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November 15, 2024

John Reilly, P.E.
Senior Environmental Engineer
Hoyle, Tanner and Associates, Inc.
125 College Street, Suite 4
Burlington, VT 05401
Submitted via e-mail to jreilly@hoyletanner.com

Stone Project No. 20-004
Subject: 456 Craftsbury Road Property Preliminary Site Capacity Analysis, Wastewater Implementation Preliminary Engineering, Greensboro, Vermont

Dear John,

Stone Environmental, Inc. (Stone) is pleased to provide a summary of field and desktop analysis of the soil-based wastewater treatment capacity of a portion of the property located at 456 Craftsbury Road (north of the Greensboro Town Hall). The site is limited by finely textured till soils and shallow bedrock but may support a new soil-based community wastewater system with a capacity of 1,800-5,300 gallons per day, as described below.

1. Project Background

The Town of Greensboro, Vermont is working with Hoyle, Tanner & Associates to determine the feasibility and potential cost of constructing a Town owned wastewater collection, conveyance, treatment and disposal system to serve the Village District, following an investigation into potential cost to serve each of three Districts (Caspian Lake, Greensboro Village, and Greensboro Bend). The Village District includes 106 properties which are anticipated to require approximately 30,000 gpd in wastewater treatment capacity (PER Section 3.3). Following completion of the 25% PER in 2021, the design capacity needed to serve the Greensboro Village Wastewater Service Area was modified to approximately 40,000 gpd to serve existing and 20-year design needs.

An initial treated effluent infiltration area soil screening for the Village District (PER Appendix 1-4) identified six potential treated effluent infiltration areas. Area 6, located off The Bend Road between Greensboro Village and Greensboro Bend, was evaluated in 2021 but determined unsuitable for community wastewater disposal. Area 10, located just west of Greensboro Bend, was evaluated in 2022-2023 and found suitable for community wastewater disposal, but the stewards and owners of the site declined to enter into an easement or purchase and sales agreement with the Town in August 2024.

The Town of Greensboro also, in 2023, entered into an option agreement with Rural Edge to evaluate the current town hall and grange structures for potential reuse and the addition of housing units. A *Site Feasibility Study* completed by Horizons Engineering, Inc. in August 2023 recommended a proposed total wastewater flow of 5,880 gallons per day (gpd) inclusive of housing redevelopment in the Town Hall (1,820 gpd), new construction north of the Town Hall structure (3,360 gpd), and the Grange Hall (700 gpd). The report also noted that the existing wastewater system serving the Town Hall has permitted capacity of 1,530 gpd, per wastewater permit PB-7-0387 issued in 1983. The report stated that while the existing septic tanks on the Town Hall property were located, information regarding the exact location of the disposal field or fields was not available.

Additional site observations were collected in September 2024[1], and it was determined that the Triangle area likely does not have sufficient land or capacity available to serve future uses with demands above the Town Hall's currently permitted design capacity of 1,530 gallons per day (gpd), such as a community wastewater disposal system. The report recommended evaluating whether abutting landowners might allow access for testing, particularly to the north of the Town Hall property.

2. Field Site and Soil Investigations

Following review of existing information and consultation with the Town and with the landowners' permission, an initial site walk and field soil characterization using hand tools were both completed on September 6, 2024. The soils investigation was conducted by Amy Macrellis of Stone. Others present during some or all of the site walk included John Reilly, P.E. and Amy DeCola, P.E. of Hoyle, Tanner and MacNeil (Greensboro Selectboard and property owner). Observation points collected are shown on Figure 1, and hand auger soil logs are included in Table 1.

The soil survey indicated areas of the site evaluated during the site walk are composed of very rocky Vershire-Glover complex soils with slopes ranging from 8-15% (map unit 94C) or 15-35 percent (map unit 94D) (Attachment A contains soil series descriptions). Thes soils are mapped as very fine sandy loam, but somewhat poorly drained (hydrologic soil group C or D) and with bedrock generally 10-40 inches below ground surface.

In the larger northern area highlighted on Figure 1, while a prior desktop evaluation[2] of soil and site suitability for small soil-based community wastewater disposal sites indicated that this land may be suitable

[1] *Town Hall Triangle Lawn Site Evaluation Summary, Wastewater Implementation Preliminary Engineering, Greensboro, Vermont.* Stone Environmental, Inc., letter report dated October 4, 2024.
[2] *Greensboro Wastewater Treatment Alternatives Study, Desktop Screening for <6,500 gpd Subsurface Disposal Sites*. Stone Environmental, Inc. letter report dated November 29, 2023.

for mound systems or at-grade systems with added pretreatment, the site walk revealed bedrock outcrops throughout the top of the ridge. No locations were marked for excavator test pit evaluation in the northern area, and no further investigation is recommended.

The southern portion of the site generally slopes from west (maximum elevation of approximately 1,475 feet) to southeast, with indications of wetland vegetation occurring along the downslope, eastern edge of the site at elevations of approximately 1,435-1,425 feet (Figure 1). A very small perennial stream flows from northeast to southwest at the base of a steep slope near the eastern edge of the property. The site walk revealed occasional bedrock outcrops in the northern, upslope corner of this area and south of the same area. Indications of seasonal high groundwater were not encountered in the two hand augers advanced, but both encountered shallow refusal (Table 1). This area, approximately 3.5 acres in size, appeared to have some potential for wastewater treatment, so eight excavator test pit locations were marked for archaeological clearance.

Table 1. Hand Auger Details

Hand Auger ID	Total Depth (in. bgs)	Soil Profile Description		Naturally Occurring Soil Thickness Above Limiting Condition (in.)	ESHGW Depth (in. bgs)	Refusal Depth (in. bgs)
HA-6	26	0–8 8-20 20-26	Silty clay loam, friable, moist, topsoil Silty clay loam, friable, moist Gravelly fine sandy loam, firm, moist. Refused on stone or bedrock at 26".	26	---	26
HA-7	12	0-8 8-12	Sandy clay loam, friable, moist, topsoil Gravelly silt loam, friable to firm, moist. Refused on stones (not bedrock) at 12".	12	---	---

Source: Stone field notes, September 2024.

Notes: in. bgs = inches below ground surface; ESHGW = estimated seasonal high groundwater;
--- = limiting feature not encountered

Once archaeological clearance was secured and excavator access was arranged, a test pit soils investigation was conducted by Amy Macrellis of Stone on October 29, 2024 using an excavator supplied by Kyle Drown. Others present during the investigation included Achouak Arfaoui (Vermont DEC, Indirect Discharge Permitting Program) and MacNeil (Greensboro Selectboard and property owner). Attachment B contains test pit logs, and test pit locations are shown on Figure 2. The test pit observations were consistent with the soil survey identification of glacial till parent material, but with finer texture (often sandy clay loam to silty clay loam). Test pit TP-01, near the crest of the ridge, encountered bedrock at 12" (Table 2). The remaining test pits generally encountered topsoil underlain by silt loam to sandy or silty clay loam with friable consistence and a firm till layer and/or bedrock with widely varied levels of weathering. Firm consistence occurred at varying depths where encountered, ranging from 17" at TP-05 to 54" at TP-08. Where encountered, indications of seasonal high groundwater in these test pits were generally within the firm horizon at 25" (TP-03) to 31" (TP-02). Bedrock, where encountered, was present at 12" (TP-01) to 42" (TP-05) below ground surface.

Table 2. Excavator Test Pit Details

Test Pit ID	Total Depth (in. bgs)	Most Limiting Soil Texture	Most Limiting Consistence	Ground Elevation (ft. AMSL)	Depth to Limiting Conditions (in.)			Limiting Condition Elevations (ft. AMSL)		
					Firm Consistence	ESHGW	Bedrock	Firm Consistence	ESHGW	Bedrock
TP-01	52	gravelly fine sandy loam	friable	1477.95	---	---	12	---	---	1477.0
TP-02	58	sandy clay loam	firm	1469.42	38	31	---	1466.3	1466.84	---
TP-03	32	gravelly sandy clay loam	firm	1475.59	25	25	28	1473.5	1473.51	1473.3
TP-04	33	silty clay loam	firm	1467.91	18	---	24	1466.4	---	1465.9
TP-05	42	silty clay loam	firm	1456.53	17	27	42	1455.1	1454.28	1453.0
TP-06	63	gravelly silty clay loam	firm	1448.20	22	28	---	1446.4	1445.87	---
TP-07	45	silty clay loam	friable	1460.52	---	---	26	---	---	1458.4
TP-08	70	gravelly sandy clay loam	firm	1456.03	54	---	---	1451.5	---	---

Source: Stone field notes, 2024.

Notes: in. bgs = inches below ground surface; ft AMSL - feet above mean sea level; ESHGW = estimated seasonal high groundwater; --- = feature not encountered

The test pits completed during this investigation showed that the soils within and near any proposed disposal fields are silt loam to silty clay loam near the ground surface, immediately underlain by firm, gravelly sandy to silty clay loam or bedrock. These observations are consistent with surficial geologic mapping in the vicinity, which shows glacial till deposits and bedrock exposures in the vicinity. No saturated soils were encountered in the test pits, while seasonal high groundwater indicators were observed generally in the firm soil horizons at 25-31 inches below ground surface. Groundwater flow across the site is assumed to follow surface topography from northwest to southeast, from the vicinity of TP-01, TP-03, and TP-04 towards the unnamed stream southeast of the site, which flows to Greensboro Brook.

3. Site Constraints and Wastewater Regulatory Assessment

The site was first evaluated for potential advancement under the Vermont Indirect Discharge Rules (IDRs) effective April 12, 2019, which apply when the design flow of a wastewater system is 6,500 gallons per day (gpd) or greater. The following required isolation distances between site features and disposal fields (IDR Table #21) were applied, and the results are shown on Figure 2:

- Streams and rivers, including groundwater seeps or wetlands: 150 feet
- Top of bank or slope greater than 30%: 50 feet
- Property line: 25 feet
- Trees: 10 feet

Once isolation distances were considered, a maximum area of approximately 0.45 acres (19,600 square feet (SF)) remains potentially available for wastewater disposal under the IDRs. Test pits TP-2 and TP-3 are within or immediately adjacent to this zone and meet the IDRs' minimum criteria for mound system construction, including 24 inches or more of undisturbed native soil of Cass 1 through 6 (IDRs 14-1501(a)(1)(G) and Table #19). Soil Class 6 (maximum wastewater loading rate of 0.24 gpd/SF) is most applicable given the sandy to silty clay loam soil textures encountered in these test pits. Thus, the maximum applicable design capacity, assuming the entire available area could be utilized for constructing a mound wastewater system, is 19,600 SF* 0.24 gpd/SF = 4,700 gallons/day. If 100% dual alternating disposal fields are required (14-1501(a)(1)(A), the system's maximum design flow would be 2,350 gallons/day, while if the option for constructing 150% of design flow without setting aside a replacement area is allowed, the system's maximum capacity would be 3,530 gallons/day. Since none of the resulting conceptual design flows or capacities are 6,500 gallons/day or greater, it is not recommended to pursue a design approach that includes applying for a permit under the IDRs. Further, though not evaluated in detail, it would likely be difficult and time consuming to demonstrate compliance with the IDRs' Aquatic Permitting Criteria in the likely receiving stream.

Next, the site was evaluated for potential advancement under the Vermont Wastewater System and Potable Water Supply Rules (WSPWSRs), effective November 6, 2023, which apply when the design flow of a soil-based wastewater system is 6,499 gallons/day or less. The following required isolation distances between site features and disposal fields (WSPWSR Table 9-3) were applied, and the results are shown on Figure 2:

- Property lines: 25 feet
- Slopes exceeding 30%: 25 feet
- Surface water, normal high-water elevation: 50 feet
- Trees: 10 feet

After accounting for the features described above, a maximum area of approximately 0.81 acres (35,300 square feet) remains potentially available for wastewater disposal under the WSPWSRs. Test pits TP-2, TP-3, TP-5, and TP-7 are within this zone and meet the WSPWSRs' minimum criteria for leachfields in mounds, including 24 inches of undisturbed native soil above estimated seasonal high groundwater, soil with consistence of firm or denser, and bedrock (§1-903(j)). A maximum wastewater application rate of 0.20 gallons/square foot/day(WSPWSR Table 9-3) is most applicable, given the sandy to silty clay loam soil textures encountered in these test pits.

4. Preliminary Wastewater Capacity Estimates

In order to estimate the wastewater treatment potential for the 456 Craftsbury Road site, we first broadly assumed that a mound disposal system could theoretically be sited within the entire maximum area identified in Figure 2 (35,300 SF). We applied a maximum wastewater loading rate of 0.2 gallons/square foot/day. The resulting order-of-magnitude estimate of maximum applicable design capacity is 35,300 SF * 0.20 gpd/SF = 7,060 gpd. If the option for constructing 150% of design flow without setting aside a replacement area is utilized (§1-902(b)), the system's maximum capacity would be 5,295 gpd.

In order to estimate the hydraulic capacity of this potential infiltration site, we used a conservative method called Darcy's Law. This formula is represented as Q = KiA where

Q = design flow (gallons/day) (gpd)
K = hydraulic conductivity (ft./day)
i = hydraulic gradient (slope of water table)
A = transmitting soil cross-sectional area (square feet) = D x L where
D = transmitting soil thickness (depth to impeding layer or water table, minus the required separation depth, minus the system depth) (feet)
L = length of the disposal system in the estimated direction of groundwater flow (feet)

We used this formula to revise hydraulic capacity scenarios for the estimated disposal area shown on Figure 2. The system design is assumed to include a leachfield in a mound with trenches or subsurface drip disposal lines located 3.0 feet above the ground surface and that the required vertical separation distance to seasonal high groundwater or limiting condition is 3.0 feet / 36" for septic tank effluent. Full assumptions and calculations are documented in Attachment 3. The resulting hydraulic capacity available for wastewater disposal, on the order of 1,800 gpd, should be considered a reasonable minimum estimate.

The estimates above *do not* account for the irregular shape of the identified potential disposal site, required 10-foot separations between disposal fields, or any of the multiple design directions (subsurface drip dispersal, pre-treatment, etc.) that may be selected for this challenging site under the WSPWSRs. The estimates may be refined following dialogue with Hoyle, Tanner and the Town of Greensboro. Additional next steps may include but are not limited to point permeability testing or percolation testing, springtime groundwater monitoring, and/or completion of hydrogeological analyses if and as required under WSPWSRs.

Sincerely,

Amy Macrellis

Amy Macrellis
Senior Water Quality Specialist
Direct Phone / 802.229.1884
Mobile / 802.272.8772
E-Mail / amacrellis@stone-env.com

Enclosures:
Figure 1. 456 Craftsbury Road Site Walk Map
Figure 2. 456 Craftsbury Road Site Map
Attachment A:Vershire-Glover Complex Soil Series Descriptions (map units 94C and 94D)
Attachment B: Excavator Test Pit Logs
Attachment C: Darcy's Law Capacity Analysis, Depth to Limiting Features Encountered in Test Pits

LEGEND

- 456 Craftsbury Road
- Archaeological clearance request area
- Greensboro Parcels (VCGI)

Field Observations

- Bedrock Outcrop
- Hand Auger

Onsite System Suitability

- (1, 2) Conventional Subsurface; Conventional w/Excessive Slope or Permeability
- (4) Mound or Filtrate + At-Grade
- (5) Mound with Curtain Drain or Filtrate + Mound
- (6) Filtrate + Mound with Curtain Drain
- (7, 8, 9) Not Suited; Not Suited or Two-Year Time of Travel and/or Store and Dose; Not Rated

- VT NRCS Soil Survey
- Contour Line, Index
- Contour Line, Index
- Class 2 Wetland

N 0 200 Feet

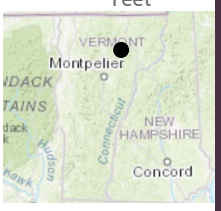


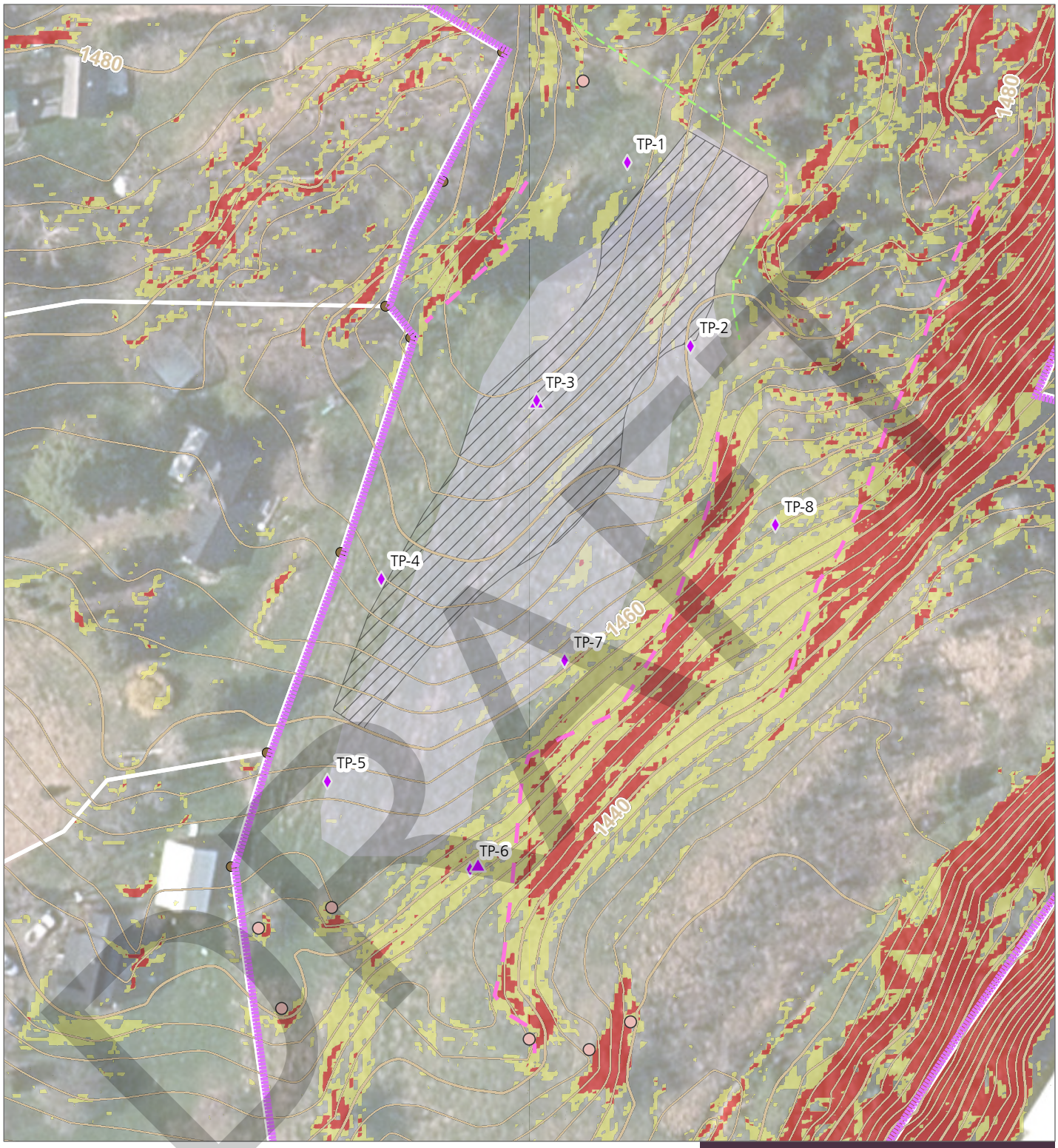
Figure 1.
456 Craftsbury Road Site Walk Map

Greensboro Wastewater Implementation Preliminary Engineering

Prepared for the Town of Greensboro

STONE ENVIRONMENTAL

Path: O:\PROJ-20\WRM\20-004 Greensboro WW\GIS\Intermediate\Greensboro_Capacity.aprx Figure 1 456 Craftsbury Road Site Walk MapExported: 11/14/2024 9:47 AM by amacrellis



LEGEND

- 456 Craftsbury Road
- Field Observations
  - Bedrock Outcrop
  - Hand Auger
  - Test Pit
  - Other
  - Top of Bank (>30% Slope)
  - Treeline
- Estimated infiltration area (IDRs)
- Estimated infiltration area (WSPWSRs)
- Parcel Boundaries
- LIDAR Slope (VCGI)
- Value
  - < 19.99%
  - 20-29.99%
  - >30%

N 0 50

Feet

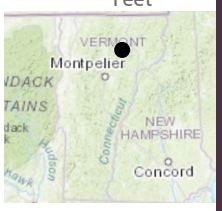


Figure 2. 456 Craftsbury Road Site Map and Potential Wastewater Disposal Zones

Greensboro Wastewater Implementation Preliminary Engineering

Prepared for the Town of Greensboro

STONE ENVIRONMENTAL

Path: O:\PROJ-20\WRM\20-004 Greensboro WW\GIS\Intermediate\Greensboro_Capacity.aprx Figure 2 456 Craftsbury Road Site MapExported: 11/14/2024 1:17 PM by amacrellis

Orleans County, Vermont

94C—Vershire-Glover complex, 8 to 15 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 9j1s
Elevation: 490 to 2,460 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 38 to 44 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Vershire, very rocky, and similar soils: 43 percent
Glover, very rocky, and similar soils: 35 percent
Minor components: 22 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Vershire, Very Rocky

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

O1 - 0 to 2 inches: moderately decomposed plant material
H1 - 2 to 5 inches: very fine sandy loam
H2 - 5 to 19 inches: very fine sandy loam
H3 - 19 to 22 inches: very fine sandy loam
R - 22 to 32 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144BY705ME - Shallow and Mod-deep Semi-rich Till, F144BY701ME - Shallow Till
Hydric soil rating: No

Description of Glover, Very Rocky

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

O1 - 0 to 1 inches: moderately decomposed plant material
H1 - 1 to 4 inches: very fine sandy loam
H2 - 4 to 18 inches: very fine sandy loam
R - 18 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144BY705ME - Shallow and Mod-deep Semi-rich Till, F144BY701ME - Shallow Till
Hydric soil rating: No

Minor Components

Lombard, very rocky

Percent of map unit: 7 percent
Landform: Hills
Hydric soil rating: No

Dummerston, very rocky

Percent of map unit: 6 percent
Landform: Hills
Hydric soil rating: No

Buckland, very rocky

Percent of map unit: 4 percent
Landform: Drainageways, depressions, hills
Hydric soil rating: No

Cabot, very rocky

Percent of map unit: 3 percent
Landform: Depressions, hills, drainageways
Hydric soil rating: Yes

Rock outcrop

Percent of map unit: 2 percent
Landform: Hills
Hydric soil rating: Unranked

Data Source Information

Soil Survey Area: Orleans County, Vermont
Survey Area Data: Version 33, Aug 28, 2024

Orleans County, Vermont

94D—Vershire-Glover complex, 15 to 35 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 9j1t
Elevation: 490 to 2,460 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 38 to 44 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Vershire, very rocky, and similar soils: 43 percent
Glover, very rocky, and similar soils: 35 percent
Minor components: 22 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Vershire, Very Rocky

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

O1 - 0 to 2 inches: moderately decomposed plant material
H1 - 2 to 5 inches: very fine sandy loam
H2 - 5 to 19 inches: very fine sandy loam
H3 - 19 to 22 inches: very fine sandy loam
R - 22 to 32 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144BY705ME - Shallow and Mod-deep Semi-rich Till, F144BY701ME - Shallow Till
Hydric soil rating: No

Description of Glover, Very Rocky

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

O1 - 0 to 1 inches: moderately decomposed plant material
H1 - 1 to 4 inches: very fine sandy loam
H2 - 4 to 18 inches: very fine sandy loam
R - 18 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144BY705ME - Shallow and Mod-deep Semi-rich Till, F144BY701ME - Shallow Till
Hydric soil rating: No

Minor Components

Lombard, very rocky

Percent of map unit: 7 percent
Landform: Hills
Hydric soil rating: No

Dummerston, very rocky

Percent of map unit: 6 percent
Landform: Hills
Hydric soil rating: No

Buckland, very rocky

Percent of map unit: 4 percent
Landform: Hills, drainageways, depressions
Hydric soil rating: No

Cabot, very rocky

Percent of map unit: 3 percent
Landform: Hills, drainageways, depressions
Hydric soil rating: Yes

Rock outcrop

Percent of map unit: 2 percent
Landform: Hills
Hydric soil rating: Unranked

Data Source Information

Soil Survey Area: Orleans County, Vermont
Survey Area Data: Version 33, Aug 28, 2024

Attachment B

Town of Greensboro, Vermont Wastewater Preliminary Engineering
456 Craftsbury Road (Greensboro Village) – Excavator Test Pit Logs

Soils investigation conducted by Amy Macrellis of Stone Environmental, Inc. on October 29, 2024. Excavator supplied by Kyle Drown. Others present during some or all of the investigation included MacNeil (property owner) and Achouak Arfaoui (Vermont DEC, Indirect Discharge Permitting Program).

Test pit locations were estimated using aerial imagery and confirmed using GPS prior to securing archaeological clearance. A total of eight test pits were excavated and logged as described below.

Test Pit TP-01 (44.58232, -72.29481)

0" – 12"	Dark brown (7.5YR 3/3) gravelly very fine sandy loam, weak granular structure, loose consistence, dry. Topsoil.
12" – 52"	Very dark grayish brown (10YR 3/2) bedrock, widely varying degree of weathering. Competent at 52".

Bedrock at 12". No Seasonal high groundwater indicators to depth.

Test Pit TP-02 (44.58205, -72.29468)

0" – 10"	Dark brown (7.5YR 3/2) silt loam, weak granular structure, loose consistence, dry. Topsoil.
10" – 19"	Dark yellowish brown (10YR 4/6) silt loam, moderate angular blocky structure, friable consistence, dry. Single granite boulder encountered.
19" – 28"	Dark grayish brown (10YR 4/2) sandy clay loam, moderate angular blocky structure, friable consistence, moist.
28" – 38"	Dark grayish brown (2.5Y 4/2) loamy sand, moderate angular blocky structure, friable consistence, moist. Few coarse faint mottles present at 31"; few coarse distinct mottles present at 36".
38" – 58"	Dark grayish brown (2.5Y 4/2) gravelly sandy clay loam, moderate angular blocky structure, firm consistence, moist. Till; 35% gravel to cobble.

No bedrock to depth. Seasonal high groundwater indicators at 31".

Test Pit TP-03 (44.58197, -72.29499)

0" – 9"	Very dark brown (7.5YR 2.5/2) silt loam, weak granular structure, loose consistence, dry. Topsoil.
9" – 14"	Yellow (10YR 7/6) silt loam, weak subangular blocky structure, friable consistence, dry.
14" – 25"	Olive brown (2.5Y 4/3) silt loam, weak angular blocky structure, friable consistence, moist.
25" – 30"	Olive brown (2.5Y 4/3) gravelly sandy clay loam, moderate angular blocky structure, firm consistence, moist. Few coarse faint mottles present at and below 25". Bedrock encountered at 24-32", wavy boundary.

Bedrock at 24". Seasonal high groundwater indicators at 25".

Test Pit TP-04 (44.58171, -72.29531)

0" – 11"	Dark brown (7.5YR 3/3) silt loam, weak granular structure, loose consistence, dry. Topsoil.
11" – 18"	Dark yellowish brown (10YR 4/4) sandy clay loam, weak subangular blocky structure, friable consistence, dry.
18" – 33"	Very dark grayish brown (2.5Y 3/2) silty clay loam, moderate angular blocky structure, firm consistence, moist. Steeply dipping bedrock surface: 8" on west face, weathered at 24" on east face, not encountered on south face.

Bedrock at 24". No seasonal high groundwater indicators to depth.

Test Pit TP-05 (44.58142, -72.29542)

0" – 14"	Dark brown (7.5YR 3/2) sandy clay loam, weak granular structure, loose consistence, dry. Topsoil
14" – 17"	Dark yellowish brown (10YR 4/6) silty clay loam, weak angular blocky structure, friable consistence, dry.
17" – 42"	Very dark grayish brown (2.5Y 3/2) silty clay loam, moderate angular blocky structure, firm consistence, moist. Few medium faint mottles at and below 27". Bedrock encountered at 42".

Bedrock at 42". Seasonal high groundwater indicators at 27".

Test Pit TP-06 (44.58129, -72.29513)

0" – 12"	Dark brown (7.5YR 3/2) silty clay loam, weak granular structure, loose consistence, dry. Topsoil.
12" – 22"	Dark brown (10YR 3/3) sandy clay loam, moderate angular blocky structure, friable consistence, dry.
22" – 63"	Dark grayish brown (2.5Y 4/2) gravelly silty clay loam, moderate angular blocky structure, firm consistence, moist. Boundary dips downslope, 22" on west side of pit and 28" on east side. Few medium faint mottles present at 28" on upslope side of pit, not present downslope.

No bedrock to depth. Seasonal high groundwater indicators at 28".

Test Pit TP-07 (44.58159, -72.29494)

0" – 9"	Very dark grayish brown (2.5Y 3/2) silt loam, wea granular structure, loose consistence, dry. Topsoil.
9" – 26"	Dark yellowish brown (10YR 4/4) silty clay loam, weak angular blocky structure, friable consistence, dry. Many roots.
26" – 45"	Black (2.5Y 2.5/1) bedrock, saprolite, highly weathered. Competent bedrock at 45".

Bedrock at 26". No seasonal high groundwater indicators to depth.

Test Pit TP-08 (44.58179, -72.29451)

0" – 8"	Dark brown (7.5YR 3/23) silt loam, weak granular structure, loose consistence, dry.
8" – 20"	Dark yellowish brown (10YR 3/6) sandy clay loam, weak angular blocky structure, friable consistence, dry.
20" – 70"	Very dark grayish brown (2.5Y 3/2) gravelly sandy clay loam, moderate angular blocky structure, friable to firm consistence, moist. Firm at and below 54"; sandier than other tills in this site. 30-45% cobble, few boulders.

No bedrock or seasonal high groundwater indicators to depth.

Attachment C
Darcy's Law Capacity Analysis, 456 Craftsbury Road, Depth to Limiting Features Encountered in Test Pits

Project Title: Greensboro Wastewater Implementation, Preliminary Engineering
Stone Project No.: 20-004
Date: November 12, 2024
Prepared by: Amy Macrellis

Darcy's Law Calculations: Q = KiA
Q = design flow (gallons / day)
K = Hydraulic conductivity (feet / day)
i = Hydraulic gradient (slope of water table, unitless)
A = transmitting soil cross-sectional area (D) times length of disposal system (L) in square feet, where
D = depth to impeding layer or water table, minus required vertical separation, minus system depth

Assumptions:

1 Hydraulic conductivity (K) = 10 feet/day (high end glacial till from Freeze and Cherry Table 2-2; high-range of VT DEC guidance for sandy clay loam, clay loam, silty clay loam)
2 Water table slope (i) is similar to ground surface slope, estimated from LIDAR and test pit observations, average slope along the disposal field area, use average from upslope field edge (west) to top of steep slope (southeast).
15 ft / 155 ft = 9.7%
3 Depth to limiting feature - use average of depths to firm consistence, seasonal high groundwater, or bedrock for TP-2 through TP-8 (28" or 2.3 ft).
4 Design is for mound with bottom of trenches or driplines loated 3 ft. above existing ground surface
5 Required separation distance to seasonal high groundwater is 3.0 feet for septic tank effluent
6 System length (L) across slope (perpendicular to contours) = 110 feet (average of north and center typical sections)

Calculations:

K = 10 ft/day
i = 0.097
L = 110 ft.
D = 2.30 ft. =2.3 ft. +3.0 ft. - 3.0 ft.

Q = 10 ft/day x 0.097 x (110 ft x 2.3 ft) x 7.48 gal/ft^3
Q = 1,800 gallons/day