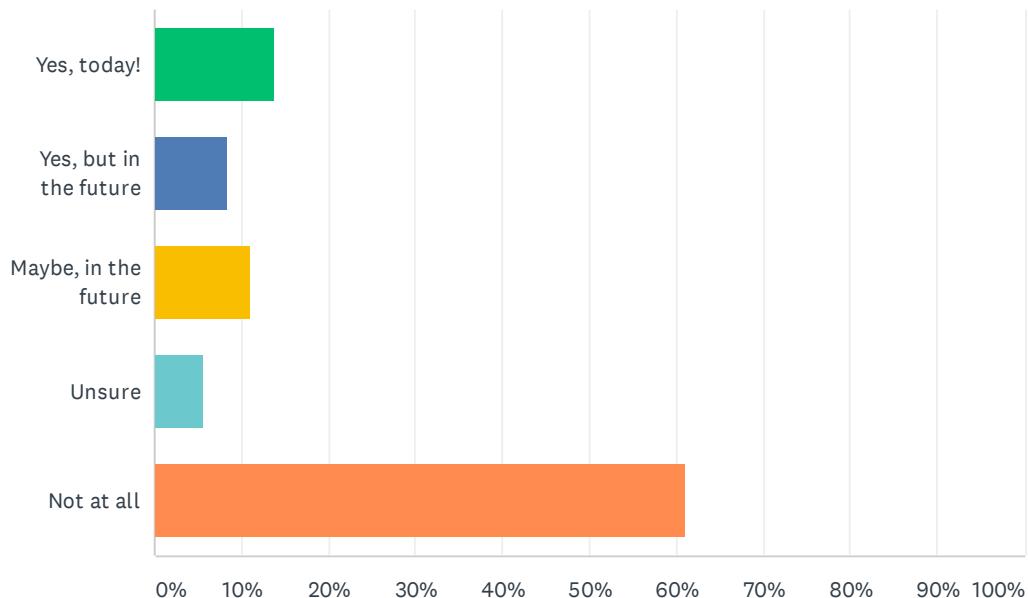
Answered: 37 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes, today!	8.11%	3
Yes, but in the future	5.41%	2
Maybe, in the future	8.11%	3
Unsure	24.32%	9
Not at all	54.05%	20
TOTAL		37

Q9 Would a better water supply system benefit you or your business?

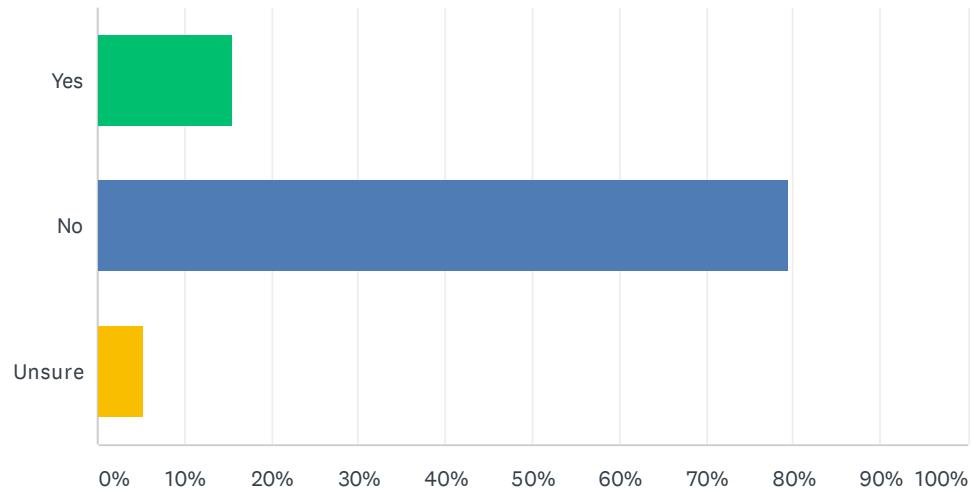
Answered: 36 Skipped: 4



ANSWER CHOICES	RESPONSES	
Yes, today!	13.89%	5
Yes, but in the future	8.33%	3
Maybe, in the future	11.11%	4
Unsure	5.56%	2
Not at all	61.11%	22
TOTAL		36

Q10 Are you concerned about your septic system?

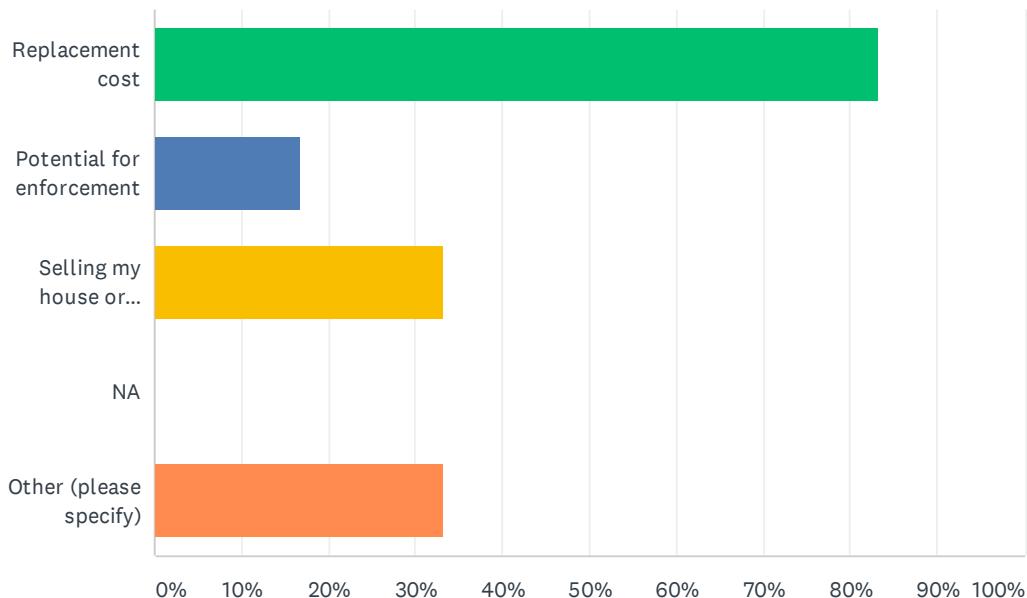
Answered: 39 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	15.38%	6
No	79.49%	31
Unsure	5.13%	2
TOTAL		39

Q11 If you are concerned about your septic system, why? Check any that apply to you:

Answered: 6 Skipped: 34

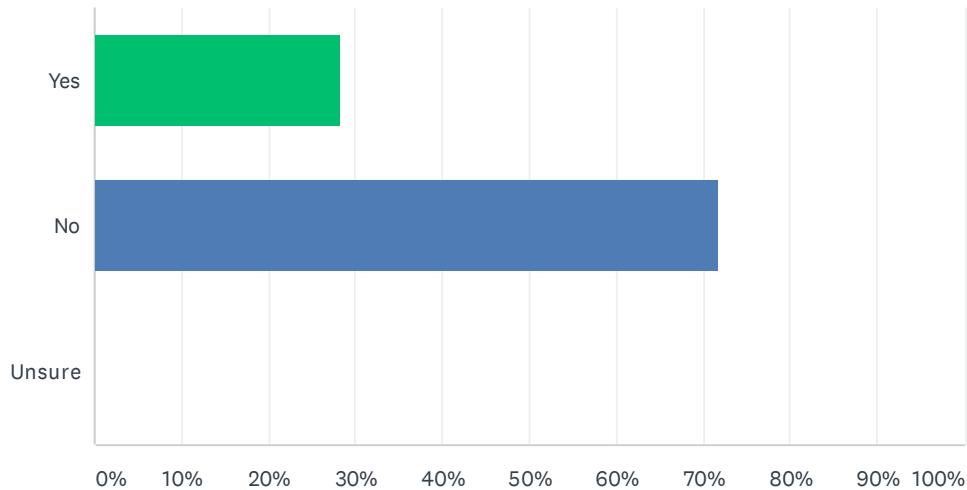


ANSWER CHOICES		RESPONSES	
Replacement cost		83.33%	5
Potential for enforcement		16.67%	1
Selling my house or business		33.33%	2
NA		0.00%	0
Other (please specify)		33.33%	2
Total Respondents: 6			

#	OTHER (PLEASE SPECIFY)	DATE
1	There are 7 homes using 1 septic field	3/26/2020 11:09 AM
2	a mound would take up our entire yard	3/12/2020 1:37 PM

Q12 Are you concerned about your water supply system?

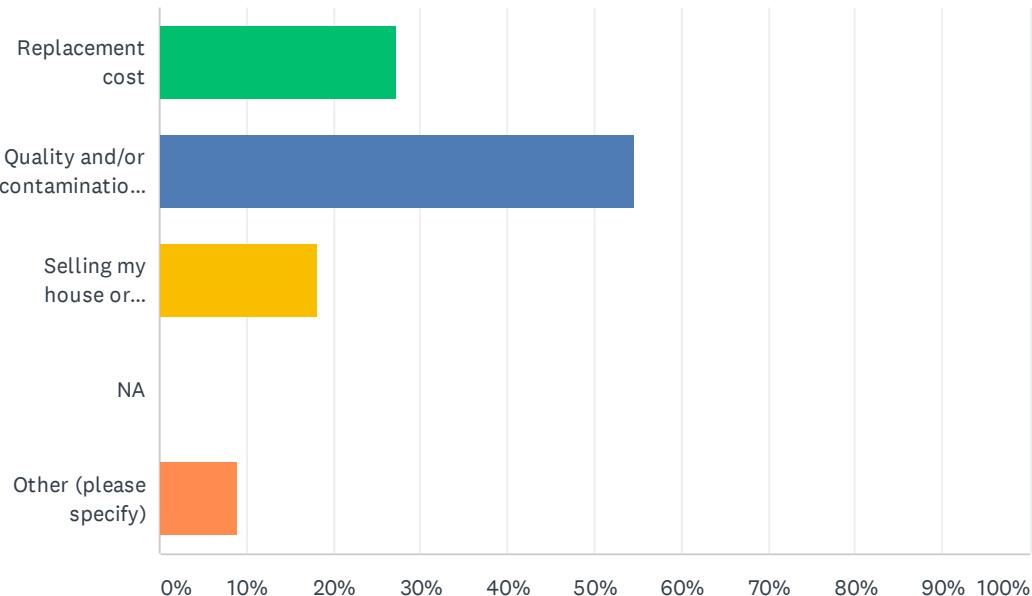
Answered: 39 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	28.21%	11
No	71.79%	28
Unsure	0.00%	0
TOTAL		39

Q13 If you are concerned about your water supply system, why? Please check all that apply:

Answered: 11 Skipped: 29

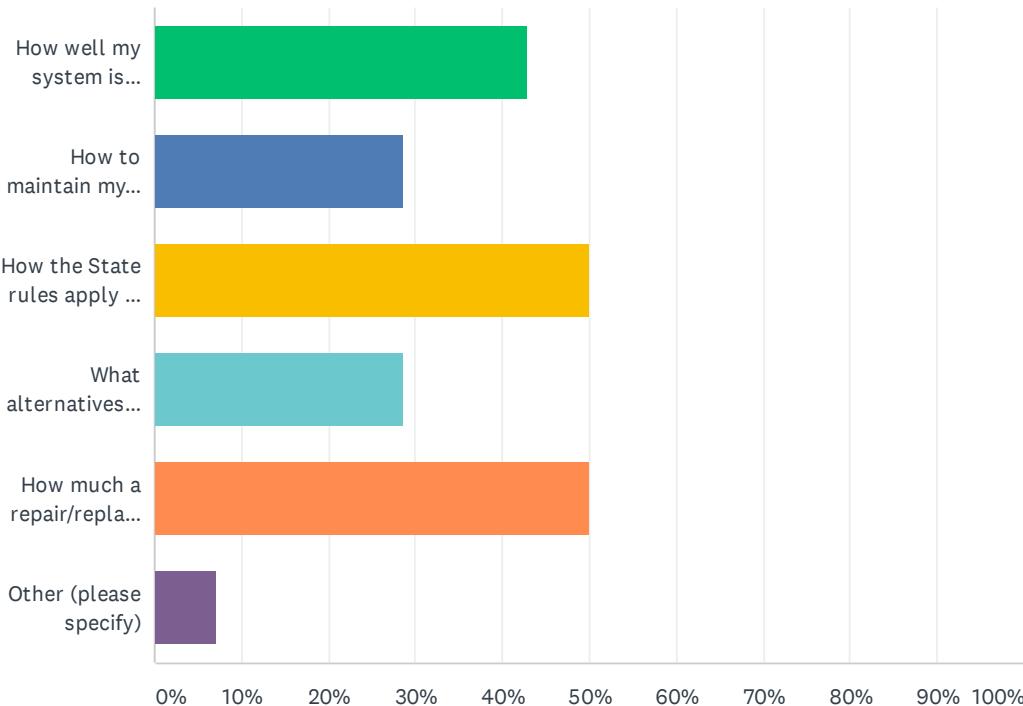


ANSWER CHOICES		RESPONSES	
Replacement cost		27.27%	3
Quality and/or contamination issues		54.55%	6
Selling my house or business		18.18%	2
NA		0.00%	0
Other (please specify)		9.09%	1
Total Respondents: 11			

#	OTHER (PLEASE SPECIFY)	DATE
1	Run off from school	3/26/2020 10:57 AM

Q14 What information or support would you like about septic systems and capacity? Check any that apply:

Answered: 14 Skipped: 26



ANSWER CHOICES		RESPONSES	
How well my system is working		42.86%	6
How to maintain my system		28.57%	4
How the State rules apply to my property		50.00%	7
What alternatives or different systems are available		28.57%	4
How much a repair/replacement system would cost, and if there's help to pay for it		50.00%	7
Other (please specify)		7.14%	1
Total Respondents: 14			

#	OTHER (PLEASE SPECIFY)	DATE
1	None	3/26/2020 10:37 AM

Q15 What do you like best about Highgate Center? What concerns you most about the village's future? What changes, if any, do you think would make Highgate Center better?

Answered: 18 Skipped: 22

#	RESPONSES	DATE
1	My location, close walking distance to food, gas, post office, town clerk, library, church, hardware store, school. Perhaps and eatery, or BBB for visitors and/or tourists.	4/2/2020 4:14 PM
2	like best- small town feeling concern- affordability of living here	4/2/2020 4:03 PM
3	Lower school taxes	4/2/2020 3:50 PM
4	Would like to get more business in town to offset taxes	4/2/2020 3:35 PM
5	To many big ideas, but no help to public living there	4/2/2020 3:30 PM
6	That Highgate is a small, supportive community. What concerns me is that everyone will leave Highgate and we won't be able to get new people to move here.	4/2/2020 3:20 PM
7	There needs to be more business in the center. Diners, Shopping, clothing	3/26/2020 10:37 AM
8	More industry	3/19/2020 3:39 PM
9	Quiet, amenities close by, fair taxes.	3/12/2020 1:43 PM
10	We like that it's relatively quiet. Everyone is friendly and welcoming. Public water + Sewer would be a nice asset.	3/12/2020 1:38 PM
11	Great small town	3/12/2020 1:31 PM
12	Like-Small town, helpful people Concerns- Trying to make it look like a city/Burlington with roundabouts Changes- Maybe housing for elderly	3/12/2020 1:21 PM
13	I am concerned about slope stabilization along river exposures; including village core.	3/12/2020 1:05 PM
14	Like-Rural Nature. Most concerned with excessive development with abundant traffic.	3/12/2020 12:07 PM
15	Extend water + sewers!	3/12/2020 11:59 AM
16	Taxes are too high!	3/12/2020 11:49 AM
17	Needs traffic control on 207 + 78 intersection, at least a stop sign like 4 corners	3/12/2020 11:45 AM
18	The small town atmosphere, keep it that way!	3/12/2020 11:38 AM

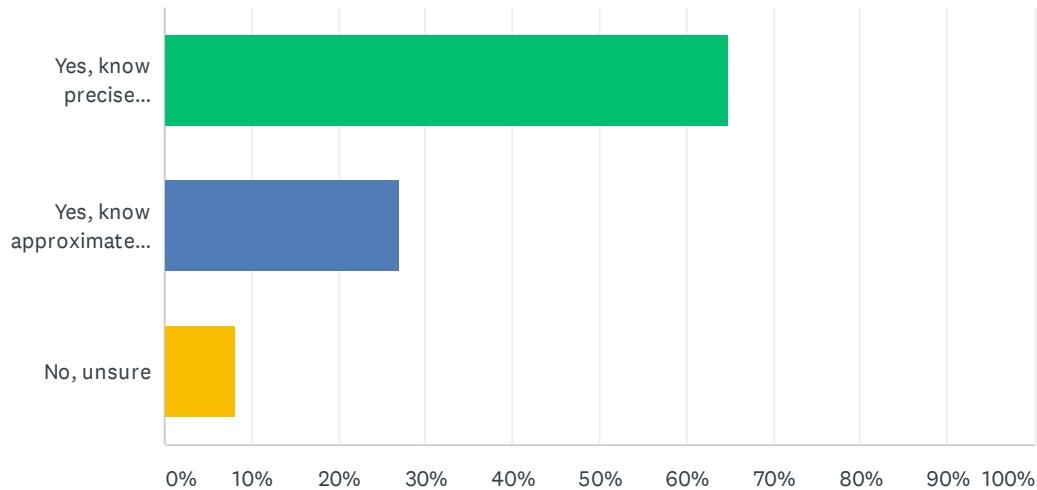
Q16 Using the example and the space provided below please indicate the approximate location of your house or other building, driveway, septic tank, leach field, and water supply. Is any portion of your property restricted from development by an easement, deed restriction, natural feature, or something else? If so, please indicate the approximate area on the sketch.

Answered: 25 Skipped: 15

#	FILE NAME	FILE SIZE	DATE
1	HighgateWasteWaterSurvey_03302020_9.pdf	236.4KB	4/2/2020 4:13 PM
2	HighgateWasteWaterSurvey_03302020_8.pdf	196.7KB	4/2/2020 4:07 PM
3	HighgateWasteWaterSurvey_03302020_7.pdf	197.4KB	4/2/2020 4:03 PM
4	HighgateWasteWaterSurvey_03302020_6.pdf	207.8KB	4/2/2020 3:54 PM
5	HighgateWasteWaterSurvey_03302020_5.pdf	217.7KB	4/2/2020 3:49 PM
6	HighgateWasteWaterSurvey_03302020_3.pdf	210KB	4/2/2020 3:35 PM
7	HighgateWasteWaterSurvey_03302020_2.pdf	224.4KB	4/2/2020 3:30 PM
8	SKM_C36820031917041.pdf	172.1KB	3/26/2020 11:09 AM
9	03192020_2.pdf	194.5KB	3/26/2020 11:01 AM
10	03192020_4.pdf	210.2KB	3/26/2020 10:37 AM
11	SKM_C36820031620170.pdf	200.4KB	3/19/2020 3:56 PM
12	SKM_C36820031620163.pdf	207.5KB	3/19/2020 3:49 PM
13	SKM_C36820031620150.pdf	209.1KB	3/19/2020 3:23 PM
14	SKM_C36820031620090.pdf	206KB	3/19/2020 3:14 PM
15	18.pdf	58.7KB	3/12/2020 1:42 PM
16	16.pdf	61.7KB	3/12/2020 1:38 PM
17	13.pdf	56KB	3/12/2020 1:30 PM
18	11.pdf	55.6KB	3/12/2020 1:26 PM
19	10.pdf	58.1KB	3/12/2020 1:20 PM
20	9.pdf	60.3KB	3/12/2020 1:15 PM
21	8.pdf	58.1KB	3/12/2020 1:10 PM
22	7.pdf	66.4KB	3/12/2020 1:05 PM
23	5.pdf	62.1KB	3/12/2020 1:00 PM
24	4.pdf	52.8KB	3/12/2020 12:52 PM
25	2.pdf	51.7KB	3/12/2020 12:48 PM

Q17 Do you know where your wastewater system is?

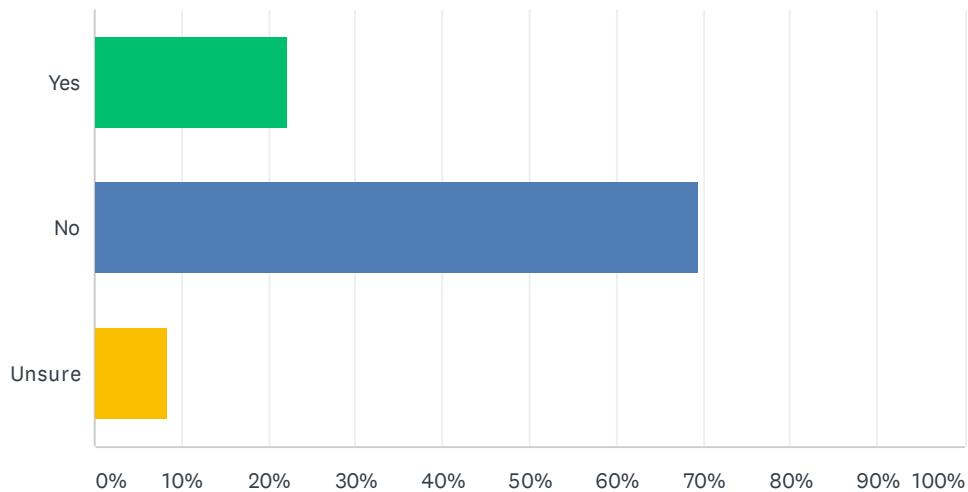
Answered: 37 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes, know precise location	64.86%	24
Yes, know approximate location	27.03%	10
No, unsure	8.11%	3
TOTAL		37

Q18 Do you have a copy of any sketches, plans, or permits of your septic system available for reference?

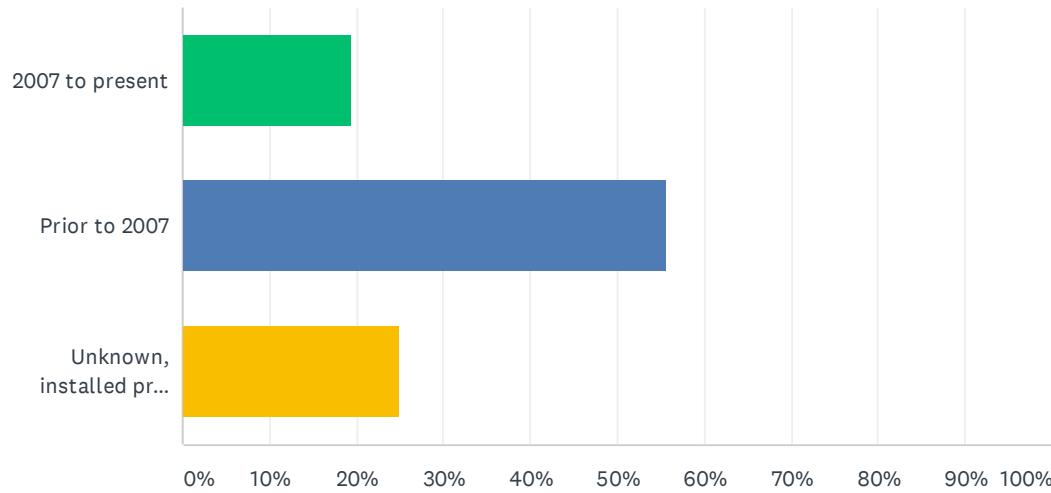
Answered: 36 Skipped: 4



ANSWER CHOICES	RESPONSES	
Yes	22.22%	8
No	69.44%	25
Unsure	8.33%	3
TOTAL		36

Q19 How old is your wastewater system (or what year was it installed)?

Answered: 36 Skipped: 4

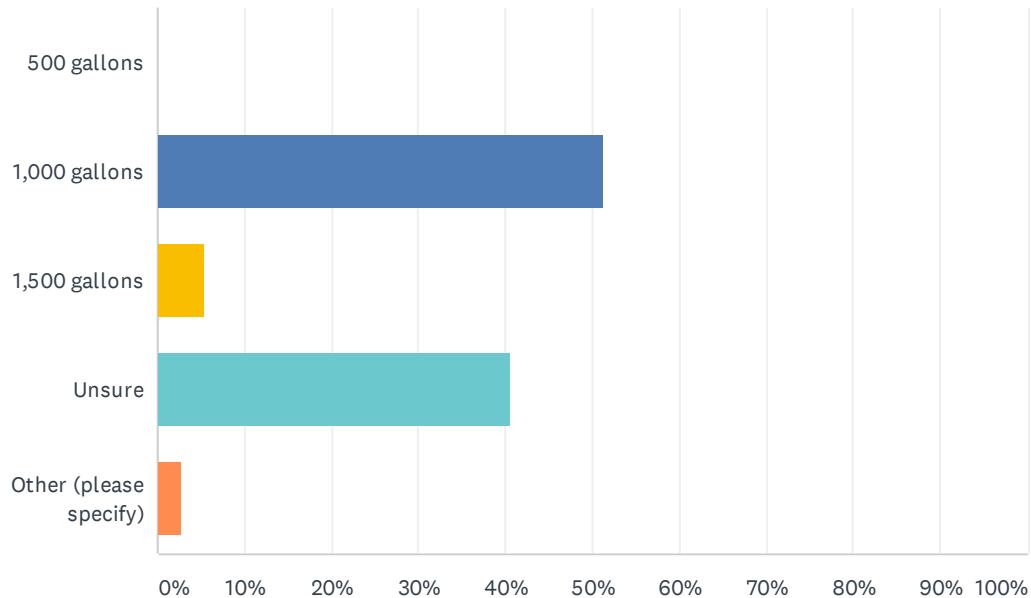


ANSWER CHOICES	RESPONSES
2007 to present	19.44%
Prior to 2007	55.56%
Unknown, installed prior to purchase of property	25.00%
TOTAL	36

#	IF INSTALLED 2007 OR LATER, PLEASE INDICATE STATE PERMIT # IF KNOWN. IF INSTALLED PRIOR TO PURCHASE OF PROPERTY, WHAT YEAR DID YOU PURCHASE YOUR PROPERTY?	DATE
1	2 years old	4/17/2020 10:02 AM
2	1981	4/2/2020 4:09 PM
3	1983 installed	4/2/2020 3:21 PM
4	2004	3/26/2020 11:11 AM
5	2015	3/26/2020 10:52 AM
6	1998	3/19/2020 3:51 PM
7	State permit #- ww-6-0714	3/12/2020 1:40 PM
8	April 2015	3/12/2020 1:28 PM
9	Year purchased 1984	3/12/2020 1:17 PM
10	2000	3/12/2020 1:06 PM
11	Purchased 1993	3/12/2020 11:51 AM

Q20 Please indicate the size of your septic tank:

Answered: 37 Skipped: 3

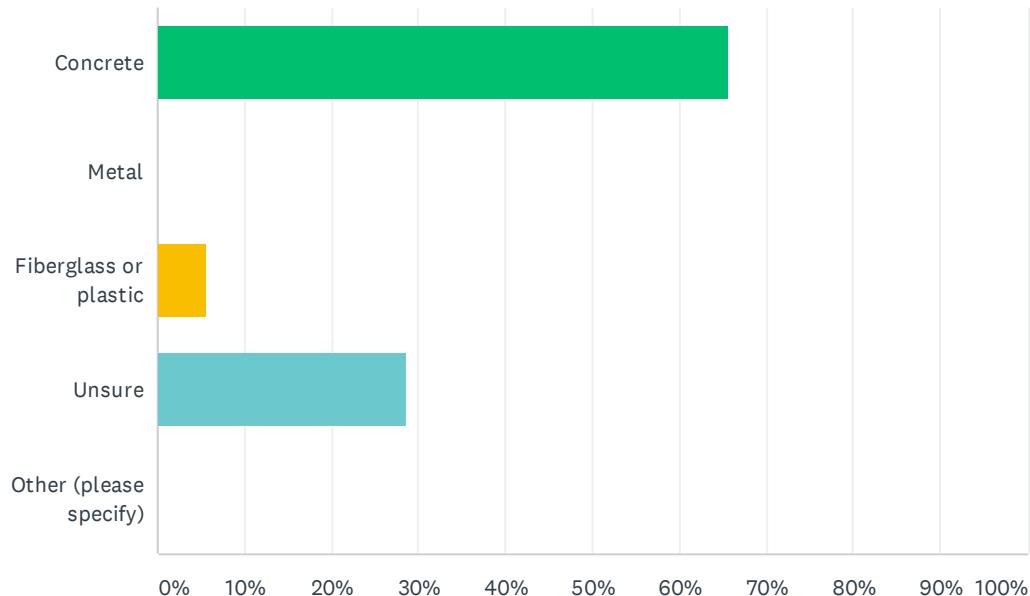


ANSWER CHOICES	RESPONSES
500 gallons	0.00%
1,000 gallons	51.35%
1,500 gallons	5.41%
Unsure	40.54%
Other (please specify)	2.70%
TOTAL	37

#	OTHER (PLEASE SPECIFY)	DATE
1	2,000	3/12/2020 1:40 PM

Q21 Please indicate the construction material of your septic tank:

Answered: 35 Skipped: 5

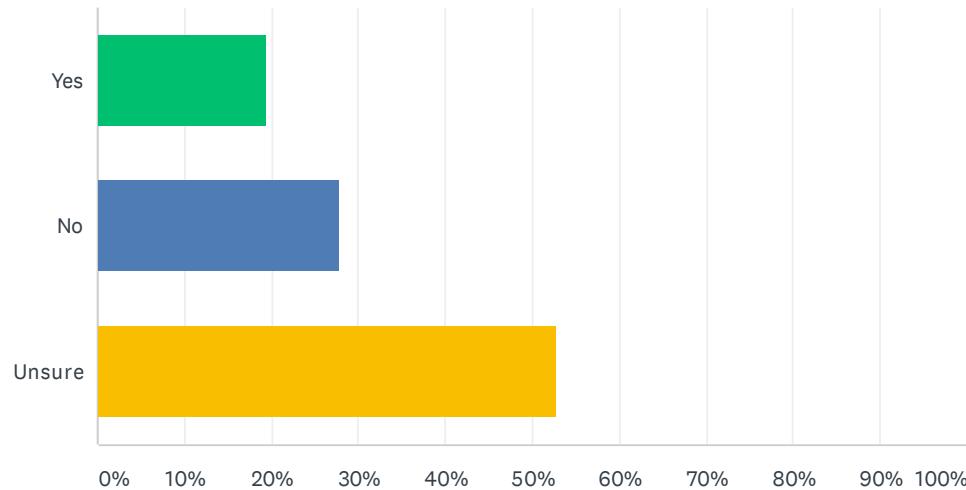


ANSWER CHOICES	RESPONSES	
Concrete	65.71%	23
Metal	0.00%	0
Fiberglass or plastic	5.71%	2
Unsure	28.57%	10
Other (please specify)	0.00%	0
TOTAL		35

#	OTHER (PLEASE SPECIFY)	DATE
There are no responses.		

Q22 Does your septic tank have an effluent filter?

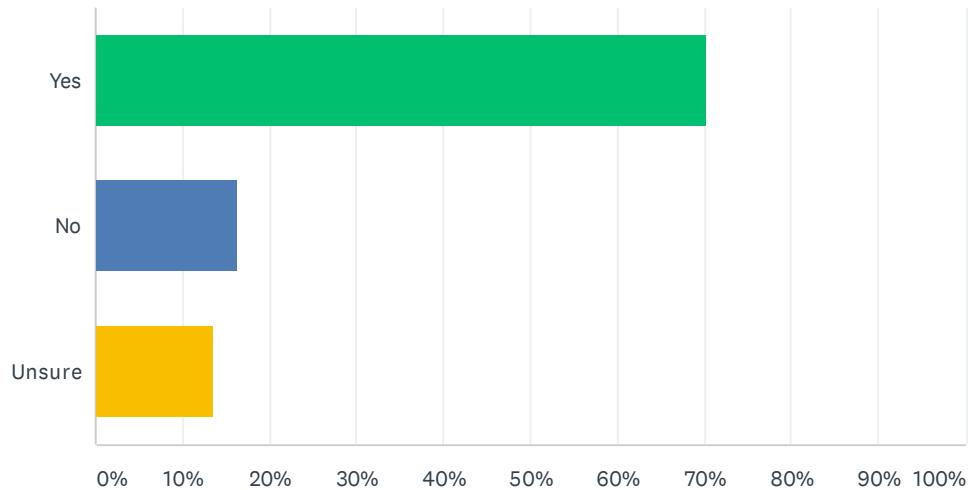
Answered: 36 Skipped: 4



ANSWER CHOICES	RESPONSES	
Yes	19.44%	7
No	27.78%	10
Unsure	52.78%	19
TOTAL		36

Q23 Does your septic tank have an accessible cover at grade?

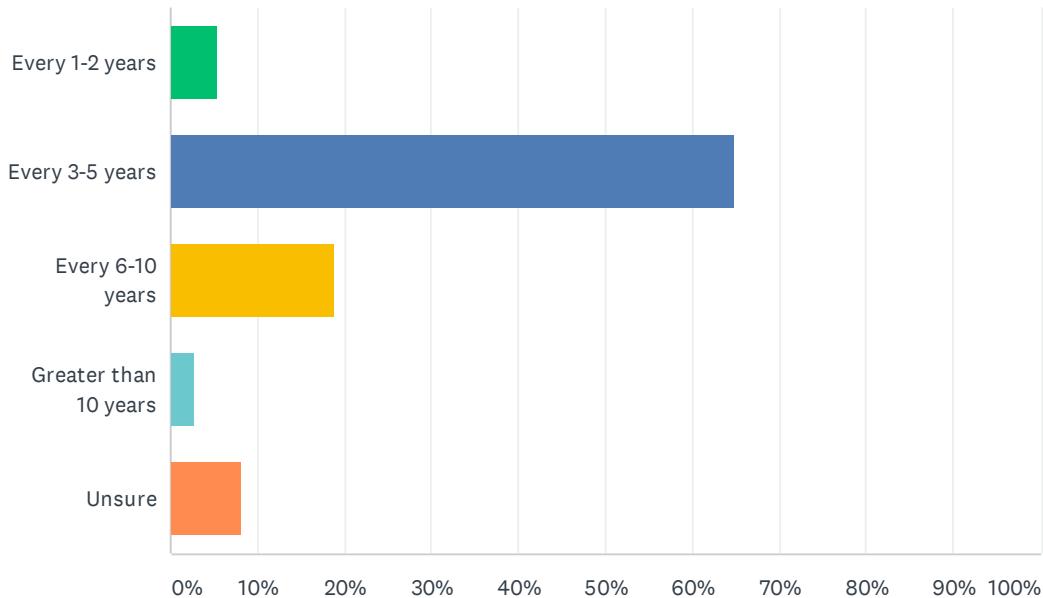
Answered: 37 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes	70.27%	26
No	16.22%	6
Unsure	13.51%	5
TOTAL		37

Q24 How often do you have your septic tank pumped?

Answered: 37 Skipped: 3



ANSWER CHOICES	RESPONSES	
Every 1-2 years	5.41%	2
Every 3-5 years	64.86%	24
Every 6-10 years	18.92%	7
Greater than 10 years	2.70%	1
Unsure	8.11%	3
TOTAL		37

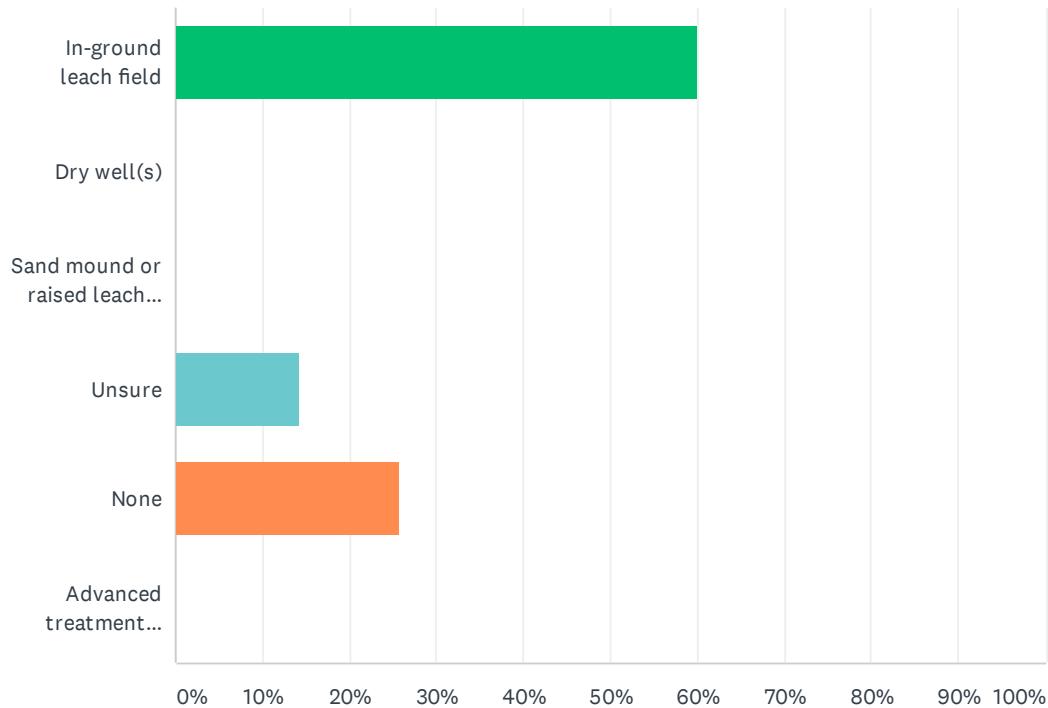
Q25 What year was your septic tank last pumped, if known?

Answered: 27 Skipped: 13

#	RESPONSES	DATE
1	2012	4/2/2020 4:15 PM
2	not known	4/2/2020 4:09 PM
3	2017	4/2/2020 4:04 PM
4	N/A	4/2/2020 3:50 PM
5	new in 2015 not done yet	4/2/2020 3:38 PM
6	2 years ago	4/2/2020 3:31 PM
7	2019	4/2/2020 3:21 PM
8	2018	3/26/2020 11:11 AM
9	2018	3/26/2020 10:58 AM
10	2015?	3/26/2020 10:52 AM
11	2019	3/19/2020 3:51 PM
12	2020	3/19/2020 3:40 PM
13	2017	3/19/2020 3:25 PM
14	2016	3/19/2020 3:16 PM
15	2019	3/12/2020 1:40 PM
16	2019	3/12/2020 1:32 PM
17	3-17-15	3/12/2020 1:28 PM
18	2018	3/12/2020 1:22 PM
19	2018	3/12/2020 1:17 PM
20	2017	3/12/2020 1:11 PM
21	2018	3/12/2020 1:06 PM
22	2018	3/12/2020 1:01 PM
23	2018	3/12/2020 12:14 PM
24	2019	3/12/2020 11:55 AM
25	Will be at the sale of this home..... Soon	3/12/2020 11:51 AM
26	2019	3/12/2020 11:39 AM
27	2018	3/12/2020 11:12 AM

Q26 What type of treatment do you have after your septic tank?

Answered: 35 Skipped: 5

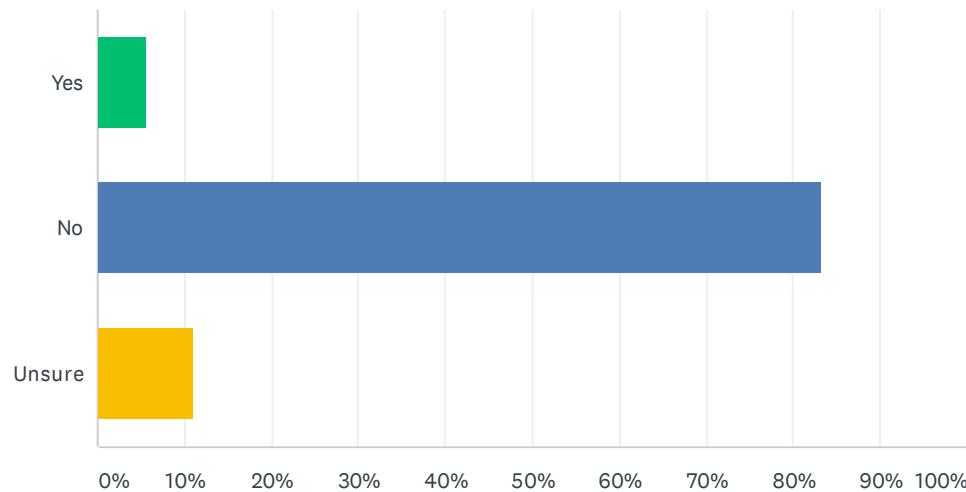


ANSWER CHOICES		RESPONSES	
In-ground leach field		60.00%	21
Dry well(s)		0.00%	0
Sand mound or raised leach field		0.00%	0
Unsure		14.29%	5
None		25.71%	9
Advanced treatment (Advantex, SeptiTech, etc.—please describe if you know)		0.00%	0
TOTAL			35

#	ADVANCED TREATMENT (ADVANTEX, SEPTITECH, ETC.—PLEASE DESCRIBE IF YOU KNOW)	DATE
There are no responses.		

Q27 Do you have a sump pump connected to your septic system?

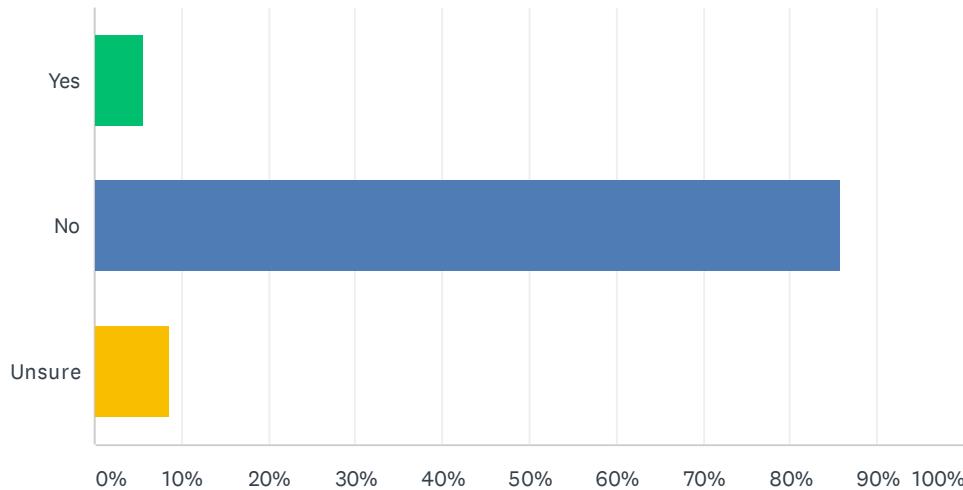
Answered: 36 Skipped: 4



ANSWER CHOICES	RESPONSES	
Yes	5.56%	2
No	83.33%	30
Unsure	11.11%	4
TOTAL		36

Q28 Is your wastewater system shared with another building or property?

Answered: 35 Skipped: 5



ANSWER CHOICES	RESPONSES	
Yes	5.71%	2
No	85.71%	30
Unsure	8.57%	3
TOTAL		35

#	IF YES, PLEASE DESCRIBE:	DATE
1	7	3/26/2020 11:11 AM
2	1 property, leach field several homes	3/12/2020 1:22 PM

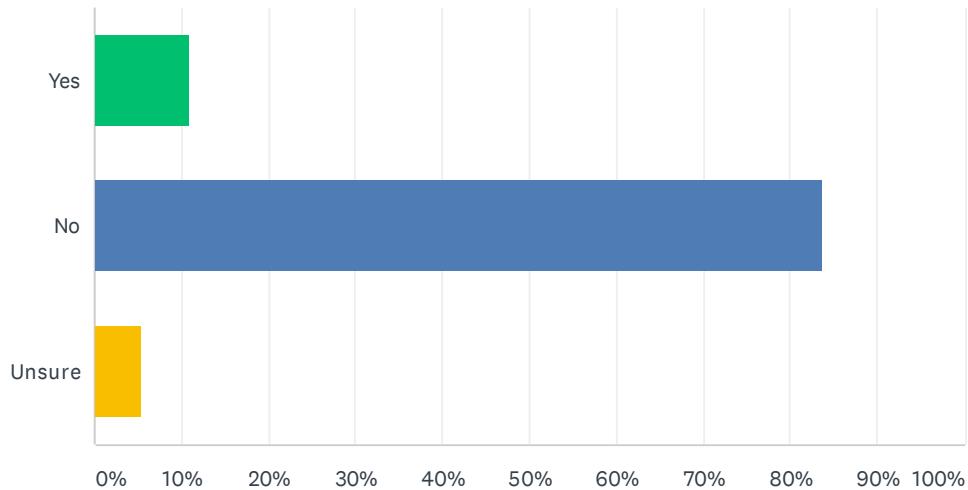
Q29 Please describe any upgrades or repairs that have been performed on your septic system within the last ten years:

Answered: 12 Skipped: 28

#	RESPONSES	DATE
1	New System	4/17/2020 10:02 AM
2	June 2018- All cast iron sewage pipes retrieved and replaced w/pvc.	4/2/2020 4:15 PM
3	none	4/2/2020 4:09 PM
4	None	4/2/2020 3:50 PM
5	None	4/2/2020 3:38 PM
6	None	4/2/2020 3:31 PM
7	Maintenance	4/2/2020 3:21 PM
8	None	3/26/2020 10:39 AM
9	None	3/19/2020 3:40 PM
10	Broken leach field dine	3/12/2020 1:28 PM
11	I've already had to have septic pumped twice and it needs it again. I think there is a problem with septic for sure but can't afford to have it replaced.	3/12/2020 12:55 PM
12	None Required	3/12/2020 12:00 PM

Q30 Has your septic system ever backed up?

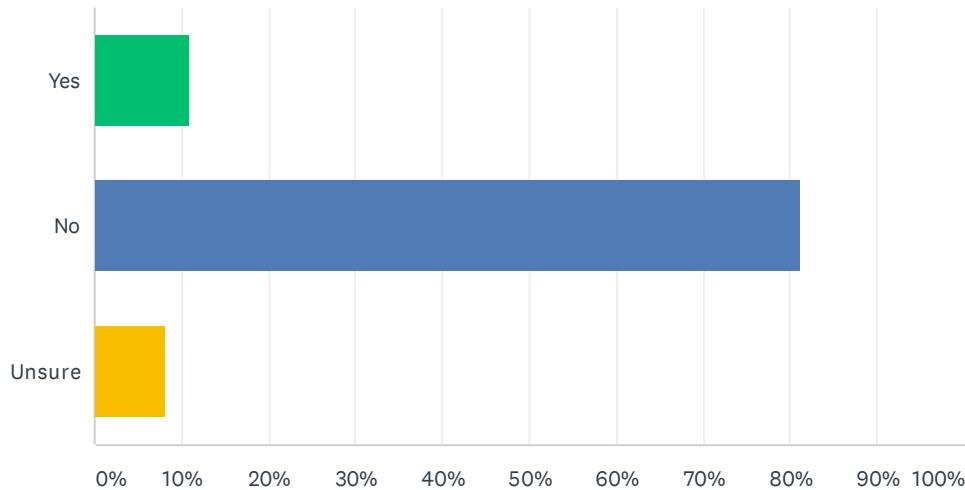
Answered: 37 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes	10.81%	4
No	83.78%	31
Unsure	5.41%	2
TOTAL		37

Q31 Does your septic system give off odors?

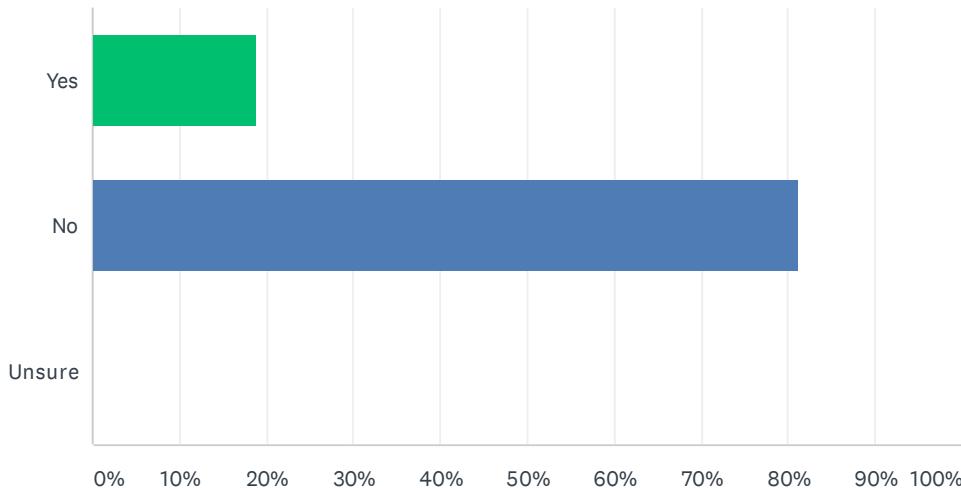
Answered: 37 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes	10.81%	4
No	81.08%	30
Unsure	8.11%	3
TOTAL		37

Q32 Do you have wet areas in your yard?

Answered: 37 Skipped: 3

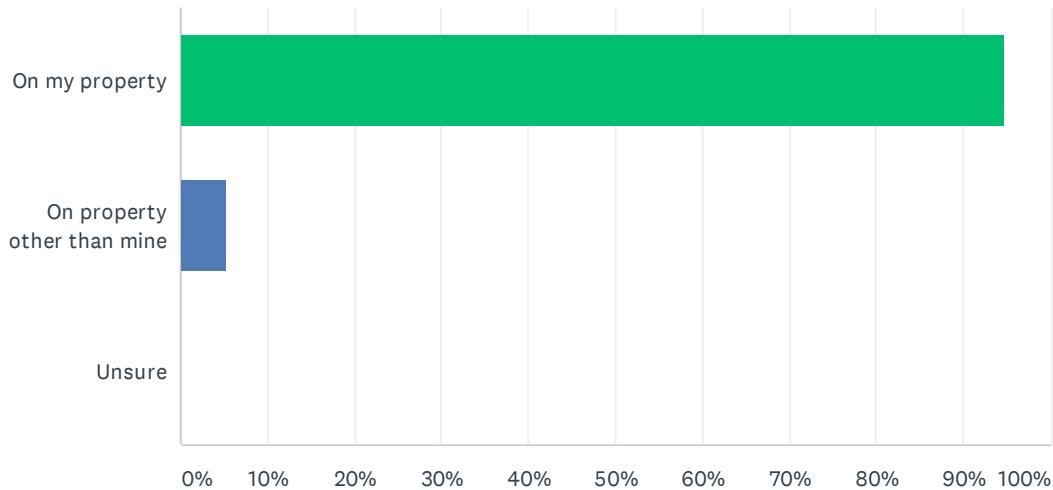


ANSWER CHOICES	RESPONSES	
Yes	18.92%	7
No	81.08%	30
Unsure	0.00%	0
TOTAL		37

#	IF YES, WHEN?	DATE
1	Spring	4/2/2020 4:09 PM
2	Sometimes	3/19/2020 3:51 PM
3	Only when the pine got crushed/broken	3/12/2020 1:28 PM
4	After rain, during Spring in the back yard	3/12/2020 12:14 PM

Q33 Do you know where your water supply (well or spring) is located?

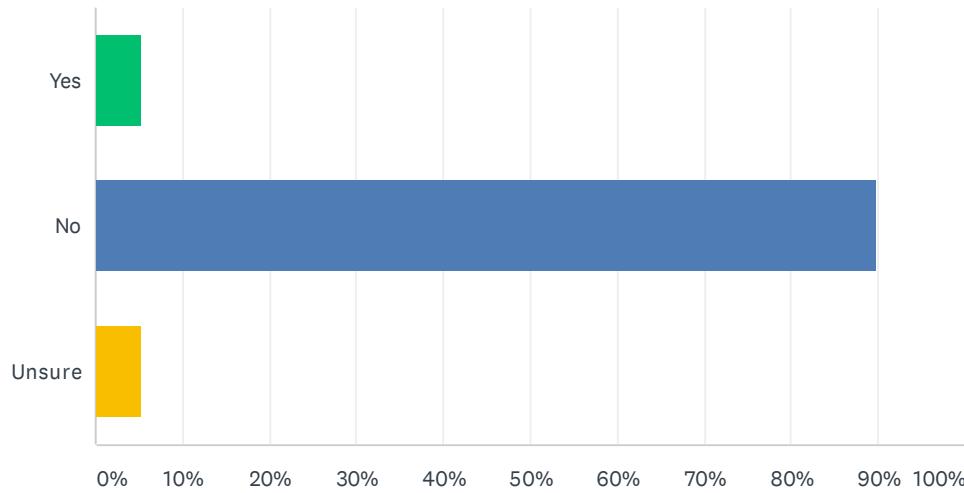
Answered: 39 Skipped: 1



ANSWER CHOICES	RESPONSES	
On my property	94.87%	37
On property other than mine	5.13%	2
Unsure	0.00%	0
TOTAL		39

Q34 Do you have more than one water supply on your property?

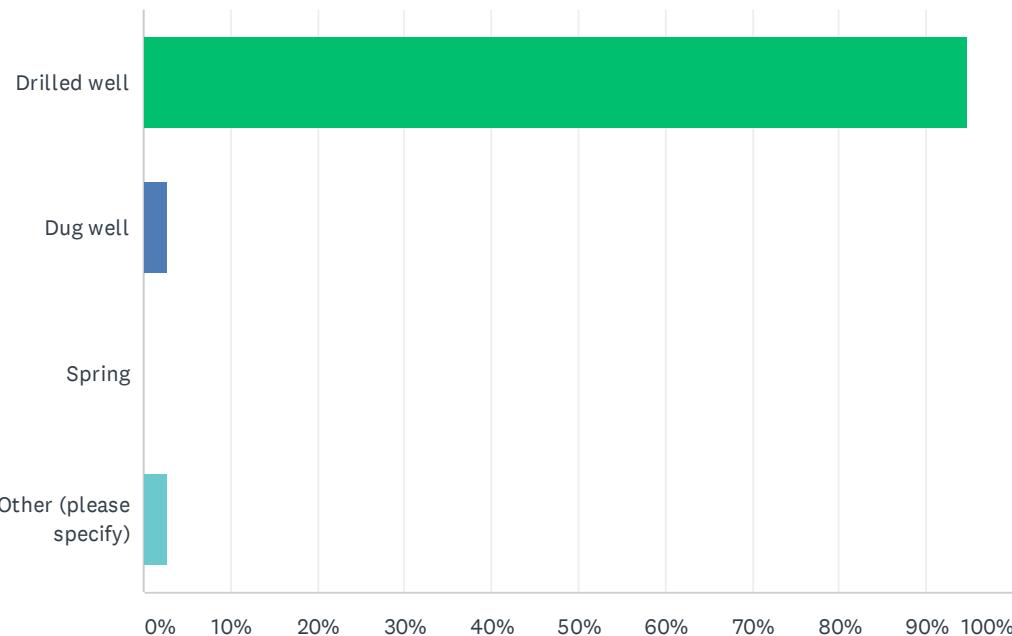
Answered: 39 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	5.13%	2
No	89.74%	35
Unsure	5.13%	2
TOTAL		39

Q35 What is the source of your household water?

Answered: 38 Skipped: 2

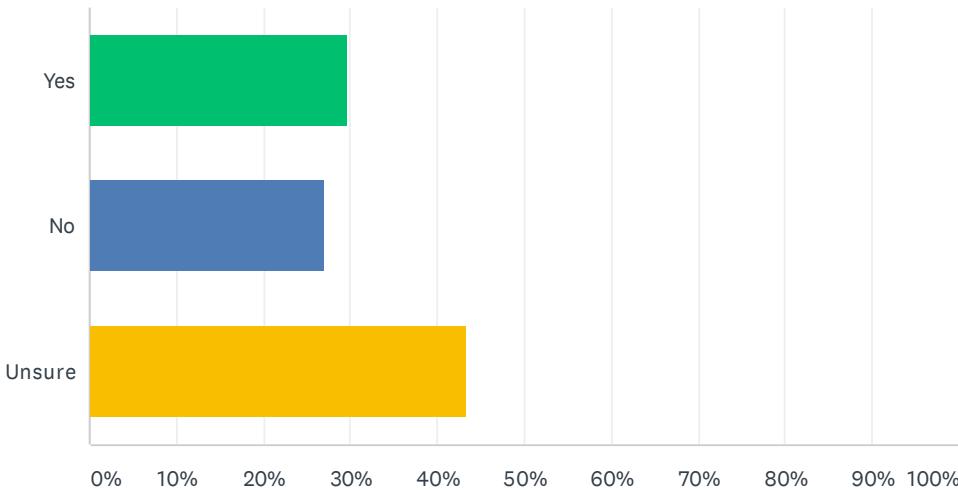


ANSWER CHOICES	RESPONSES	
Drilled well	94.74%	36
Dug well	2.63%	1
Spring	0.00%	0
Other (please specify)	2.63%	1
TOTAL		38

#	OTHER (PLEASE SPECIFY)	DATE
1	Unknown	3/19/2020 3:43 PM

Q36 Does your well have a tag (aluminum)?

Answered: 37 Skipped: 3

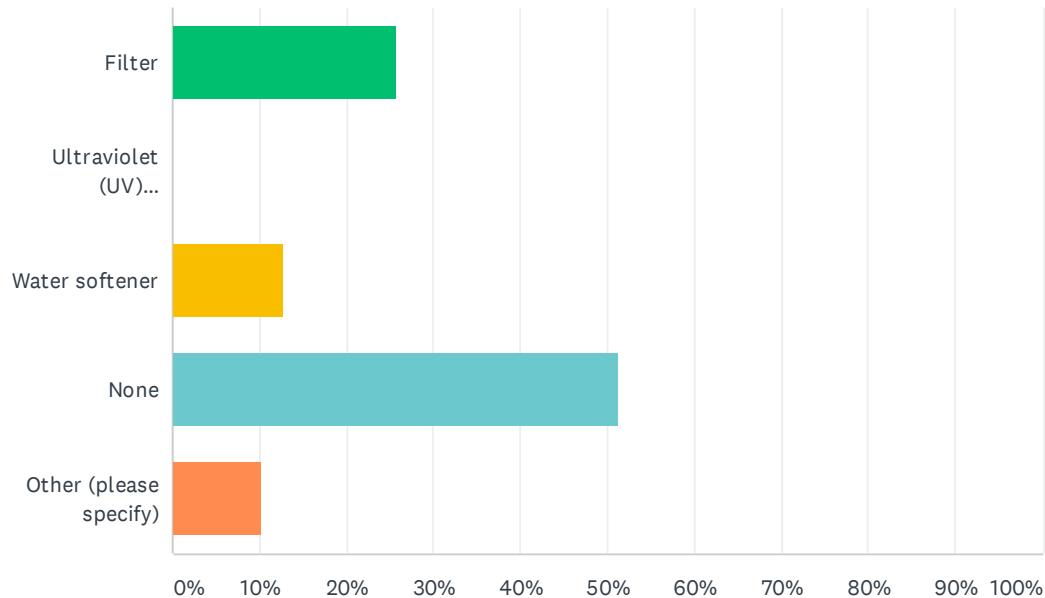


ANSWER CHOICES	RESPONSES	
Yes	29.73%	11
No	27.03%	10
Unsure	43.24%	16
TOTAL		37

#	IF YES, WHAT IS THE DATE THE WELL WAS INSTALLED? WHAT IS THE DRILLER NUMBER? WHAT IS THE TAG #/ ID?	DATE
1	4/8/2009. 191. 45106	4/2/2020 4:16 PM
2	Chevalier Drilling	4/2/2020 4:05 PM
3	Oct. 2016 198 56635	4/2/2020 3:22 PM
4	March 2015	3/19/2020 3:18 PM
5	Drill date- 8/6/08 Driller #-191 Tag#- 39552	3/12/2020 12:09 PM

Q37 Do you have any type of water treatment system?

Answered: 39 Skipped: 1

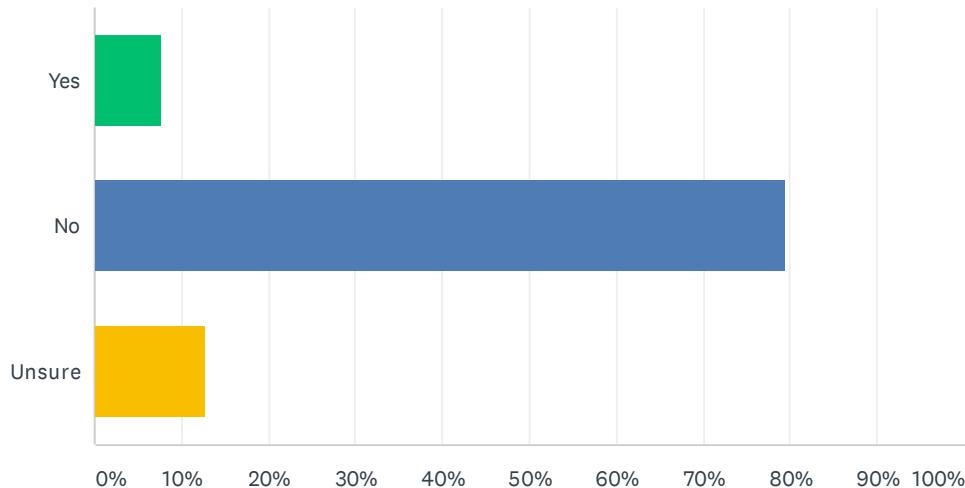


ANSWER CHOICES		RESPONSES
Filter		25.64%
Ultraviolet (UV) disinfection		0.00%
Water softener		12.82%
None		51.28%
Other (please specify)		10.26%
TOTAL		39

#	OTHER (PLEASE SPECIFY)	DATE
1	N/A	3/26/2020 11:06 AM
2	unsure	3/26/2020 10:54 AM
3	Needs to be replaced also	3/12/2020 12:57 PM
4	GAC	3/12/2020 12:09 PM

Q38 Have you ever had contamination problems with the water supply system(s) on your property?

Answered: 39 Skipped: 1

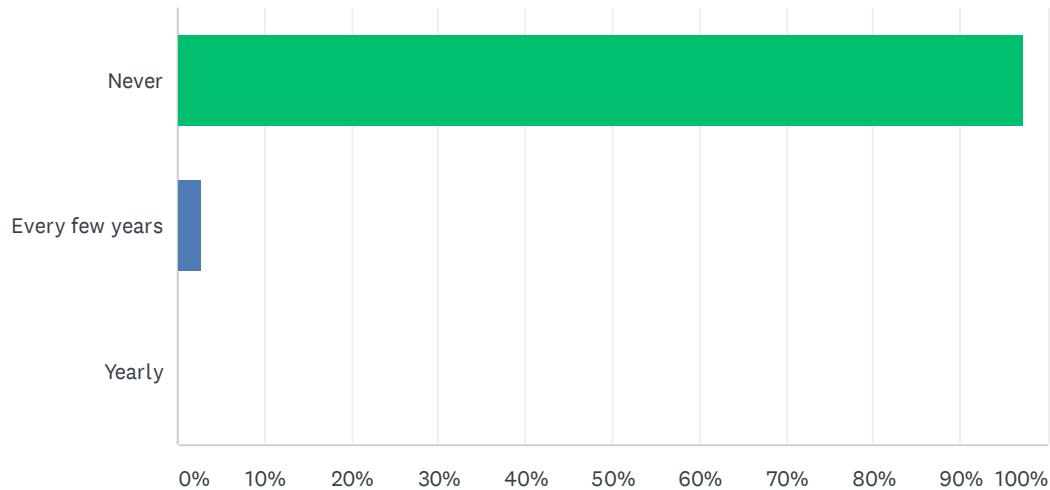


ANSWER CHOICES	RESPONSES	
Yes	7.69%	3
No	79.49%	31
Unsure	12.82%	5
TOTAL		39

#	IF YES, PLEASE DESCRIBE:	DATE
1	Had to treat with chlorox tabs.	3/26/2020 11:04 AM
2	Water tested every 4 months	3/26/2020 10:59 AM
3	Filtered twice	3/19/2020 3:52 PM
4	Sulfur, Minerals, etc.	3/12/2020 12:03 PM

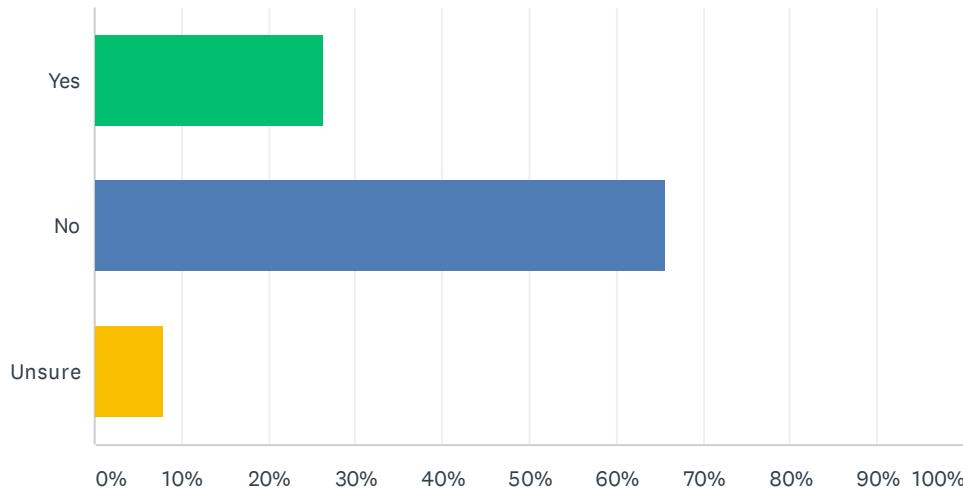
Q39 Have you ever run out of water?

Answered: 37 Skipped: 3



Q40 Has the property had any other problems with water, or has work been done on the water system in the last 10 years?

Answered: 38 Skipped: 2

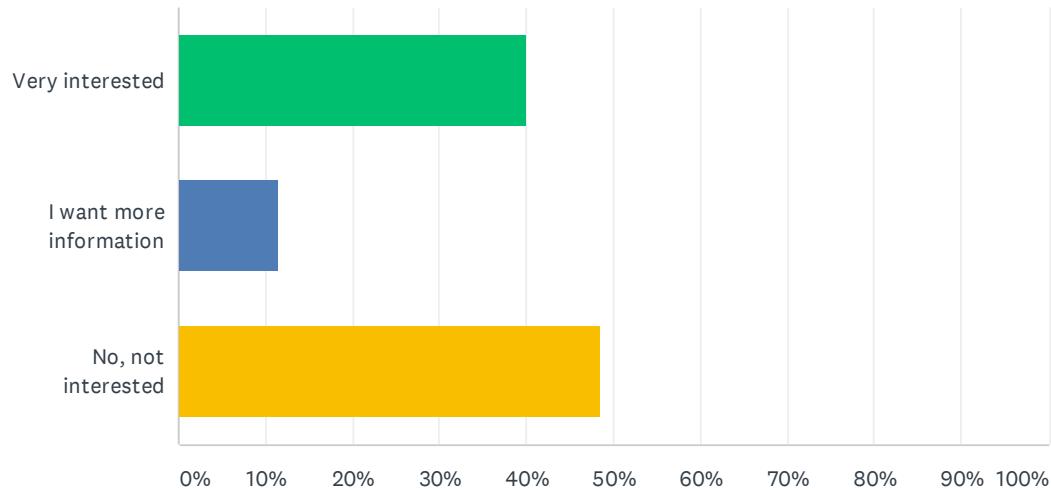


ANSWER CHOICES	RESPONSES	
Yes	26.32%	10
No	65.79%	25
Unsure	7.89%	3
TOTAL		38

#	IF YES, PLEASE DESCRIBE:	DATE
1	Was removed from town well/water	4/2/2020 4:16 PM
2	Cleaned out, new foot valve	4/2/2020 4:10 PM
3	new well	4/2/2020 4:00 PM
4	Water has an odor. We will not drink it. We buy spring water.	3/26/2020 10:54 AM
5	Drilled deeper/ new piping	3/19/2020 3:52 PM
6	New bladder tank and pump	3/19/2020 3:43 PM
7	Drilled a well- Provider did away with others on his system	3/19/2020 3:18 PM
8	Replaced pump 2015	3/12/2020 1:08 PM
9	Grading land not much help	3/12/2020 12:16 PM
10	Replaced water softener	3/12/2020 11:56 AM

Q41 Are you interested in free water quality testing?

Answered: 35 Skipped: 5



ANSWER CHOICES	RESPONSES	
Very interested	40.00%	14
I want more information	11.43%	4
No, not interested	48.57%	17
TOTAL		35

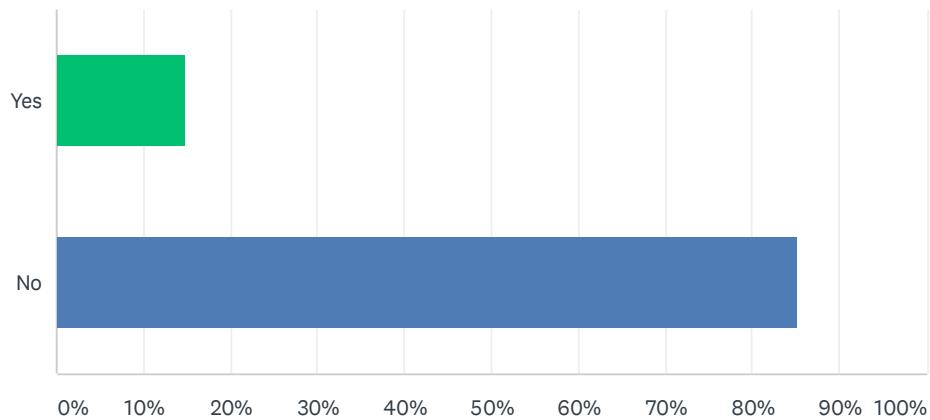
Q42 Do you have any other thoughts, concerns, or comments you would like to share about wastewater or water systems in Highgate Center?

Answered: 17 Skipped: 23

#	RESPONSES	DATE
1	Highgate has good drainage for septic its almost all sand	4/17/2020 10:04 AM
2	Close proximity to other systems	4/2/2020 4:16 PM
3	No	4/2/2020 4:00 PM
4	None	4/2/2020 3:51 PM
5	No	4/2/2020 3:39 PM
6	No, I'm happy with mine.	4/2/2020 3:22 PM
7	We have a new well and septic. We do not need a wastewater plant.	3/26/2020 11:04 AM
8	It would be effective in large developments, but in the center I think it a waste of time and money. The center is all existing and nobody will change over.	3/26/2020 10:53 AM
9	No	3/19/2020 3:52 PM
10	Would like to see a waste water treatment plant	3/19/2020 3:43 PM
11	I prefer well water over treated water	3/19/2020 3:26 PM
12	I am sure there are some that need a central system, but mine is ok, no problems.	3/12/2020 1:44 PM
13	I think it is a great idea.	3/12/2020 1:41 PM
14	Close attention to creating any additional runoff should be paramount; as well as potentially reducing existing village core runoff.	3/12/2020 1:08 PM
15	I would like to see better water and septic options.	3/12/2020 12:57 PM
16	Excellent soils with capacity for residential development. Need municipal w+s for commercial and industrial growth.	3/12/2020 12:03 PM
17	Refuse to drink chlorinated water!	3/12/2020 11:41 AM

Q43 To discuss your comments or concerns in greater detail, would you like a member of the Village Core Steering Committee or one of the consultants to contact you?

Answered: 27 Skipped: 13



ANSWER CHOICES	RESPONSES	
Yes	14.81%	4
No	85.19%	23
TOTAL		27

#	IF YES, PLEASE PROVIDE YOUR NAME, PHONE NUMBER AND THE BEST TIME TO CONTACT YOU:	DATE
1	Gil Tremblay, 782-0789, 7pm	4/17/2020 10:04 AM
2	Kermit + Susan Drowa, 802-868-6169, Evening after 6pm.	3/19/2020 3:43 PM
3	Donald English, 582-1201	3/12/2020 1:33 PM
4	Crystal Curran, (802)-782-6595, Anytime	3/12/2020 12:57 PM
5	Brendan Deso, 393-7074, Daytime M-F	3/12/2020 12:03 PM

**APPENDIX G – EXCERPTS OF SOIL TYPE DESCRIPTIONS FROM THE APRIL 1979 UNITED STATES
DEPARTMENT OF AGRICULTURE (USDA) SOIL CONSERVATION SERVICE (SCS) SOIL SURVEY OF
FRANKLIN COUNTY, VERMONT, AND THE JANUARY 2015 USDA NATURAL RESOURCES
CONSERVATION SERVICE (NRCS)**

Appendix G

Excerpts of soil type descriptions from the April 1979 United States Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Franklin County, Vermont, and the January 2015 USDA Natural Resources Conservation Service (NRCS).

As shown in **Figure No. 3**, the two favorable soil types for wastewater disposal include the Missisquoi Series: Missisquoi loamy sand, 0-3% slopes (MsA); and the Windsor Series: Windsor loamy fine sand, 0-3% slopes (WsA), and Windsor loamy fine sand, 3-8% slopes (WsB).

Soil Descriptions and Wastewater Disposal (Figure No. 3)

Property A, Locations 1 and 2 (SPAN #291-092-12053, 34.27 Acres)

Windsor loamy fine sand, 3-8% slopes (WsB)

Review of Property 1, Locations 1 and 2 indicates the USDA SCS description for the Windsor loamy fine sand, 3-8% slopes (WsB) soil: "This gently sloping, excessively drained soil is in smooth and slightly convex areas on broad terraces and deltas...Permeability is rapid in this soil, and available water capacity is low...Depth to bedrock is commonly more than 5 feet....This soil is suitable for some urban uses. However, the rapid permeability of this soil allows wastes to contaminate some shallow wells."

The USDA NRCS Soil Fact Sheet for soil Windsor loamy fine sand, 0-3% slopes (WsA), and for Windsor loamy fine sand, 3-8% slopes (WsB), states that the soil "unit is well suited as a site for soil-based residential wastewater disposal soil systems"..."the rapid permeability in the substratum is a concern"..."backfilling absorption trenches with at least one foot of finer textured material or other site modifications may be necessary to slow the percolation rate enough to allow for thorough filtering of effluent."

Property B, Location 3 (SPAN #291-092-10782, 3.5 Acres)

Property C, Location 4 (SPAN #291-092-11747, 98.1 Acres)

Property D, Location 5 (SPAN #291-092-11068, 59.79 Acres)

Missisquoi loamy sand, 0-3% slopes (MsA)

Review of Property B, Location 3; Property C, Location 4; and Property D, Location 5; indicates the USDA SCS description for the Missisquoi loamy sand, 0-3% slopes (MsA) soil: "This nearly level, excessively drained, deep soil is on broad terraces and deltas... Permeability is rapid in this soil...Available water capacity and natural fertility is low... and available water capacity is low...Depth to bedrock is commonly more than 5 feet...This soil is suitable for some urban uses. However, the rapid permeability of this soil allows wastes to contaminate some shallow wells."

The USDA NRCS Soil Fact Sheet for soil MsA, Missisquoi loamy sand, 0-3% slopes, states that the soil "unit is well suited as a site for soil-based residential wastewater disposal soil

systems"..."the rapid permeability in the substratum is a concern"..."backfilling absorption trenches with at least one foot of finer textured material or other site modifications may be necessary to slow the percolation rate enough to allow for thorough filtering of effluent."

Property E, Location 6 (SPAN #291-092-12235, 32.43 Acres)

Windsor loamy fine sand, 0-3% slopes (WsA)

Windsor loamy fine sand, 3-8% slopes (WsB)

Review of Property E, Location 6, indicates the USDA SCS description for the Windsor loamy fine sand, 0-3% slopes (WsA) soil: "This nearly level, excessively drained soil is on broad terraces and deltas...Permeability is rapid in this soil, and available water capacity is low...Depth to bedrock is commonly more than 5 feet....This soil is suitable for some urban uses. However, the rapid permeability of this soil allows wastes to contaminate some shallow wells."

And the USDA SCS description for the Windsor loamy fine sand, 3-8% slopes (WsB) soil: "This gently sloping, excessively drained soil is in smooth and slightly convex areas on broad terraces and deltas...Permeability is rapid in this soil, and available water capacity is low...Depth to bedrock is commonly more than 5 feet....This soil is suitable for some urban uses. However, the rapid permeability of this soil allows wastes to contaminate some shallow wells."

The USDA NRCS Soil Fact Sheet for soil Windsor loamy fine sand, 0-3% slopes (WsA), and for Windsor loamy fine sand, 3-8% slopes (WsB), states that the soil "unit is well suited as a site for soil-based residential wastewater disposal soil systems"..."the rapid permeability in the substratum is a concern"..."backfilling absorption trenches with at least one foot of finer textured material or other site modifications may be necessary to slow the percolation rate enough to allow for thorough filtering of effluent."

APPENDIX H – SOIL TEST PIT LOGS, WRIGHT PROPERTY



Project: #978-001 Town of Highgate

Location: Sand Pit, Lamkin Street, Highgate, Vermont

Date: October 14, 2020 Time: 8:00a.m. Weather: Overcast, calm, 60-70° F

Excavation method and Contractor: John Deere 410G - rubber tire backhoe

Ground Surface Slope: 0 - 3% Logged by: Bill Norland, C.P.G., Hydrogeologist

Test Pit #	Depth interval (inches)	Texture	Structure	Consistence	Matrix Color (Munsell)	Mottles/ RMF Colors (Munsell)	Notes
TP-20-01	0-11	fine to coarse sandy loam	subangular blocky	friable	10 YR 3/2	-	moist, topsoil, roots
	11-59	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	moist to dry
	59-72	fine sand	granular	loose	10 YR 5/3	-	dry
	72-80	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	dry NBTD, NGWTD, SHWT >>80"
TP-20-02	0-12	fine to coarse sandy loam	subangular blocky	friable	10 YR 3/2	-	moist, topsoil, roots
	12-62	fine to medium sand, trace coarse sand	granular	loose	10 YR 3/2	-	moist to dry
	62-82	medium to coarse sand, trace fine gravel	granular	loose	10 YR 4/2	-	dry NBTD, NGWTD, SHWT >>82"
TP-20-03	0-10	fine to coarse sandy loam	subangular blocky	friable	10 YR 3/2	-	moist, topsoil, roots
	10-53	fine sand, little medium sand	granular	loose	10 YR 4/2	-	moist to dry
	53-56	silty fine sand	granular	friable	10 YR 4/2	-	dry
	56-76	fine to medium sand	granular	loose	10 YR 5/2	-	dry

Test Pit #	Depth interval (inches)	Texture	Structure	Consistence	Matrix Color (Munsell)	Mottles/ RMF Colors (Munsell)	Notes
TP-20-03	76-82	silty fine sand	granular	friable	10 YR 4/2	-	dry
	82-120	fine to medium sand	granular	loose	10 YR 5/2	-	dry NBTD, NGWTD, SHWT >>120"
TP-20-04	0-12	fine to coarse sandy loam	subangular blocky	friable	10 YR 3/2	-	moist, topsoil, roots
	12-96	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	moist to dry
	85-88	silt loam	angular blocky	friable	10 YR 4/2	-	moist
	88-110	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	dry NBTD, NGWTD, SHWT >>110"
TP-20-05	0-12	fine to coarse sandy loam	subangular blocky	friable	10 YR 3/2	-	moist, topsoil, roots
	12-96	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	moist to dry NBTD, NGWTD, SHWT >>96"
TP-20-06	0-9	fine to coarse sandy loam	subangular blocky	friable	10 YR 3/2	-	moist, topsoil, roots
	9-50	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	moist to dry
	50-54	silt loam	angular blocky	friable	10 YR 4/2	-	moist
	54-72	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	dry

Test Pit #	Depth interval (inches)	Texture	Structure	Consistence	Matrix Color (Munsell)	Mottles/ RMF Colors (Munsell)	Notes
TP-20-06	72-92	medium to coarse sand, trace fine gravel	granular	loose	10 YR 4/2	-	dry NBTD, NGWTD, SHWT >>92"
TP-20-07	0-11	fine to coarse sandy loam	subangular blocky	friable	10 YR 3/2	-	moist, topsoil, roots
	11-33	medium to coarse sand, trace fine gravel	granular	loose	10 YR 4/2	-	moist
	33-39	coarse sand, some fine to medium gravel	granular	loose	10 YR 4/2	-	moist
	39-57	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	dry
	57-63	clay loam	angular blocky	firm	10 YR 5/3	-	moist
	63-96	fine to medium sand, trace coarse sand	granular	loose	10 YR 4/2	-	dry NBTD, NGWTD, SHWT >>96"

Note:

SHWT - Seasonal high water table

NBTD - No bedrock to depth

NGWTD - No groundwater to depth

APPENDIX I – CONSTRUCTION COST ESTIMATE

Appendix I
Town of Highgate
Community Wastewater Feasibility Study
Wastewater Collection System Options

CS1 - Septic/PS at Village Core, Force Main to Steele/Griswold Property

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	1 EA	\$10,000	\$10,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$30,000	\$30,000
6	Effluent Force Main	1,000 LF	\$60	\$60,000
7	Force Main State Highway Crossing	1 LS	\$35,000	\$35,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
9	General Conditions & Miscellaneous Work	15%		\$27,375
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$209,875

CS2 - Septic/PS at Village Core, Force Main to Wright Property

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	1 EA	\$10,000	\$10,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$40,000	\$40,000
6	Effluent Force Main	2,000 LF	\$60	\$120,000
7	Force Main State Highway Crossing	1 LS	\$35,000	\$35,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
9	General Conditions & Miscellaneous Work	15%		\$37,875
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$290,375

CS3 - Sewer on St. Armand Road, Septic/PS at Village Core, Force Main to Wright Property

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
	<i>St. Armand Road</i>			
1	4" SDR35 PVC Sewer Service Connections (ROW to Sewer Main)	15 EA	\$3,000	\$45,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	1,200 LF	\$100	\$120,000
3	Sewer Manhole	5 Each	\$5,000	\$25,000
	<i>Village Core Property</i>			
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	3 EA	\$10,000	\$30,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$100,000	\$100,000

Wastewater Collection System Options

6	Effluent Force Main	2,000	LF	\$60	\$120,000
7	Force Main State Highway Crossing	1	LS	\$35,000	\$35,000
8	Electrical/Controls	1	LS	\$10,000	\$10,000
	General Conditions & Miscellaneous Work	15%			\$78,375
					TOTAL OPINION OF PROBABLE CONSTRUCTION COST =
					\$600,875

CS4 - Collection System for Village Center Area to Wright Property

Item No.	Item Description	Unit	Quantity	Unit Cost	Total Cost
	<i>STEP Systems for Gore Road, Decatur St., Lamkin St to Wright Property</i>				
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	25	EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	25	EA	\$3,000	\$75,000
3	2" PVC Effluent Force Main	2,500	LF	\$60	\$150,000
	<i>STEP Systems for Route 78 (east of Village Core) to Wright Property</i>				
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	20	EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	20	EA	\$3,000	\$60,000
3	2" PVC Effluent Force Main	1,600	LF	\$60	\$96,000
	<i>Gravity Sewer for Route 78 (east of Village Core) to Village Core Pump Station</i>				
1	4" SDR35 PVC Sewer Service Connections	6	EA	\$3,000	\$18,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	500	LF	\$80	\$40,000
3	Sewer Manhole	3	Each	\$5,000	\$15,000
	<i>Lamkin Street</i>				
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	10	EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	10	EA	\$3,000	\$30,000
	<i>St. Armand Road</i>				
1	4" SDR35 PVC Sewer Service Connections	10	EA	\$3,000	\$30,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	1,200	LF	\$80	\$96,000

Wastewater Collection System Options

3	Sewer Manhole	5	Each	\$5,000	\$25,000
<i>Village Core Property</i>					
1	2,500 Gallon Grease Tank	1	EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	3	EA	\$10,000	\$30,000
3	4" SDR35 PVC Sewer Service	250	LF	\$50	\$12,500
4	Sewer Manholes	4	EA	\$5,000	\$20,000
5	Wastewater Pump Station	1	LS	\$150,000	\$150,000
6	Effluent Force Main	2,000	LF	\$60	\$120,000
7	Force Main State Highway Crossing	1	LS	\$25,000	\$25,000
8	Electrical/Controls	1	LS	\$10,000	\$10,000
	General Conditions & Miscellaneous Work	15%			\$151,125
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =					
\$1,158,625					

Wastewater Collection System Options

CS5 - STEP Collection System for Gore Road, Rt 78 Properties

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
	<i>STEP System for Gore Road</i>			
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	15 EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	15 EA	\$3,000	\$45,000
3	2" PVC Effluent Force Main	2,200 LF	\$60	\$132,000
	<i>STEP System for Route 78</i>			
1	Retrofit Individual Properties with New Septic Tank/Effluent Filter and Pump Station	25 EA	see assumptions	
2	Effluent Services (from ROW to Force Main)	25 EA	\$3,000	\$75,000
3	2" PVC Effluent Force Main	2,700 LF	\$60	\$162,000
	<i>St. Armand Road</i>			
1	4" SDR35 PVC Sewer Service Connections	10 EA	\$3,000	\$30,000
2	8" SDR35 PVC - Sewer Main on St. Armand Rd	1,200 LF	\$80	\$96,000
3	Sewer Manhole	5 Each	\$5,000	\$25,000
	<i>Village Core Property</i>			
1	2,500 Gallon Grease Tank	1 EA	\$5,000	\$5,000
2	5,000-Gallon Septic Tank with Effluent Filter	3 EA	\$10,000	\$30,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	4 EA	\$5,000	\$20,000
5	Wastewater Pump Station	1 LS	\$150,000	\$150,000
6	Effluent Force Main	2,000 LF	\$60	\$120,000
7	Force Main State Highway Crossing	1 LS	\$25,000	\$25,000
8	Electrical/Controls	1 LS	\$10,000	\$10,000
	General Conditions & Miscellaneous Work	15%		\$140,625
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$1,078,125

Appendix I**Town of Highgate****Community Wastewater Feasibility Study****Wastewater Disposal Options****DIS1 - Holding Tanks at Village Core Property (600 gpd)**

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	5,000 Gallon Precast Tanks	2 Each	\$15,000	\$30,000
2	4" SDR35 PVC Sewer Service	150 LF	\$50	\$7,500
3	Sewer Manhole	1 Each	\$5,000	\$5,000
4	Electrical/Controls	1 LS	\$2,500	\$2,500
5	General Conditions & Miscellaneous Work	15%		\$6,750
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$51,750

DIS2 - On-Site Septic at Village Core Property (2,500 gpd)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2,500 Gallon Grease Tank	1 EA	\$10,000	\$10,000
2	5,000-Gallon Septic Tank with Effluent Filter	1 EA	\$15,000	\$15,000
3	4" SDR35 PVC Sewer Service	250 LF	\$50	\$12,500
4	Sewer Manholes	2 Each	\$5,000	\$10,000
5	Distribution Box	1 LS	\$5,000	\$5,000
6	Wastewater Disposal Field	2,500 gpd	\$10	\$25,000
7	Electrical/Controls	1 LS	\$2,500	\$2,500
8	General Conditions & Miscellaneous Work	15%		\$12,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$92,000

DIS3 - On-Site Septic at Disposal Site No. 3 - Former Steele/Griswold Property (2,500 gpd)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	400 LF	\$50	\$20,000
2	Clearing/Grubbing	1 LS	\$5,000	\$5,000
3	Site Work	LS		\$0
4	Sewer Manholes	EA		\$0
5	Distribution System	LS		\$0
6	Wastewater Disposal Field	2,500 gpd	\$10	\$25,000
7	Electrical/Controls	LS		\$0
8	General Conditions & Miscellaneous Work	15%		\$7,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$57,500

DIS4A - On-Site Septic at Wright Property for Village Core only (2,500 gpd)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	600 LF	\$25	\$15,000
2	Clearing/Grubbing	LS		\$0
3	Site Work	LS		\$0
4	Sewer Manholes	Each		\$0
5	Distribution System	Each		\$0
6	Wastewater Disposal Field	2,500 gpd	\$10	\$25,000
7	Electrical/Controls	LS		\$0
8	General Conditions & Miscellaneous Work	15%		\$6,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$46,000

Wastewater Disposal Options

DIS4B - On-Site Septic at Wright Property for Village Core and Select Properties with Poor Soils (6,500 gpd)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	600 LF	\$25	\$15,000
2	Clearing/Grubbing	LS		\$0
3	Site Work	LS	\$15,000	\$0
4	Sewer Manholes	EA		\$0
5	Distribution System	EA	\$15,000	\$0
6	Wastewater Disposal Field	6,500 gpd	\$10	\$65,000
7	Electrical/Controls	0 LS		\$0
8	General Conditions & Miscellaneous Work	15%		\$12,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$92,000

DIS4C - On-Site Septic at Wright Property, Full Buildout (30,000 gpd)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	600 LF	\$25	\$15,000
2	Clearing/Grubbing	LS		\$0
3	Site Work	LS		\$0
4	Sewer Manholes	EA		\$0
5	Distribution System	1 EA	\$30,000	\$30,000
6	Wastewater Disposal Field	30,000 gpd	\$20	\$600,000
7	Electrical/Controls	1 LS	\$15,000	\$15,000
8	General Conditions & Miscellaneous Work	15%		\$99,000
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$759,000

DIS5 - Decentralized On-Site Septics at Multiple Properties (6,500 gpd each)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
<i>Cassidy Meadows Site</i>				
1	Access Road	400 LF	\$50	\$20,000
2	Site Work	LS		\$0
3	Distribution System	EA		\$0
4	Wastewater Disposal Field	6,500 gpd	\$10	\$65,000
<i>Potential Disposal Location No. 6 (Gervais Properties, LLC)</i>				
1	Access Road	400 LF	\$50	\$20,000
2	Site Work	LS		\$0
3	Distribution System	EA		\$0
4	Wastewater Disposal Field	6,500 gpd	\$10	\$65,000
5	Site Work	LS		\$0
4	Sewer Manholes	EA		\$0
5	Distribution System	EA		\$0
6	Wastewater Disposal Field	gpd		\$0
7	Electrical/Controls	0 LS		\$0
8	General Conditions & Miscellaneous Work	15%		\$25,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$195,500

Appendix I
Town of Highgate
Community Wastewater Feasibility Study
Water Source Options

WS1 - Convert Highgate Sports Arena to Public Community Water System

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Building Addition to Sports Arena for Equip	200 SF	\$400	\$80,000
2	Piping/Mech (booster pumps, flow meters, pressure tanks)	1 LS	\$40,000	\$40,000
3	Electrical/Controls	1 LS	\$10,000	\$10,000
4	Replace Well Pump	1 EA	\$7,500	\$7,500
5	Water Storage Tank	40,000 gallons	\$3.00	\$120,000
6	General Conditions & Miscellaneous Work	15%		\$38,625
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$296,125

WS2 - Drill New Well for Village Core Property on Steele/Griswold Property

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Access Road	350 LF	\$50	\$17,500
2	Clearing/Grubbing	1 EA	\$2,500	\$2,500
3	Power	300 LF	\$20	\$6,000
4	Well Pump and Drop Piping	1 LS	\$10,000	\$10,000
5	General Conditions & Miscellaneous Work	15%		\$5,400
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$41,400

WS3- Drill New Public Community Supply Well near Cassidy Meadows Project

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Temp Access	1 EA	\$5,000	\$5,000
2	Clearing/Grubbing	1 EA	\$2,500	\$2,500
3	Well Drilling	1 LS	\$15,000	\$15,000
4	Permanent Access Road	1,000 LF	\$50	\$50,000
5	Pump, Drop Pipe, and Appurtenances	1 LS	\$15,000	\$15,000
6	Electrical Service	1,000 LF	\$20	\$20,000
7	Water Storage Tank	40,000 gallons	\$3.00	\$120,000
8	Treatment Building and Booster Pumps	1 LS	\$400,000	\$400,000
9	General Conditions & Miscellaneous Work	15%		\$94,125
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$721,625

Appendix I
Town of Highgate
Community Wastewater Feasibility Study
Water Distribution System Options

WD1 - Interim Water Service Connection (assumed to Highgate Village Market)

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	Interconnect with Existing System	1 EA	\$3,000	\$3,000
2	Water Service Line	100 LF	\$45	\$4,500
3	1-Inch Water Service in 3-Inch Sleeve - Highway Crossing	1 LS	\$10,000	\$10,000
4	General Conditions & Miscellaneous Work	15%		\$2,625
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$20,125

WD2 - Water Transmission Main from Highgate Sports Arena to Village Core, plus Service Connections to Eliminate Source Isolation Zones on Village Core Property

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	4-Inch Water Transmission Main to Village Core	2,000 LF	\$120	\$240,000
2	4-Inch Water Service in 12-Inch Sleeve - Highway Crossing	1 LS	\$15,000	\$15,000
3	1-Inch Water Service Connections	10 EA	\$7,500	\$75,000
4	General Conditions & Miscellaneous Work	15%		\$49,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$379,500

WD3 - Water Service Connection from Highgate Sports Area for Village Core Site Only

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2-Inch Water Service Piping	2,000 LF	\$90	\$180,000
2	Interconnection with Sports Arena Piping	1 LS	\$5,000	\$5,000
3	General Conditions & Miscellaneous Work	15%		\$27,750
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$212,750

WD4 - Water Service from New Well on Steele/Griswold to Village Core

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
1	2-Inch Water Service Piping	1,000 LF	\$100	\$100,000
2	2-Inch Water Service in 8-Inch Sleeve - Highway Crossing	1 EA	\$10,000	\$10,000
3	General Conditions & Miscellaneous Work	15%		\$16,500
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$126,500

WD5 - New Transmission Main and Distribution Mains throughout Village Center

Item No.	Item Description	Unit Quantity	Unit Cost	Total Cost
	<i>Transmission Main from Cassidy Meadows Well to Village Center (at Sports Arena)</i>			
1	4-Inch Water Transmission Main	2,000 LF	\$100	\$200,000
2	Allowance for Ledge	100 CY	\$200	\$20,000
	<i>Distribution Mains</i>			
1	Water Distribution Main - Gore Road	1,500 EA	\$120	\$180,000
2	Water Service Connections - Gore Road	14 EA	\$7,500	\$105,000
3	Water Distribution Main - St. Armand Road	1,200 LF	\$120	\$144,000
4	Water Service Connections - St. Armand Road	24 EA	\$7,500	\$180,000
5	Water Distribution Main - Route 78	2,000 LF	\$150	\$300,000
6	Water Service Connections - Route 78	22 EA	\$7,500	\$165,000
7	Water Distribution Main - Lamkin St	1,200 LF	\$120	\$144,000
8	Water Service Connections - Lamkin St	15 EA	\$7,500	\$112,500
9	General Conditions & Miscellaneous Work	15%		\$161,100
TOTAL OPINION OF PROBABLE CONSTRUCTION COST =				\$1,711,600

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 1A

Wastewater: Holding Tank at Village Core Site, Limited Municipal Uses (600 gpd capacity)
Water: Interim Connection with Nearby Existing Water System

CONSTRUCTION COSTS

Item	Description	Total Cost	Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (none)	\$ -	\$ -	\$ -	
2	WW Disposal System (DIS1)	\$ 51,750	\$ -	\$ -	
3	Water Source Option (none)	\$ -	\$ -	\$ -	
4	Water Distribution Option (WD1)	\$ 20,125	\$ -	\$ -	
5		\$ -	\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS

\$ 72,000

OTHER PROJECT COSTS

Standard Engineering Costs	\$ 16,560	Percentage based on State Fee Curve
Special Engineering Costs	\$ -	
Legal/Administrative Costs	\$ 1,440	
Land Acquisition- Wastewater	\$ -	
Land Acquisition- Water	\$ -	
SUBTOTAL - OTHER COSTS	\$ 18,000	

PROJECT CONTINGENCY

20%

\$ 14,400

Percentage of Construction and Other upfront costs

TOTAL - INITIAL CAPITAL COSTS

\$ 104,400

Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Wastewater Hauling	27,375 gal	\$ 0.29	\$ 7,939 every year	\$7,939	\$241,887	Based on average usage of 100 gpd; Assumes long-term contract with septic hauler; based on quote from Wind River Environmental
2	Annual Maintenance - WW	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance
3	Annual Maintenance - Water	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance

Projected Annual O&M Costs

\$ 9,939

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

\$ 303,000

TOTAL PRESENT WORTH OF ALTERNATIVE

\$ 407,400 Initial Capital Costs plus Present Worth of Periodic O&M Costs

600 gpd of wastewater capacity for this Alternative

\$ 679 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 1B-1

Wastewater: On-site Septic on Village Core Property (2,500 gpd capacity)

Water: Convert Highgate Sports Arena to PCWS, Water Main to Village Core Site, Service Connections to Eliminate Well Isolation Zones for On-site septic

CONSTRUCTION COSTS

Item	Description	Total Cost		Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (none)	\$ -		\$ -	\$ -	
2	WW Disposal System (DIS2)	\$ 92,000		\$ -	\$ -	
3	Water Source Option (WS1)	\$ 296,125		\$ -	\$ -	
4	Water Distribution Option (WD2)	\$ 379,500		\$ -	\$ -	
5		\$ -		\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS

\$ 768,000

OTHER PROJECT COSTS

Standard Engineering Costs	\$ 176,640	Percentage based on State Fee Curve
Special Engineering Costs	\$ 40,000	Allowance for source pump testing, which is assumed to be required to convert to PCWS
Legal/Administrative Costs	\$ 15,360	
Land Acquisition- Wastewater	\$ -	
Land Acquisition- Water	\$ 15,000	Requires easement for Source Isolation Zone from neighboring property (approx. 1 acre)

SUBTOTAL - OTHER COSTS

\$ 247,000

PROJECT CONTINGENCY

20%

\$ 153,600

Percentage of Construction and Other upfront costs

TOTAL - INITIAL CAPITAL COSTS

\$ 1,168,600

Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Septic Pumping	7,500 gal	\$ 0.31	\$ 2,325 every year	\$2,325	\$70,841	Assumes one pump out per year (septic tank, grease trap)
2	Annual Maintenance - WW	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance
3	Annual O&M - Water	1 LS	\$ 15,000	\$ 15,000 every year	\$15,000	\$457,037	PCWS requires licensed operator, monthly sampling and reporting, power, contribution to Reserve Fund

Projected Annual O&M Costs

\$18,325

\$ 558,000

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

\$ 1,726,600 Initial Capital Costs plus Present Worth of Periodic O&M Costs

2,500 gpd of wastewater capacity for this Alternative

\$ 691 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 1B-2

Wastewater: Off-site Septic on Wright Property (2,500 gpd capacity)

Water: Extend a water service connection from Highgate Sports Arena to Village Core Site only

CONSTRUCTION COSTS

Item	Description	Total Cost	Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (CS2)	\$ 290,375	\$ -	\$ -	
2	WW Disposal System (DIS4A)	\$ 46,000	\$ -	\$ -	
3	Water Source Option (none)	\$ -	\$ -	\$ -	
4	Water Distribution Option (WD3)	\$ 212,750	\$ -	\$ -	
5		\$ -	\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS

\$ 549,000

OTHER PROJECT COSTS

Standard Engineering Costs	\$ 126,270	Percentage based on State Fee Curve
Special Engineering Costs		
Legal/Administrative Costs	\$ 10,980	
		Assumes 1-2 acres needed (permanent easement) plus access easement at Wright property; recommend Town obtain option/right of first refusal for up to 15 acres for future
Land Acquisition- Wastewater	\$ 25,000	
Land Acquisition- Water	\$ -	
SUBTOTAL - OTHER COSTS	\$ 162,250	
PROJECT CONTINGENCY	20%	Percentage of Construction and Other upfront costs
TOTAL - INITIAL CAPITAL COSTS	\$ 821,050	Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Septic Pumping	7,500 gal	\$ 0.31	\$ 2,325 every year	\$2,325	\$70,841	Assumes one pump out per year (septic tank, grease trap)
2	Annual Maintenance - WW	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance
3	Annual O&M - Water	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance

Projected Annual O&M Costs

\$4,325

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

\$ 132,000

TOTAL PRESENT WORTH OF ALTERNATIVE

\$ 953,050 Initial Capital Costs plus Present Worth of Periodic O&M Costs

2,500 gpd of wastewater capacity for this Alternative

\$ 381 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 1B-3

Wastewater: Off-site Septic on Wright Property (2,500 gpd capacity)

Water: Drill and Permit a New Well (5-10 gpm) only for Village Core Site, assumed on Town Property (former Steele/Griswold Property)

CONSTRUCTION COSTS

Item	Description	Total Cost		Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (CS2)	\$ 290,375		\$ -	\$ -	
2	WW Disposal System (DIS4A)	\$ 46,000		\$ -	\$ -	
3	Water Source Option (WS2)	\$ 41,400		\$ -	\$ -	
4	Water Distribution Option (WD4)	\$ 126,500		\$ -	\$ -	
5		\$ -		\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS

\$ 504,000

OTHER PROJECT COSTS

Standard Engineering Costs		\$ 115,920	Percentage based on State Fee Curve
Special Engineering Costs (New Well Source)		\$ 35,000	Allowance for drilling new well and source permitting including pump testing
Legal/Administrative Costs	2%	\$ 10,080	
Land Acquisition- Wastewater		\$ 25,000	Assumes 1-2 acres needed (permanent easement) plus access easement at Wright property; recommend Town obtain option/right of first refusal for up to 15 acres for future
Land Acquisition- Water		\$ -	Town-owned site
SUBTOTAL - OTHER COSTS		\$ 186,000	
PROJECT CONTINGENCY	20%	\$ 100,800	Percentage of Construction and Other upfront costs
TOTAL - INITIAL CAPITAL COSTS		\$ 790,800	Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Septic Pumping	7,500 gal	\$ 0.31	\$ 2,325 every year	\$2,325	\$70,841	Assumes one pump out per year (septic tank, grease trap)
2	Annual Maintenance - WW	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance
3	Annual O&M - Water	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance

Projected Annual O&M Costs

\$4,325

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

\$ 132,000

TOTAL PRESENT WORTH OF ALTERNATIVE

\$ 922,800 Initial Capital Costs plus Present Worth of Periodic O&M Costs
 2,500 gpd of wastewater capacity for this Alternative
\$ 369 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 1C

Wastewater: Collection System to Serve Village Core and Properties with Poor Soils on St. Armand Road, Off-site Septic on Wright Property (6,500 gpd)
Water: Extend a water service connection from Highgate Sports Arena to Village Core Site only

CONSTRUCTION COSTS

Item	Description	Total Cost	Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (CS3)	\$ 600,875	\$ -	\$ -	
2	WW Disposal System (DIS4B)	\$ 92,000	\$ -	\$ -	
3	Water Source Option (none)	\$ -	\$ -	\$ -	
4	Water Distribution Option (WD3)	\$ 212,750	\$ -	\$ -	
5		\$ -	\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS

\$ 906,000

OTHER PROJECT COSTS

Standard Engineering Costs	\$ 206,954	Percentage based on State Fee Curve
Special Engineering Costs (New Well Source)	\$ 35,000	Allowance for drilling new well and source permitting including pump testing
Legal/Administrative Costs	\$ 18,120	
		Assumes 2-4 acres needed (permanent easement) plus access easement at Wright property; recommend Town obtain option/right of first refusal for up to 15 acres for future
Land Acquisition- Wastewater	\$ 25,000	Town-owned site
Land Acquisition- Water	\$ -	

SUBTOTAL - OTHER COSTS

PROJECT CONTINGENCY 20% \$ 181,200

Percentage of Construction and Other upfront costs

TOTAL - INITIAL CAPITAL COSTS \$ 1,372,274

Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Septic Pumping	7,500 gal	\$ 0.31	\$ 2,325 every year	\$2,325	\$70,841	Assumes one pump out per year (septic tank, grease trap)
2	Annual Maintenance - WW	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance
3	Annual O&M - Water	1 LS	\$ 1,000	\$ 1,000 every year	\$1,000	\$30,469	Allowance for Reserve Fund to cover misc. repairs and maintenance

Projected Annual O&M Costs \$4,325

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS \$ 132,000

TOTAL PRESENT WORTH OF ALTERNATIVE

\$ 1,504,274 Initial Capital Costs plus Present Worth of Periodic O&M Costs
 6,500 gpd of wastewater capacity for this Alternative
 \$ 231 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 2A

Wastewater: Future Concept which expands the system beyond Alternative 1C, to include expansion of the disposal capacity to 30,000 gpd, new collection system via STEP for Service Area
 Water: Not Included

CONSTRUCTION COSTS

Item	Description	Total Cost	Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (CS4)	\$ 1,158,625	\$ -	\$ -	
2	WW Disposal System (DIS4C)	\$ 759,000	\$ -	\$ -	
3	Water Source Option (not included)		\$ -	\$ -	
4	Water Distribution Option (not included)		\$ -	\$ -	
5		\$ -	\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS **\$ 1,918,000**

OTHER PROJECT COSTS

Standard Engineering Costs	\$ 412,793	Percentage based on State Fee Curve
Special Engineering Costs	\$ 30,000	Testing and Monitoring for the Indirect Discharge Permit
Legal/Administrative Costs	\$ 38,360	
		Assumes 10-15 acres needed (permanent easement) plus access easement at Wright property
Land Acquisition- Wastewater	\$ 60,000	
Land Acquisition- Water	\$ -	Town-owned site

SUBTOTAL - OTHER COSTS

PROJECT CONTINGENCY **20%** **\$ 383,600** Percentage of Construction and Other upfront costs

TOTAL - INITIAL CAPITAL COSTS **\$ 2,842,753** Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Septic Pumping	7,500 gal	\$ 0.31	\$ 2,325 every year	\$2,325	\$70,841	Assumes one pump out per year (septic tank, grease trap)
2	Annual O&M - WW	1 LS	\$ 15,000	\$ 15,000 every year	\$15,000	\$457,037	Would require system operator for monthly monitoring, general site maintenance, annual permit reporting, and contribution to Reserve Fund for replacement of short-term assets
3		LS		\$ - every year	\$0	\$0	

Projected Annual O&M Costs **\$17,325**

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS **\$ 528,000**

TOTAL PRESENT WORTH OF ALTERNATIVE **\$ 3,370,753** Initial Capital Costs plus Present Worth of Periodic O&M Costs
 30,000 gpd of wastewater capacity for this Alternative
\$ 112 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 2B

Wastewater: Future Concept which expands the system beyond Alternative 1C, to include separate decentralized wastewater service areas for Gore Road and Franklin Street (Rt. 78)
 Water: Not Included

CONSTRUCTION COSTS

Item	Description	Total Cost	Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (CSS)	\$ 1,078,125	\$ -	\$ -	
2	WW Disposal System (DIS5)	\$ 195,500	\$ -	\$ -	
3	Water Source Option (not included)		\$ -	\$ -	
4	Water Distribution Option (not included)		\$ -	\$ -	
5		\$ -	\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS **\$ 1,274,000**

OTHER PROJECT COSTS

Standard Engineering Costs	\$ 283,244	Percentage based on State Fee Curve
Special Engineering Costs		
Legal/Administrative Costs	\$ 25,480	
		Assumes 2-4 acres needed (permanent easement) plus access easements at each of three sites (Cassidy Meadows, Gervais Properties, and Wright property)
Land Acquisition- Wastewater	\$ 60,000	
Land Acquisition- Water	\$ -	
SUBTOTAL - OTHER COSTS	\$ 368,724	

PROJECT CONTINGENCY **20%** **\$ 254,800** Percentage of Construction and Other upfront costs

TOTAL - INITIAL CAPITAL COSTS **\$ 1,897,524** Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Septic Pumping	7,500 gal	\$ 0.31	\$ 2,325 every year	\$2,325	\$70,841	Assumes one pump out per year (septic tank and grease trap); Property owners would be responsible for maintenance of individual STEP systems
2	Annual O&M - WW	1 LS	\$ 3,000	\$ 3,000 every year	\$3,000	\$91,407	Allowance for Reserve Fund to cover misc. repairs and maintenance (3 sites)
3		LS		\$ - every year	\$0	\$0	

Projected Annual O&M Costs **\$5,325**

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS **\$ 162,000**

TOTAL PRESENT WORTH OF ALTERNATIVE **\$ 2,059,524** Initial Capital Costs plus Present Worth of Periodic O&M Costs
 19,500 gpd of wastewater capacity for this Alternative
\$ 106 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.

Appendix J
 Town of Highgate
 Community Wastewater Feasibility Study
 Present Worth Analysis

ALTERNATIVE 2C

Wastewater: Not Included

Water: New Public Community Water System including New Source Well (60 - 75 gpm), Treatment Building, Storage, Transmission Main and Water Distribution Mains throughout Village Center Service Area

CONSTRUCTION COSTS

Item	Description	Total Cost		Salvage Value in 20 years	Present Worth of Salvage Value	Notes
1	WW Collection System (Not Included)			\$ -	\$ -	
2	WW Disposal System (Not Included)			\$ -	\$ -	
3	Water Source Option (WS3)	\$ 721,625		\$ -	\$ -	
4	Water Distribution Option (WD5)	\$ 1,711,600		\$ -	\$ -	
5		\$ -		\$ -	\$ -	

SUBTOTAL - CONSTRUCTION COSTS

\$ 2,433,000

OTHER PROJECT COSTS

Standard Engineering Costs	\$ 513,836	Percentage based on State Fee Curve
Special Engineering Costs	\$ 30,000	Testing and Monitoring for the Indirect Discharge Permit
Legal/Administrative Costs	\$ 2%	
Land Acquisition- Wastewater	\$ 48,660	
		Assumes 10-15 acres needed (permanent easement) plus access easements at Cassidy Meadows for well isolation zones, water storage and treatment, and transmission main)
Land Acquisition- Water	\$ 60,000	

SUBTOTAL - OTHER COSTS

\$ 652,496

PROJECT CONTINGENCY

20%

\$ 486,600

Percentage of Construction and Other upfront costs

TOTAL - INITIAL CAPITAL COSTS

\$ 3,572,096

Construction Costs plus Other Costs plus Project Contingency

ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

Item	Description	Qty. Unit	Unit Costs	Total Cost and Frequency	Annual Capitalized Cost for Period	Present Worth of Periodic Cost for 40 year Design Life	Notes
1	Septic Pumping	gal		\$ - every year	\$0	\$0	
2	Annual O&M - WW	LS		\$ - every year	\$0	\$0	
3	Annual O&M - Water	1 LS	\$ 35,000	\$ 35,000 every year	\$35,000	\$1,066,420	PCWS requires licensed operator, monthly sampling and reporting, power, general site and building maintenance, contribution to Reserve Fund for replacement of short-term assets

Projected Annual O&M Costs

\$35,000

TOTAL PRESENT WORTH OF ANNUAL/PERIODIC OPERATION AND MAINTENANCE COSTS

\$ 1,066,000

TOTAL PRESENT WORTH OF ALTERNATIVE

\$ 4,638,096 Initial Capital Costs plus Present Worth of Periodic O&M Costs

43,200 gpd of water capacity for this Alternative

\$ 107 per gpd of capacity

General Notes:

1. All Subtotals and Totals are rounded to the nearest thousand dollars.
2. Interest Rate for Present Worth is 1.4% based on current Real Interest Rate on 30-Year Treasury Notes and Bonds (December 2014) per USDA Rural Development's guidance for Present Worth Analysis.
3. Periodic costs are converted to an annualized capital cost for the frequency stated, and this annual cost is converted to a Present Worth based on a 40-year design life.