# Needs Assessment for Onsite Wastewater Treatment Systems

**INTEGRATED WATER RESOURCES MANAGEMENT PROGRAM: TASK 3 DRAFT REPORT**

**TOWN OF COLCHESTER, VERMONT**

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# EXECUTIVE SUMMARY

This report summarizes application of the infrastructure knowledge base developed during the first year of the demonstration grant *Infrastructure Inventory* (Task 1) and *Water Resources Inventory, Mapping and Assessment* (Task 2) to conduct a screening-level assessment of onsite wastewater treatment opportunities, limitations, and needs—both under current conditions and under potential future or "build-out" conditions. In completing this work, Stone utilized the data collected during Tasks 1 and 2, including the parcel level inventories of onsite wastewater treatment systems (OWTS), onsite water supplies, stormwater infrastructure inventory, and water resource datasets. We also utilized the knowledge base to conduct a more detailed assessment of the longevity of onsite wastewater systems and components in the Town of Colchester. To accomplish this analysis, we completed a thorough review of permits for a subset of OWTS on residential properties where multiple permits were issued over the development history of those properties.

As part of our preparation to complete the screening level onsite wastewater needs assessments, wastewater design flows for residential properties and condominiums were estimated based on the number of bedrooms recorded for each property in the Town's Assessor database files. Wastewater flows for commercial properties are much more variable and dependent on the specific property use, so a combination of permit information and long-term water use records were used to determine wastewater flows for commercial properties. During this process, we compared permitted wastewater design flows to actual, long-term average water use for a subset of commercial properties. On commercial properties with design flows less than about 1,300 gallons per day, long-term average water use was less than the permitted design flow. For larger systems (1,300 to 2,500 gpd), design flows based on long-term water use tended to be higher than the permitted flows. This finding implies that wastewater systems serving larger commercial properties may be prone to over-loading, which can lead to a higher risk of premature malfunction of the onsite wastewater systems serving such properties—a possibility that should be carefully considered when developing management options or programs for onsite wastewater systems.

A series of onsite sewage disposal rankings were to the Natural Resource Conservation Service (NRCS) soil data for Colchester, which are based on the type of wastewater dispersal system which can be sited under the current Wastewater System and Potable Water Supply Rules (effective September 2007) given a soil series' soil texture, hydric status, depth to groundwater, and depth to bedrock. Only about 37% of the soils in Town are suitable for conventional, passive septic tank / absorption field onsite wastewater systems, and almost half of the soils in Town would be considered unsuitable for onsite wastewater dispersal. While most historic development in Colchester has closely followed areas of soils suitable for conventional onsite wastewater systems, these areas are now fairly densely developed and thus may have little capacity for future development.

## Town-Wide, Current Condition Needs Assessment

The Town-wide, current condition needs assessment used a data-driven Geographic Information System (GIS) analysis that combined spatial information, such as LIDAR topography and NRCS soils information, with local information such as parcel boundaries, building footprint areas, building uses, and current wastewater flows, to determine what, if any, constraints a property may contain for onsite wastewater treatment and dispersal. This assessment compared the land area available on each developed, unsewered parcel, after subtracting areas occupied by environmental limitations and development-based limitations, to the land area that would be required to successfully build a replacement onsite wastewater dispersal field to serve the existing development on that same parcel. Each parcel with sufficient land available was characterized as conforming with current regulations. If the available area analysis on a parcel showed that the parcel did not have adequate area for a conventional trench or mound system, a second screening assessment was completed to determine whether the addition of advanced treatment might allow the siting of a 'filtrate system' on the property. Filtrate systems can be sized up to 50% smaller, since some of the treatment that normally occurs in the unsaturated soil occurs in a pre-treatment unit.

Of the 5,682 parcels in the screening level, current condition needs assessment, there were 3,125 developed parcels that can support a conforming onsite wastewater treatment system under current conditions and regulations. Another 1,828 parcels (nearly a third of developed parcels in Town) could not support an onsite wastewater dispersal system that fully complies with current regulations and environmental conditions and, therefore, are developed but potentially non-conforming. Of the parcels that were potentially non-complying, 264 parcels were identified that did not meet environmental setbacks for a conventional system, but that did meet those same setback restrictions if a filtrate system were sited instead. There are a total of 502 undeveloped parcels in Town; of these, 186 appear to be suitable for some amount of future development that is served by onsite wastewater treatment systems. The remaining 316 undeveloped parcels either do not have sufficient suitable soil area to support development, or are restricted from development in some other way (roads and rights-of-way, conserved lands, prime agricultural soils, etc.). Finally, 227 parcels are currently served by a centralized sewer system; these parcels were not assessed for potential on-site wastewater treatment capacity or compliance with on-site wastewater treatment related regulations.

If a parcel is developed but potentially non-complying in the current condition needs assessment, this means that if a change or replacement to the property's on-site wastewater system were needed in the future, the parcel could not likely be able to fully comply with the current state-level onsite wastewater regulations without at least a variance on one or more permitting conditions. The significant number of developed, non-complying parcels also has implications from the perspective of developing potential management program options for on-site wastewater systems. Systems on non-conforming parcels may require a "best fix" or "advanced" replacement onsite wastewater treatment system, possibly with

restrictions on changes in use or on increases in wastewater flows. Such systems can sometimes be more costly to maintain and can also require more frequent maintenance or more rigorous monitoring as compared to conventional, passive on-site wastewater systems. If the wastewater management strategy is to assume maintenance and operation of these systems, detailed documentation of what currently exists and what improvements are needed to bring these systems into conformance with the rules will be necessary.

Based on the results of the current condition needs analysis, there is reason to suspect an adverse environmental impact from current land use practices and development. While many “non-conforming” parcels are located in relatively close proximity to the shoreline, there are scattered pockets of “non-conforming” parcels in other areas throughout Colchester. Areas recommended for further, more detailed assessment include the Malletts Bay and Lake Champlain Lakeshore, Meadow Drive, Shore Acres, Julie/Jeffrey Drive, Malletts Bay School, Colchester Middle School, Westbury Trailer Park, Village Acres, and Canyon Estates.

## Town-Wide, Build-out Condition Needs Assessment

The current condition onsite wastewater needs assessments for conventional wastewater dispersal and filtrate dispersal were combined with a build-out analysis performed by the Chittenden County Regional Planning Commission (CCRPC), to analyze the implications of current zoning, and current soil conditions and onsite wastewater treatment management practices, on the prospects for future development in Colchester.

At build-out, of the 5,682 parcels that were assessed, there were 3,311 developed parcels that can support conventional onsite wastewater treatment systems and may support a portion of proposed CCRPC build-out development under current conditions and regulations. There are 1,828 parcels that are currently developed and do not appear to have suitable site and soil conditions to support an onsite wastewater dispersal system that fully complies with current regulations and environmental conditions and, therefore, are potentially non-conforming. Of these potentially non-conforming parcels, 258 appear to comply with setback restrictions if a filtrate system were sited instead. Of the 502 parcels that were undeveloped at current condition, 186 have additional development potential based on the CCRPC build-out analysis and may be suitable for some amount of future development that is served by onsite wastewater treatment systems. Of these 186 parcels, however, there are 110 parcels that may support a portion of the CCRPC build-out projected development, but not all of the development would be accommodated by soils on that property at build-out. The remaining 316 undeveloped parcels either do not have sufficient suitable soil area to support development and have no additional development potential according to the CCRPC build-out analysis, or are restricted from development in some other way (roads and rights-of-way, conserved lands, prime agricultural soils, etc.). Finally, 227 parcels are currently served by a centralized

sewer system; the build-out needs assessment assumed that sewer service would not be extended beyond the currently sewered parcels.

A large portion of additional dwelling units (56%), buildings (51%), and commercial/industrial square footages (31%) projected for limited parcels at build-out fall within existing Sewer Service Areas. While these parcels are currently not sewered with municipal service, it may be that if these properties are developed in the future, that municipal sewer service will be extended to the new development. Thus, it may be reasonable to assume that these properties could developed to the full capacity proposed by the CCRPC build-out analysis. The needs assessment results at build-out indicate that full build-out is clearly limited by onsite wastewater system needs. If municipal sewer service is not extended to new development within the sewer service area in Town, full build-out may occur as soon as 2023. If new development within the Sewer Service Area is sewered with municipal service at the time of development, however, full build-out may occur as soon as 2035.

## Onsite System Longevity Analysis

An analysis of onsite wastewater treatment system component longevity was completed in two steps: an initial screening analysis, followed by extraction of system and soil characteristics from electronic permit documents and completion of a targeted assessment of system and component replacements.

The onsite wastewater permits inventory was used to calculate mean time between wastewater permits, in years. There are a total of 4,953 developed parcels with on-site wastewater systems in Colchester; of these, 1,090 residential parcels (about 25%) had sufficient permit inventory information to complete the calculation. Another 2,740 parcels had one wastewater permit on file, so although permitting information was available, no mean time between permits could be calculated. The remaining 1,123 parcels have no electronic record of a wastewater permit, though in many cases it is likely that permit data exists in paper files. Parcels with average times between permits of 5 years or less, upon investigation, generally did not mean that those parcels had frequent onsite system malfunctions or need for frequent repairs. Rather, those permits were often for component relocation or leach field expansion. Parcels with mean times between permits of more than five years were more likely to have a permitting history that included at least one major component replacement. Significantly, mapping out the permit mean time classes did not show any clustering in particular areas of town that might represent particular issues related to development density, age range of development, or soil characteristics.

The targeted assessment of system and component replacements showed that onsite wastewater systems with a permitting history sufficient to calculate times to component replacement were generally more than 15 years old. No systems included in the analysis were newly constructed since the inclusion of sand filters in the state's wastewater system rules in 1994, and most systems (100 of the 122 included in the

analysis) were originally constructed before the advent of scientifically-based, state-wide onsite wastewater system regulations in 1982.

For systems that were installed before 1982, the distribution over time in years since installation of component or system replacement events was evaluated for leach fields only, for septic tanks, and for whole onsite wastewater systems. Interestingly, within this age grouping, septic tanks seem to have much better longevity (about 31 years) than leach fields (about 17 years to replacement on average). For systems installed between 1982 and 1993, a meaningful calculation could only be created for leachfield replacements. The median age at which dispersal components needed to be replaced within the 1982-1993 cohort is 10 years. In all instances where the type of original dispersal component could be determined in this age group, the replaced component was an adsorption bed. In both age groups, there was not a particular geographic pattern to the replacement component types, except that which might naturally be expected given the soil conditions on the site.

More than 70% of Colchester's 4,953 unsewered parcels were developed prior to the state-level adoption of scientifically based rules governing onsite wastewater treatment in 1982. This finding has both positive and negative implications. Many onsite wastewater systems in Town are more than 30 years old and therefore will be likely to need replacement or upgrade in the future. On the positive side, corrections will be implemented based on modern design and siting understandings, and will therefore result in more reliable systems.

The detailed longevity analysis indicates that leach fields appear to be the most vulnerable component of on-site systems, especially for older installations. This finding indicates that, in considering management program options, or in the Town's administration of state regulations for onsite wastewater systems, there may be a need to increase regulatory and administrative oversight (both review and inspection) of these systems to ensure good performance and long term operation. Increasing oversight would also increase the overall costs associated with wastewater system management.

Finally, soils and available area on individual properties are the prime factors in the location and type of suitable new or replacement on-site systems. Some replacements, such as mound systems and advanced treatment systems, are more costly to construct. There currently is a low-interest loan program for onsite system replacement, administered by the Town. If repairs are too costly, they may be deferred, or not be completed by property owners, especially if no cost-share or financial assistance program is in place to support upgrades and replacements. Additionally, while improvements in technology have allowed the use of more challenging soil types and smaller wastewater dispersal areas, eventually the availability of suitable soils will become a limiting factor to future growth and development.

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# 1. INTRODUCTION AND METHODS

The Town of Colchester secured a demonstration grant from the U.S. Environmental Protection Agency (EPA) for development of an Integrated Water Resource Management Plan (IWRMP) with a goal to improve the overall management of non-point source pollution control infrastructure, and that can be supported by the community at large. This plan has a technical component that includes the development of a sufficient knowledge base of the town's distributed infrastructure to support the creation of a comprehensive plan sufficient to address the community's needs and concerns, an educational component to convince the community that the plan is necessary, and finally the forging of a public private partnership, including a funding strategy to make the plan economically feasible. These three components are intricately linked and are therefore dependent of one another, and are all critical to the successful implementation of the Town's overall plan.

This report summarizes application of the infrastructure knowledge base developed during the first year of the demonstration grant *Infrastructure Inventory* (Task 1) and *Water Resources Inventory, Mapping and Assessment* (Task 2) to conduct a screening-level assessment of onsite wastewater treatment opportunities, limitations, and needs—both under current conditions and under potential future or "build-out" conditions (Task 3). During this task, Stone utilized the data collected during Tasks 1 and 2, including the parcel level inventories of onsite wastewater treatment systems (OWTS), onsite water supplies, stormwater infrastructure inventory, and water resource datasets as applicable, following the methodology defined in the task-specific protocol (Appendix A).

We also utilized the knowledge base to conduct a more detailed assessment of the longevity of onsite wastewater systems and components in the Town of Colchester. To accomplish this analysis, we completed a more detailed review of permits for a subset of OWTS on residential properties where multiple permits were issued over time.

This report describes the results of each assessment, following the order defined in the task-specific protocol. Data compilation and reduction activities performed to facilitate the Town-wide wastewater needs assessments are summarized in Section 2. The results of the town-wide onsite wastewater screening needs assessment, including recommendations for targeted follow-up, are included in Section 3. The findings of the needs assessment under build-out conditions are included in Section 4, and Section 5 summarizes the results and insights gained during the assessment of onsite wastewater system component replacement rates in the Town of Colchester.

# 2. DATA COMPILATION

In addition to the data compiled in Tasks 1 and 2, Stone refined the existing parcel level OWTS permit and document inventory developed during Task 1 to include factors affecting design flows, such as number of bedrooms for residential properties, in a database importable to GIS. Wastewater design flows were estimated where necessary, particularly for commercial properties, using either long-term water use records or professional judgment as informed by the current state-level regulations governing OWTS. We also developed refined ratings of soil conditions for onsite wastewater treatment for use in our analysis, and obtained the Chittenden Regional Planning Commission's 2009 Town of Colchester Build-out Database.

## 2.1. Colchester Build-out Analysis

The results of the build-out analysis conducted in 2009 by the Chittenden County Regional Planning Commission (CCRPC) were obtained and were utilized in conducting the onsite wastewater needs assessment at build-out (Section 4). The build-out condition needs assessment was calculated for two different growth scenarios including the 100% build-out scenario provided by CCRPC and a 20-year growth scenario as agreed in collaboration with Colchester's Planning & Zoning and Public Works departments.

Assumptions regarding undevelopable land within the build-out analysis were slightly different from those that are typically utilized in screening assessments for adequate on-site wastewater treatment capacity. For instance, CCRPC excluded undeveloped parcels with prime agricultural soils from consideration for development due to the Town's current zoning—not necessarily because these soils do not have potential capacity for on-site wastewater dispersal. To ensure consistency between the current condition and build-out condition needs assessments (Sections 3 and 4), undeveloped parcels with prime agricultural soils were excluded from the analyses and are considered to be "undeveloped, not suitable" in tabulation and illustration of analysis results. Conserved lands, where easements or other legal frameworks are in place to preserve natural habitats, are similarly excluded from both the current condition and build-out condition needs assessments.

## 2.2. Onsite sewage disposal ratings

There is a range of soil types in the study area. Soils vary based on geologic material, slope, hydrology, human disturbance, and other factors. The best generalized source of soils data for this area is the Soil Survey Report of Chittenden County prepared by the Natural Resource Conservation Service (NRCS). SSURGO is the name of the digital version of this information. The NRCS data was derived by mapping the landscape with spot field checks to arrive at an approximate level of resolution of 3 acres, with acknowledged inclusions of other soils. This report describes the soil series, or groups of soils with common properties, found in the study area.

The NRCS soils information is planning-level data, and the 3-acre resolution means that it is not very precise for small parcels of land. Site-specific testing, including backhoe test pits and/or percolation tests, would be required to determine the proper wastewater treatment options for an individual property.

For the purposes of this assessment, we are primarily concerned with the properties of the soils that determine suitability for the siting of onsite septic systems: depth to seasonal high groundwater, depth to bedrock, soil permeability, and slope. Stone applied a series of onsite sewage disposal rankings to the NRCS soils polygons in Colchester based on the type of system which can be sited under the current Vermont's Wastewater System and Potable Water Supply Rules (effective September 2007) given a soil series' soil texture, hydric status, depth to groundwater, and depth to bedrock. Plate 2 shows the resulting rankings for soils throughout the Town. The details of soil characteristics related to onsite wastewater treatment are summarized by soil series in Table 1, and by the type of onsite wastewater treatment and dispersal that may be permitted on the soils in Town in Table 2.

About a quarter of the land area in the Town of Colchester is suitable for conventional subsurface wastewater dispersal systems (Tables 1 and 2). An additional 11% of the soils in Town may be suitable for conventional systems, though portions of these soils may have surface slopes in excess of 30% that would require site modification, if feasible, or very high permeability that may require soil replacement to be suitable (Tables 1 and 2). These soils are generally located in the southern half of town, in broad bands along VT Route 2A and Bay Road, along Severance and Blakely Roads (and south into the Fort Ethan Allen vicinity), and between Church Road and Colchester Point (Plate 2). Smaller areas of these soils are also located along Jasper Mine and Clay Point Roads in the northern portion of Town. These areas of conventionally suitable, relatively well-drained soils are also where much of the Town's residential development is situated (Plate 2).

About 16% of the soils in Town would require some form of raised dispersal system (an at-grade system or mound system), and potentially also advanced pre-treatment or site modifications such as curtain drains, to overcome limitations due to shallow groundwater or, in some cases, shallow bedrock (Tables 1 and 2). Most of these soils are located in pockets in the northern portion of Town, though areas of these soils also exist near Exit 16, in the Porters Point Road/Heineberg Drive vicinity, and along Shore Acres Drive (Plate 2).

Roughly 41% of the soils in Town are marginally or not suited for the use of on-site wastewater treatment systems (Tables 1 and 2). Any system that could be sited would likely be a 'performance based' system, which requires pre-treatment, additional inspections and monitoring, and regular reporting to the Town and VT DEC. Limitations of the soil conditions that contribute to this rating are shallow bedrock or seasonal groundwater (less than 18 inches of soil above bedrock or seasonal high groundwater), and steep slopes (greater than 40%). If a property with these difficult soils is undeveloped, it may not be developable. Soils with this rating located near the Winooski River and Colchester Bog, as well as those

*Needs Assessment for Onsite Wastewater Treatment Systems*
*Town of Colchester, Vermont*
*TABLE 1*
*Summary of Soil Characteristics Related to Onsite Wastewater Treatment*

| Series Name | Mapping Unit | Slope (Percent) | | Water Table (Feet) | | Hydric Soil | Depth to Bedrock (Inches) | | Potential On-Site System Suitability | % Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | | Low | High | | |
| Adams and Windsor loamy sands | AdA | 0 | 5 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 16.6 |
| Adams and Windsor loamy sands | AdB | 5 | 12 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 2.9 |
| Adams and Windsor loamy sands | AdD | 12 | 30 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 2.3 |
| Adams and Windsor loamy sands | AdE | 30 | 60 | 6 | 6 | N | 60 | 60 | Conventional, Excessive Slope or Permeability | 3.0 |
| Agawam fine sandy loam | AgA | 0 | 5 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.5 |
| Agawam fine sandy loam | AgD | 12 | 30 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.1 |
| Agawam fine sandy loam | AgE | 30 | 60 | 6 | 6 | N | 60 | 60 | Conventional, Excessive Slope or Permeability | 5.9 |
| Alluvial land | An | 999 | 999 | 99.9 | 99.9 | U | 999 | 999 | Not Ranked | 0.2 |
| Au Gres fine sandy loam | Au | 0 | 5 | 0.5 | 1.5 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.7 |
| Beaches | Be | 1 | 5 | 0 | 6 | U | 60 | 60 | Not Ranked | 0.4 |
| Belgrade and Eldridge soils | BlA | 0 | 3 | 1 | 3.5 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 1.1 |
| Belgrade and Eldridge soils | BlB | 3 | 8 | 1 | 3.5 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.4 |
| Belgrade and Eldridge soils | BlC | 8 | 15 | 1 | 3.5 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.0 |
| Belgrade and Eldridge soils | BlD | 15 | 25 | 1 | 3.5 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.1 |
| Blown-out land | Bo | 999 | 999 | 6 | 6 | U | 60 | 60 | Not Ranked | 0.1 |
| Borrow pits | Br | 999 | 999 | 6 | 6 | U | 60 | 60 | Not Ranked | 0.0 |
| Cabot extremely stony silt loam | CbA | 0 | 3 | 0 | 2 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 0.0 |
| Cabot extremely stony silt loam | CbD | 3 | 25 | 0 | 2 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 0.3 |

Source: National Resource Conservation Service (NRCS), SEI Field Notes

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Notes: % Area was calculated using data from NRCS and Geographic Information Systems (GIS) by dividing the total area (acres) of each soil series in Town by the total land area (acres) within the Town.

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*Needs Assessment for Onsite Wastewater Treatment Systems*
*Town of Colchester, Vermont*
*TABLE 1 (continued)*
*Summary of Soil Characteristics Related to Onsite Wastewater Treatment*

| Series Name | Mapping Unit | Slope (Percent) | | Water Table (Feet) | | Hydric Soil | Depth to Bedrock (Inches) | | Potential On-Site System Suitability | % Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | | Low | High | | |
| Cabot stony silt loam | CaC | 3 | 15 | 0 | 2 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 0.1 |
| Colton and Stetson soils | CsD | 20 | 30 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Colton and Stetson soils | CsE | 30 | 60 | 6 | 6 | N | 60 | 60 | Conventional, Excessive Slope or Permeability | 0.1 |
| Colton gravelly loamy sand | CoA | 0 | 5 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 1.0 |
| Colton gravelly loamy sand | CoB | 5 | 12 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.1 |
| Colton gravelly loamy sand | CoC | 12 | 20 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Covington silty clay | Cv | 0 | 2 | 0.5 | 1 | Y | 60 | 60 | Not Suited | 0.6 |
| Duane and Deerfield soils | DdA | 0 | 5 | 1.5 | 3 | N | 60 | 60 | Mound w/Curtain Drain or Filtrate + Mound | 1.9 |
| Duane and Deerfield soils | DdB | 5 | 12 | 1.5 | 3 | N | 60 | 60 | Mound w/Curtain Drain or Filtrate + Mound | 0.2 |
| Duane and Deerfield soils | DdC | 12 | 20 | 1.5 | 3 | N | 60 | 60 | Mound w/Curtain Drain or Filtrate + Mound | 0.0 |
| Enosburg and Whately soils | EwA | 0 | 3 | 0 | 1.5 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 0.4 |
| Enosburg and Whately soils | EwB | 3 | 8 | 0 | 1.5 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 0.0 |
| Farmington extremely rocky loam | FaC | 5 | 20 | 6 | 6 | N | 10 | 20 | Not Suited, 2 Year Time of Travel, or Store + Dose | 6.5 |
| Farmington extremely rocky loam | FaE | 20 | 60 | 6 | 6 | N | 10 | 20 | Not Suited, 2 Year Time of Travel, or Store + Dose | 8.0 |
| Farmington-Stockbridge rocky loams | FsB | 5 | 12 | 6 | 6 | N | 10 | 60 | Mound or Filtrate + At-grade | 0.4 |
| Farmington-Stockbridge rocky loams | FsC | 12 | 20 | 6 | 6 | N | 10 | 60 | Mound or Filtrate + At-grade | 0.2 |
| Farmington-Stockbridge rocky loams | FsE | 20 | 60 | 6 | 6 | N | 10 | 60 | Mound or Filtrate + At-grade | 0.0 |
| Fill land | Fu | 999 | 999 | 99.9 | 99.9 | U | 999 | 999 | Not Ranked | 0.2 |

Source: National Resource Conservation Service (NRCS), SEI Field Notes

STONE ENVIRONMENTAL, INC.

Notes: % Area was calculated using data from NRCS and Geographic Information Systems (GIS) by dividing the total area (acres) of each soil series in Town by the total land area (acres) within the Town.

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Date/Initials: 11/18/10 anm

*Needs Assessment for Onsite Wastewater Treatment Systems*
*Town of Colchester, Vermont*
*TABLE 1 (continued)*
*Summary of Soil Characteristics Related to Onsite Wastewater Treatment*

| Series Name | Mapping Unit | Slope (Percent) | | Water Table (Feet) | | Hydric Soil | Depth to Bedrock (Inches) | | Potential On-Site System Suitability | % Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | | Low | High | | |
| Fresh water marsh | Fw | 999 | 999 | 99.9 | 99.9 | U | 999 | 999 | Not Ranked | 0.1 |
| Georgia extremely stony loam | GgC | 0 | 15 | 1.5 | 3 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.1 |
| Georgia extremely stony loam | GgE | 15 | 60 | 1.5 | 3 | N | 60 | 60 | Not Suited | 0.0 |
| Georgia stony loam | GeB | 3 | 8 | 1.5 | 3 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.0 |
| Georgia stony loam | GeC | 8 | 15 | 1.5 | 3 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.0 |
| Groton gravelly fine sandy loam | GrB | 5 | 12 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.2 |
| Groton gravelly fine sandy loam | GrC | 12 | 20 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Groton gravelly fine sandy loam | GrD | 20 | 30 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Hadley very fine sandy loam | Hf | 0 | 3 | 4 | 6 | N | 60 | 60 | At-grade or Filtrate + Conventional | 0.7 |
| Hadley very fine sandy loam, frequentl | Hh | 0 | 3 | 4 | 6 | N | 60 | 60 | At-grade or Filtrate + Conventional | 0.2 |
| Hartland very fine sandy loam | HlB | 2 | 6 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.4 |
| Hartland very fine sandy loam | HlC | 6 | 12 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.1 |
| Hartland very fine sandy loam | HlD | 12 | 25 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.1 |
| Hartland very fine sandy loam | HlE | 25 | 60 | 6 | 6 | N | 60 | 60 | Conventional, Excessive Slope or Permeability | 2.0 |
| Hinesburg fine sandy loam | HnA | 0 | 3 | 2 | 4 | N | 60 | 60 | Mound or Filtrate + At-grade | 0.7 |
| Hinesburg fine sandy loam | HnB | 3 | 8 | 2 | 4 | N | 60 | 60 | Mound or Filtrate + At-grade | 0.5 |
| Hinesburg fine sandy loam | HnC | 8 | 15 | 2 | 4 | N | 60 | 60 | Mound or Filtrate + At-grade | 0.1 |
| Hinesburg fine sandy loam | HnD | 15 | 25 | 2 | 4 | N | 60 | 60 | Mound or Filtrate + At-grade | 0.1 |

Source: National Resource Conservation Service (NRCS), SEI Field Notes

STONE ENVIRONMENTAL, INC.

Notes: % Area was calculated using data from NRCS and Geographic Information Systems (GIS) by dividing the total area (acres) of each soil series in Town by the total land area (acres) within the Town.

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Date/Initials: 11/18/10 anm

*Needs Assessment for Onsite Wastewater Treatment Systems*
*Town of Colchester, Vermont*
*TABLE 1 (continued)*
*Summary of Soil Characteristics Related to Onsite Wastewater Treatment*

| Series Name | Mapping Unit | Slope (Percent) | | Water Table (Feet) | | Hydric Soil | Depth to Bedrock (Inches) | | Potential On-Site System Suitability | % Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | | Low | High | | |
| Hinesburg fine sandy loam | HnE | 25 | 60 | 2 | 4 | N | 60 | 60 | Not Suited | 0.5 |
| Limerick silt loam | Le | 0 | 3 | 0 | 1.5 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 5.0 |
| Limerick silt loam, very wet | Lf | 0 | 1 | 0 | 1.5 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 2.9 |
| Livingston clay | Lh | 0 | 2 | 0 | 0.5 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 0.5 |
| Lyman-Marlow rocky loams | LmB | 5 | 12 | 2 | 6 | N | 10 | 60 | Mound or Filtrate + At-grade | 0.0 |
| Lyman-Marlow rocky loams | LmC | 12 | 20 | 2 | 6 | N | 10 | 60 | Mound or Filtrate + At-grade | 0.0 |
| Lyman-Marlow very rocky loams | LyD | 5 | 30 | 2 | 6 | N | 10 | 60 | Mound or Filtrate + At-grade | 2.5 |
| Lyman-Marlow very rocky loams | LyE | 30 | 60 | 2 | 6 | N | 10 | 60 | Not Suited | 1.0 |
| Massena extremely stony silt loam | MoC | 0 | 15 | 1 | 1.5 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.1 |
| Muck and Peat | Mp | 0 | 1 | -1 | 0 | Y | 60 | 60 | Not Suited | 3.0 |
| Munson and Belgrade silt loams | MuD | 12 | 25 | 0.5 | 3.5 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 2.5 |
| Munson and Raynham silt loams | MyB | 2 | 6 | 0 | 2 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 4.2 |
| Munson and Raynham silt loams | MyC | 6 | 12 | 0 | 2 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 2.6 |
| Palatine silt loam | PaB | 3 | 8 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.6 |
| Palatine silt loam | PaC | 8 | 15 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.2 |
| Palatine silt loam | PaD | 15 | 25 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.1 |
| Palatine silt loam | PaE | 25 | 60 | 6 | 6 | N | 60 | 60 | Conventional, Excessive Slope or Permeability | 0.1 |
| Peru extremely stony loam | PsC | 0 | 20 | 1 | 2 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.5 |

Source: National Resource Conservation Service (NRCS), SEI Field Notes

STONE ENVIRONMENTAL, INC.

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Date/Initials: 11/18/10 anm

*Needs Assessment for Onsite Wastewater Treatment Systems*
*Town of Colchester, Vermont*
*TABLE 1 (continued)*
*Summary of Soil Characteristics Related to Onsite Wastewater Treatment*

| Series Name | Mapping Unit | Slope (Percent) | | Water Table (Feet) | | Hydric Soil | Depth to Bedrock (Inches) | | Potential On-Site System Suitability | % Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | | Low | High | | |
| Peru extremely stony loam | PsE | 20 | 60 | 1 | 2 | N | 60 | 60 | Not Suited | 0.1 |
| Peru stony loam | PeB | 5 | 12 | 1 | 2 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.7 |
| Peru stony loam | PeC | 12 | 20 | 1 | 2 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.1 |
| Peru stony loam | PeD | 20 | 30 | 1 | 2 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.0 |
| Pits, sand and Pits, gravel | Gpi | 999 | 999 | 6 | 6 | U | 60 | 60 | Not Ranked | 0.2 |
| Quarries | Qd | 999 | 999 | 6 | 6 | U | 0 | 0 | Not Ranked | 0.1 |
| Rock land | Rk | 999 | 999 | 0 | 6 | U | 0 | 0 | Not Ranked | 1.3 |
| Scantic silt loam | ScA | 0 | 2 | 0 | 1 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 2.4 |
| Scantic silt loam | ScB | 2 | 6 | 0 | 1 | Y | 60 | 60 | Not Suited, 2 Year Time of Travel, or Store + Dose | 1.2 |
| Scarboro loam | Sd | 0 | 2 | -1 | 0.5 | Y | 60 | 60 | Not Suited | 1.1 |
| Stetson gravelly fine sandy loam | StA | 0 | 5 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Stetson gravelly fine sandy loam | StC | 12 | 20 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Stockbridge & Nellis ext. stony loams | SxC | 3 | 15 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Stockbridge & Nellis ext. stony loams | SxE | 15 | 60 | 6 | 6 | N | 60 | 60 | Conventional, Excessive Slope or Permeability | 0.1 |
| Stockbridge and Nellis stony loams | SuB | 3 | 8 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.1 |
| Stockbridge and Nellis stony loams | SuC | 8 | 15 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Stockbridge and Nellis stony loams | SuD | 15 | 25 | 6 | 6 | N | 60 | 60 | Conventional Subsurface | 0.0 |
| Terrace escarpments, silty and clayey | TeE | 999 | 999 | 99.9 | 99.9 | U | 999 | 999 | Not Ranked | 3.1 |

Source: National Resource Conservation Service (NRCS), SEI Field Notes

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Date/Initials: 11/18/10 anm

*Needs Assessment for Onsite Wastewater Treatment Systems*
*Town of Colchester, Vermont*
*TABLE 1 (continued)*
*Summary of Soil Characteristics Related to Onsite Wastewater Treatment*

| Series Name | Mapping Unit | Slope (Percent) | | Water Table (Feet) | | Hydric Soil | Depth to Bedrock (Inches) | | Potential On-Site System Suitability | % Study Area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | High | Low | High | | Low | High | | |
| Vergennes clay | VeB | 2 | 6 | 1 | 3 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.4 |
| Vergennes clay | VeC | 6 | 12 | 1 | 3 | N | 60 | 60 | Filtrate + Mound w/Curtain Drain | 0.2 |
| Water | W | 999 | 999 | 99.9 | 99.9 | w | 999 | 999 | Not Ranked | 0.4 |
| Winooski very fine sandy loam | Wo | 0 | 3 | 1.5 | 3 | N | 60 | 60 | Mound w/Curtain Drain or Filtrate + Mound | 1.8 |

Source: National Resource Conservation Service (NRCS), SEI Field Notes

STONE ENVIRONMENTAL, INC.

Notes: % Area was calculated using data from NRCS and Geographic Information Systems (GIS) by dividing the total area (acres) of each soil series in Town by the total land area (acres) within the Town.

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Date/Initials: 11/18/10 anm

between VT Route 7 and I-89 in the northern part of Town, tend to be limited by shallow seasonal high groundwater (Plate 2). Soils with this rating around Colchester Pond, in the Brae Loch Road vicinity, on Marble and Coates Islands, and between Bay Road and Blakely Road tend to be limited by shallow bedrock.

The remaining 7% of the soils in Town cannot be ranked relative to their suitability for onsite wastewater dispersal given the information available in the NRCS soil survey (Tables 1 and 2). These soil classes include alluvial land (along stream channels), recent fill, quarries, and borrow pits, and other areas where soil characteristics are extremely variable and difficult to classify.

*Table 2. Summary of Soil Suitability for Onsite Wastewater Treatment.*

| Soils Rating for Onsite System Suitability | Acres | Percentage of Total Land Area |
|---|---|---|
| Conventional Subsurface | 6,153 | 25.4% |
| Conventional w/Excessive Slope or Permeability | 2,713 | 11.2% |
| At-grade or Filtrate + Conventional | 242 | 1.0% |
| Mound or Filtrate + At-grade | 1,114 | 4.6% |
| Mound w/Curtain Drain or Filtrate + Mound | 945 | 3.9% |
| Filtrate + Mound w/Curtain Drain | 1,696 | 7.0% |
| Performance Based or Not Suited | 9,835 | 40.6% |
| Not Ranked | 1,525 | 6.3% |
| **TOTAL** | 24,223 | 100.% |

## 2.3. Assessor data and wastewater design flows

Account-level fields in the Assessor's database on number of bedrooms for residential properties and condominiums were standardized and utilized to estimate wastewater design flows for residential and residential condominium properties. This information was used in the Needs Assessment to calculate the area which would be required to site a replacement onsite system on a given property if the existing system were to malfunction in the future (see Section 3.1).

Design flows for commercial properties were derived, and the land areas required for onsite wastewater dispersal on commercial properties were calculated, using the three-tier process defined in the task-specific protocol (Appendix A). Table 3 summarizes the methods utilized to estimate design flows and required areas for each currently developed parcel, along with the total number of parcels on which each method was applied.

*Table 3. Summary of Methods Used to Derive Design Flows and Required Areas for Onsite Wastewater Treatment Systems.*

| Design Flow/Required Area Estimation Method | Total Parcels |
|---|---|
| Single-Family Residences and Condos, estimated by # of bedrooms in Assessor db | 4,719 |
| Commercial, design flow or required area extracted from permit | 158 |
| Commercial, design flow estimated based on long-term average water use | 41 |
| Commercial, design flow estimated based on property use only | 35 |
| **TOTAL** | 4,953 |

First, if wastewater design flow or specific design information was available from the Task 1 wastewater permits inventory, it was transcribed during permit review and used to calculate the required wastewater dispersal area. For developed commercial accounts where permits were already linked to accounts, we extracted design flow (and leachfield area/design information if available) from each parcel's scanned permit document records.

Second, where no electronic permit was available for review, site specific water use data was used to determine average daily usage and design flow. The estimated design flow was then used to calculate the required wastewater dispersal area. The staff of Colchester Fire District #2 provided copies of water meter log books, and Aldrich + Elliott staff entered recent water usage into a spreadsheet on an individual account basis. Stone used the long-term average water usage from each account to calculate an estimated wastewater design flow. Where both design flow from permits and water usage data were available, we checked the accuracy of the calculation based on water usage against the permitted design flow. The project consultants attempted to follow this process for commercial properties in Colchester Fire District #3, but met with only limited success. Thus, the majority of the design flows and required replacement areas for commercial properties in Fire District #3 were estimated.

A subset of 18 commercial properties in Colchester Fire District #2 where both permit information and water use information are available were evaluated to test the reasonableness of our assumptions regarding long-term water use being similar to permitted design flows. Generally, where permitted design flows were less than about 1,300 gpd, long-term average water use was less than the permitted design flow (Figure 1). For these properties, if required area is calculated based on water use, the required area would be an under-estimate of what the permitted system might require. For larger systems (1,300 to 2,500 gpd), design flows based on long-term water use tended to be higher than the permitted flows (Figure 1). In these cases, if required area were calculated based on water use, the required area would be an over-estimate of what a permitted system might require.

In some cases where water use was higher than permitted design flow, the excess water use may be going to pool filling or landscape irrigation, rather than to the onsite wastewater treatment system. In other cases, the commercial property uses indicate that these activities are less likely to be occurring and thus,

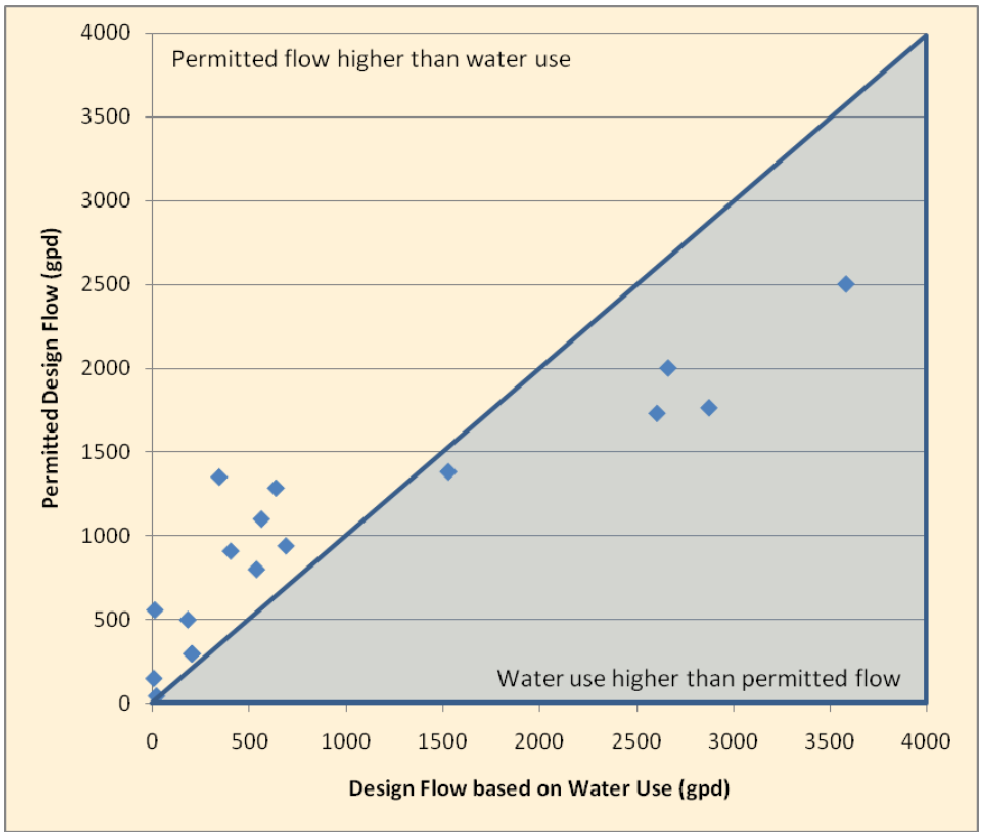



*Figure 1. Permitted design flow versus design flow estimate based on long-term water use records, selected commercial properties in Colchester Fire District #2.*

that consistent water use in excess of wastewater design flow may result in premature onsite wastewater system malfunction due to hydraulic overload. This does not impact the results of the screening level needs assessment, but may be a consideration in developing a management program for onsite systems.

Design flows based on long-term average water use are a reasonably good approximation for wastewater design flow (and thus, for use in estimates of design flows and the areas required for siting or replacing a wastewater system on site). On average, design flows calculated based on water use were about 35 gpd lower than design flows extracted directly from permit data.

If neither of the two information sources described and assessed above was available for a currently developed commercial property, wastewater design flow was estimated on a site basis, based on the type of commercial development as derived from the Assessor's database and the design flow criteria of the 2007 Wastewater System and Potable Water Supply Rules.

Design flows, system details, and calculation methods entered into the wastewater permits inventory during this task were retained in the inventory database.

## 2.4. Municipal water transmission mains

CAD drawings of the municipal water transmission lines in Colchester were converted into a GIS feature class, so that the water transmission lines could be appropriately buffered in the available area portion of the wastewater needs assessment (see Section 3.1).

## 2.5. Colchester Parcels 2009

Minor corrections required to completely join the infrastructure inventory datasets with the 2009 parcels dataset from the Town of Colchester/VCGI were completed before work commenced on the Town-wide needs assessments.

In the current condition and build-out town-wide needs assessments, we were concerned with whether or not the land surrounding a residential building or commercial enterprise could support a fully complying replacement onsite wastewater system, if one were needed in the future. Thus, in order to accurately complete the assessments, the spatial parcels that represent the footprints of condominium-type properties in the parcel shape file were merged with the surrounding common land. This merging operation reduced the number of parcels to be screened to 5,682 parcels in Town, which were analyzed in the screening-level needs assessments (Sections 3 and 4).

## 2.6. Topography and Slope % (based on 10 ft contours)

Colchester's topography consists mostly of gently rolling terrain, sloping generally from northeast to west (Plate 1). There are large areas of relatively level land along the Winooski River floodplain on the southern boundary of the Town, and in the wetland area where Smith Hollow Creek, Pond Brook, Malletts Creek, and Allen Brook converge in the north-central part of Town between I-89 and VT Route 7 (Plate 1). In the southern half of the town, the topography is marked by steep-sided stream valleys, particularly in the Crooked Creek and Sunderland Brook watersheds. Generally, elevations range from 880 feet above mean sea level (AMSL) on Brigham Hill in the northeast corner of Colchester, to a low of about 98 feet AMSL to the east along the shore of Malletts Bay and Lake Champlain.

Slope percentages across the Town were calculated based on the higher-resolution LIDAR data, rather than the older 1:24,000 digital elevation model and resulting 20-foot elevation contours, for use in the needs assessments. Areas where the ground surface slope is greater than 30% are indicated on Plate 1; such areas cannot be utilized for onsite wastewater treatment without site modification, if feasible, under current regulations.

# 3. TOWNWIDE GIS-BASED CURRENT CONDITIONS NEEDS ASSESSMENT

The Town-wide, current condition needs assessment used a data-driven Geographic Information System (GIS) analysis that combined spatial information, such as LIDAR topography and NRCS soils information, with local information such as parcel boundaries, building footprint areas, building uses, and current wastewater flows, to determine what, if any, constraints a property may contain for onsite wastewater treatment and dispersal. The Needs Assessment only includes parcels that were designated as being served by onsite wastewater treatment systems during the Task 1 infrastructure inventory.

A brief description of the process followed to complete the current condition needs assessment is included below; details of the methods and procedures are included in Appendix A.

A needs assessment is generally performed to identify parcels that may not be suitable for onsite wastewater treatment systems. There are two main components to the analysis: an “available area” analysis and a “required area” analysis, each of which is described below.

The objective of the available area analysis is to identify which developed parcels would be constrained by inadequate lot size if required to install an onsite system that complies with all horizontal setbacks as set forth in current rules, regulations, and local ordinances. There are many factors that result in areas of a parcel being unavailable for construction of an onsite system. For example, state and local regulations require that certain "setbacks" or distances from natural or artificial features be maintained in order to protect those resources. One such setback is a required separation of 50 feet from surface waters such as ponds or streams. It is because of setback regulations that the total area on a parcel is significantly reduced when determining which areas are suitable for onsite systems.

A second and equally important part of determining if a parcel has enough suitable land area to support an onsite system is an analysis of the soil conditions on the parcel to determine the area required to treat the wastewater flows generated on the parcel. A parcel is considered to have adequate area for an onsite wastewater system if the land area available to site the soil-based treatment and dispersal component of an onsite wastewater system is equal to or larger than the land area that would be required to treat the wastewater generated on the property, given its current land use.

If the available area analysis on a parcel showed that the parcel did not have adequate area for a conventional trench or mound system, a second screening assessment was completed to determine whether the addition of advanced treatment might allow the siting of a ‘filtrate system’ on the property. A filtrate system, under current regulations, is any dispersal component that is preceded by advanced treatment. Such dispersal systems can be sized up to 50% smaller, since some of the treatment that normally occurs in the unsaturated soil occurs in the pre-treatment unit. For parcels with area-related

limitations, the property's required leachfield area was halved, and the smaller required area was then compared to the available area. Parcels are identified as filtrate system area limited if the smaller available area was still less than the required area. Parcels are identified as being unconstrained by filtrate system area when the available area was greater than or equal to the required area for the type of system suited to the soil conditions.

The next step identifies those properties with soil conditions where the seasonal high groundwater table is 24 inches or less below ground surface, or where the depth to bedrock is less than 24 inches below ground surface. Both of these conditions impact the type of onsite system that may be built.

A limited screening assessment was completed for undeveloped but potentially developable parcels—meaning parcels that are currently undeveloped but do not contain prime agricultural soils and are not conserved. The minimum land area required to site an on-site dispersal system for a 2 bedroom dwelling is 364 square feet. Undeveloped parcels at least this square footage of potentially suitable soil available were considered to be potentially suitable for the purposes of the current condition assessment. Undeveloped parcels with less than 364 square feet of potentially suitable soil available were considered to be unsuitable for development utilizing onsite wastewater treatment. (Parcels classified as roads, rights-of-way, conserved lands, or undeveloped properties with prime agricultural soils were also considered to be unsuitable for development.)

Finally, the GIS analyses were further condensed to summarize all results for developed parcels in terms of compliance with current on-site wastewater treatment regulations. Developed parcels that meet all environmental, soil-based, or development-based limitations and requirements of the current regulations were classified as "developed, conforming". Developed parcels with one or more of the environmental or development-based limitations described above were classified as "developed, not conforming".

Once the results of the GIS analyses were produced, a screening level review was conducted on a subset of the parcel-level results. This review included using additional information known about the properties (permits, test pit and percolation test results if included in the document inventory, etc.) to confirm the results of the GIS analyses. Draft versions of the results of the GIS analyses were also reviewed in collaboration with Planning and Zoning and Public Works staff members.

## 3.1. Current Condition Needs Assessment Results

The results of the current condition analyses are represented on Plates 3-6 and summarized in Tables 4-6.

Plate 3 highlights land areas in Colchester that are suitable for onsite wastewater dispersal, based on the data sources described in Section 2. The green areas on Plate 3 represent land that is potentially suitable for an onsite system, while the white areas have one or more environmental limitation. Of the 24,223 total acres in Colchester, 69% (or 16,752 acres) of the land is not suitable for development using conventional

onsite wastewater systems. About a quarter of the land in town (5,797 acres or 24%) is suitable for development using onsite wastewater systems, and the remaining 7% (1,674 acres) is sewered with municipal wastewater service.

The environmental limitations that were compiled to produce the white areas on Plate 3 often overlap—so in any one location, there may be more than one environmental factor that makes the land unsuitable for a conventional onsite system. For example, there may be areas that have both shallow bedrock and steep soils, or areas where there may be surface water, floodplain, and shallow groundwater. For this reason, the individual factors will always sum to a greater value than the actual total acreage or percentage of unsuitable areas. The acreage characterized as "not suitable for conventional onsite systems" on Plate 3 due to environmental limitations consist of land in the following categories:

- Conserved lands: 2,419 acres (10% of land in entire Town)
- Rights-of-way, roads: 1,451 acres (6%)
- Environmental horizontal setbacks:
  - Surface waters plus 50 ft setback: 2,414 acres (10%)
  - Wetlands plus 50 ft setback (excluding surface water): 2,320 acres (10%)
  - Top of embankment or slope greater than 30% with 25 ft buffer: 4,623 acres (19%)
  - Bedrock escarpments plus a 25 ft buffer: 0 acres (0%)
  - Floodplain (excluding surface water and wetlands): 2,927 acres (12%)
  - Depth to groundwater (excluding surface water, wetlands, and floodplain) less than 2 feet: 2,927 acres (12%)
  - Depth to bedrock less than 2 feet: 3,391 acres (14%)

In addition, there are development-based limitations that need to be accounted for when evaluating the land on a parcel basis. These development-based limitations are added to the environmental limitations to understand how Colchester could have been developed based on current parcel boundaries and on compliance with state regulations for siting conventional onsite wastewater systems. Development-based horizontal setbacks were defined in the task protocol (Appendix A), and include:

- Property lines with a 25-foot buffer
- Zone 1 wellhead protection areas
- Private drilled well locations with a 100-foot buffer
- Private shallow well/spring locations with a 150-foot buffer
- Main or municipal water lines with a 50-foot buffer
- Foundation, footing, or curtain drains with a 35-foot buffer

- Stormwater infiltration features with a 35-foot buffer

Plate 4 illustrates how the Town of Colchester might look today if only parcels that met current regulatory standards, including the environmental and development-based limitations described above, were actually developed. If all development in the Town of Colchester had, over the history of the Town, followed the current onsite wastewater standards for conventional systems, a total of 3,311 currently existing parcels (including both developed and undeveloped parcels) could support some level of development (Plate 4). This development pattern would, generally speaking, closely follow the soil types and textures that are most suitable for on-site wastewater treatment.

Plate 5 and Tables 4-5 summarize Colchester's current condition with regard to conventional on-site wastewater treatment. Of the 5,682 parcels that were assessed, there were 3,125 developed parcels that can support a conforming onsite wastewater treatment system under current conditions and regulations, within the assumptions and considerations described above (Plate 5, Table 4). These parcels met all the environmental setbacks required by the available area analysis, as well as the depth to groundwater and bedrock criteria.

The GIS analysis estimated that 1,828 parcels could not support an onsite wastewater dispersal system that fully complies with current regulations and environmental conditions and, therefore, are developed but potentially non-conforming (Plate 5, Table 4). This number represents nearly a third of the currently developed parcels in Town. It is likely that a number of these properties have sub-standard or inadequately performing systems that may be impacting the environment. Of these potentially non-conforming parcels, 1,689 were constrained by environmental setbacks, 96 parcels were constrained by only shallow groundwater, and 43 were constrained by only shallow bedrock.

If a parcel is developed but non-complying, this means that if a change or replacement to the property's on-site wastewater system were needed in the future, the parcel could not likely not be able to fully comply with the current state-level onsite wastewater regulations without at least a variance on one or more permitting conditions. These conditions are factors of safety designed into the Rules to prevent adverse environmental and/or public health impacts. Varying from these conditions is sometimes reasonable and justified (on a case-by-case basis), but variances are not always appropriate or warranted.

The significant number of developed, non-complying parcels also has implications from the perspective of developing potential management program options for on-site wastewater systems. Systems on "non-conforming" parcels may require a "best fix" or "advanced" replacement onsite wastewater treatment system, possibly with restrictions on changes in use or on increases in wastewater flows. Such systems can sometimes be more costly to maintain and can also require more frequent maintenance or more rigorous monitoring as compared to conventional, passive on-site wastewater systems. If the wastewater management strategy is to assume maintenance and operation of these systems, detailed documentation of

what currently exists and what improvements are needed to bring these systems into conformance with the rules will be necessary.

There are a total of 502 undeveloped parcels in Town (Plate 5, Table 4). Of the undeveloped parcels, 186 appear to be suitable for some amount of future development that is served by onsite wastewater treatment systems. These parcels and their potential capacities to serve future development are assessed further in the build-out condition analysis described in Section 4. The remaining 316 undeveloped parcels either do not have sufficient suitable soil area to support development, or are restricted from development in some other way (roads and rights-of-way, conserved lands, prime agricultural soils, etc.).

Finally, 227 parcels are currently served by a centralized sewer system; these parcels were not assessed for potential on-site wastewater treatment capacity or compliance with on-site wastewater treatment related regulations.

*Table 4. Summary of Current Condition Needs Assessment Results, Conventional Dispersal.*

| Current Condition Status | Total Parcels | Percent of Parcels | Total Acres | Percent of Acres |
|---|---|---|---|---|
| Developed, Conforming | 3,125 | 55% | 10,676 | 44% |
| Developed, Not Conforming | 1,828 | 32% | 1,579 | 7% |
| Undeveloped, Suitable for Conventional Onsite System | 186 | 3% | 4,414 | 18% |
| Undeveloped, Not Suitable for Conventional Onsite System | 316 | 6% | 5,880 | 24% |
| Sewered with Municipal Service | 227 | 4% | 1,674 | 7% |
| TOTAL | 5,682 | 100% | 24,223 | 100% |

The different types of restrictions related to the area available on each parcel, and the total parcels affected by each type of environmental setback, are listed in Table 5. It is important to note that in many cases, the areas affected by these setbacks overlap on any given parcel. For example, one developed parcel might have restrictions related to parcel boundaries, structure footprints, a private well shield, and a nearby wetland or stream. Also, restrictions related to wetlands, stream channels, and 100-year floodplains often overlap (see Plate 1). Notable concentrations of parcels with area-related restrictions include the following areas (Plate 5):

- Colchester Point Road
- Belwood and Meadow Drive
- Beach Road
- East Lakeshore Drive

- Malletts Bay Ave. near the Winooski boundary
- Village Acres
- Canyon Estates

A total of 1,689 parcels have some form of area-related limitation (Table 5). Parcel boundaries and structure footprints were, by far, the most common types of area-related limitations identified in the current conditions assessment (Table 5). These limitations are not unexpected, given the significant proportion of small-lot residential development in the Town of Colchester. A relatively high number of parcels (939) also have area limitations related to setbacks from municipal water mains. This is also not unexpected, as many of the smaller residential lots in the Town are only 130 to 150 feet deep. The current regulatory setback between water mains and onsite wastewater dispersal is 50 feet—a distance that effectively makes the entire front yard of many of these lots off-limits for onsite wastewater treatment systems.

*Table 5. Summary of Current Condition Assessment Available Area Limitations by Type.*

| **Available Area Limitation (for Area-Limited Parcels Only)** | **Total Parcels with Limitation – Conventional Dispersal** |
|---|---|
| Parcel Boundaries | 1,689 |
| Structure Footprints | 1,662 |
| Public Groundwater Source Protection Areas | 1 |
| Private Well Shields | 80 |
| Municipal Water Lines (Mains) | 939 |
| Subsurface Groundwater Drains | 42 |
| Stormwater Infrastructure Points (Drywells) | 110 |
| Stormwater Infrastructure Lines | 18 |
| Slopes Greater than 30% | 681 |
| Water Bodies (Ponds, Lakes) | 273 |
| Wetlands | 162 |
| Streams | 119 |
| Floodplains | 373 |
| Soils designated “Not Rated” in Soil Survey | 329 |

About 680 parcels contain areas with ground slope greater than 30%, where replacement wastewater treatment systems may not be sited even if soils are otherwise suitable. A significant number of the area limited parcels, about 375, contain land areas within mapped 100-year floodplains; these areas include both stream-related floodplains and many properties along East Lakeshore Drive and Colchester Point Road, where the flood stage of Lake Champlain covers significant areas of some lakeshore parcels. Over

325 parcels had area limitations related to soils that were not rated in the NRCS soils characterization. For parcels that had this limitation, either the soils are extremely limiting in terms of onsite wastewater treatment, or insufficient information exists to characterize the soils (as is often the case for fill soils, e.g., along Colchester Point Road, or properties that have been re-developed after serving as borrow pits). Smaller numbers of parcels were limited by proximity to water bodies, streams and wetlands, stormwater infrastructure, and wellhead protection areas for public and private water supplies (Table 5).

Compared to the results of the available area assessment, relatively small numbers of parcels were constrained only by insufficient depth to groundwater or bedrock (Plate 5). A total of 96 developed parcels were constrained by only shallow groundwater, and 43 were constrained by only shallow bedrock. Notable areas of multiple groundwater-limited parcels include the Shore Acres neighborhood, the eastern end of Jasper Mine Road, and scattered, relatively large parcels throughout the northeast quadrant of Town. Clusters of parcels with only bedrock limitations include shoreline areas along the northern half of Malletts Bay and the western portion of the Shore Acres neighborhood.

Plate 6 and Table 6 summarize the current condition needs assessment results given the reduced land area required to site a filtrate dispersal system. The results of the filtrate system assessment were generally similar to those of the available area assessment for conventional systems (Plate 6 and Table 6). A total of 264 parcels were identified (258 developed, non-conforming; 6 undeveloped, not suitable) that did not meet environmental setbacks for a conventional system, but that did meet those same setback restrictions if a filtrate system were sited instead. These parcels were scattered throughout the Town with no particular geographic pattern. Under the filtrate assessment, the number of groundwater-limited and bedrock-limited parcels increased slightly, indicating that even though a filtrate system could be sited that met all horizontal environmental setbacks on those parcels, the relatively challenging soils on the parcels still posed limitations to adequate onsite wastewater treatment. In such situations, current practice in Town and in the application of state-wide onsite wastewater regulations by the Vermont DEC is to utilize best-fix systems to overcome as many site and soil limitations as possible on the site, and to replace existing wastewater treatment systems at existing flows.

*Table 6. Summary of Current Condition Needs Assessment Results, Filtrate Dispersal.*

| Current Condition–Filtrate Option Status | Total Parcels | Percent of Parcels | Total Acres | Percent of Acres |
|---|---|---|---|---|
| Developed, Conforming | 3,383 | 60% | 10,905 | 45% |
| Developed, Not Conforming | 1,570 | 28% | 1,350 | 6% |
| Undeveloped, Suitable for Conventional Onsite System | 192 | 3% | 4,425 | 18% |
| Undeveloped, Not Suitable for Conventional Onsite System | 310 | 5% | 5,869 | 24% |
| Sewered with Municipal Service | 227 | 4% | 1,674 | 7% |
| TOTAL | 5,682 | 100% | 24,223 | 100% |

## 3.2. Screening Review and Recommendations

Once the results of the GIS analyses were produced, a screening review was conducted. This review included using all of the additional information known about the properties, confirming the results of the GIS analyses, and developing recommendations for more detailed evaluations during Task 4 work.

Draft maps summarizing environmental sensitivities in Town and the current condition needs assessment results were reviewed in collaboration with Planning and Zoning Department and Public Works Department staff. Recommendations for site-specific assessments were developed based on the results of the Task 1 stormwater, wastewater, and water supply inventory work, Task 2 resource mapping and phosphorus sampling results to date, and the results of the screening level assessment completed during Task 3. Based on the results of the current condition needs analysis, there is reason to suspect an adverse environmental impact from current land use practices and development. While many “non-conforming” parcels are located in relatively close proximity to the shoreline, there are scattered pockets of “non-conforming” parcels in other areas throughout Colchester. The areas recommended for further more detailed assessment, along with the rationale for choosing each area, are included as Table 7 below. Figure 2 highlights the locations of these priority areas.

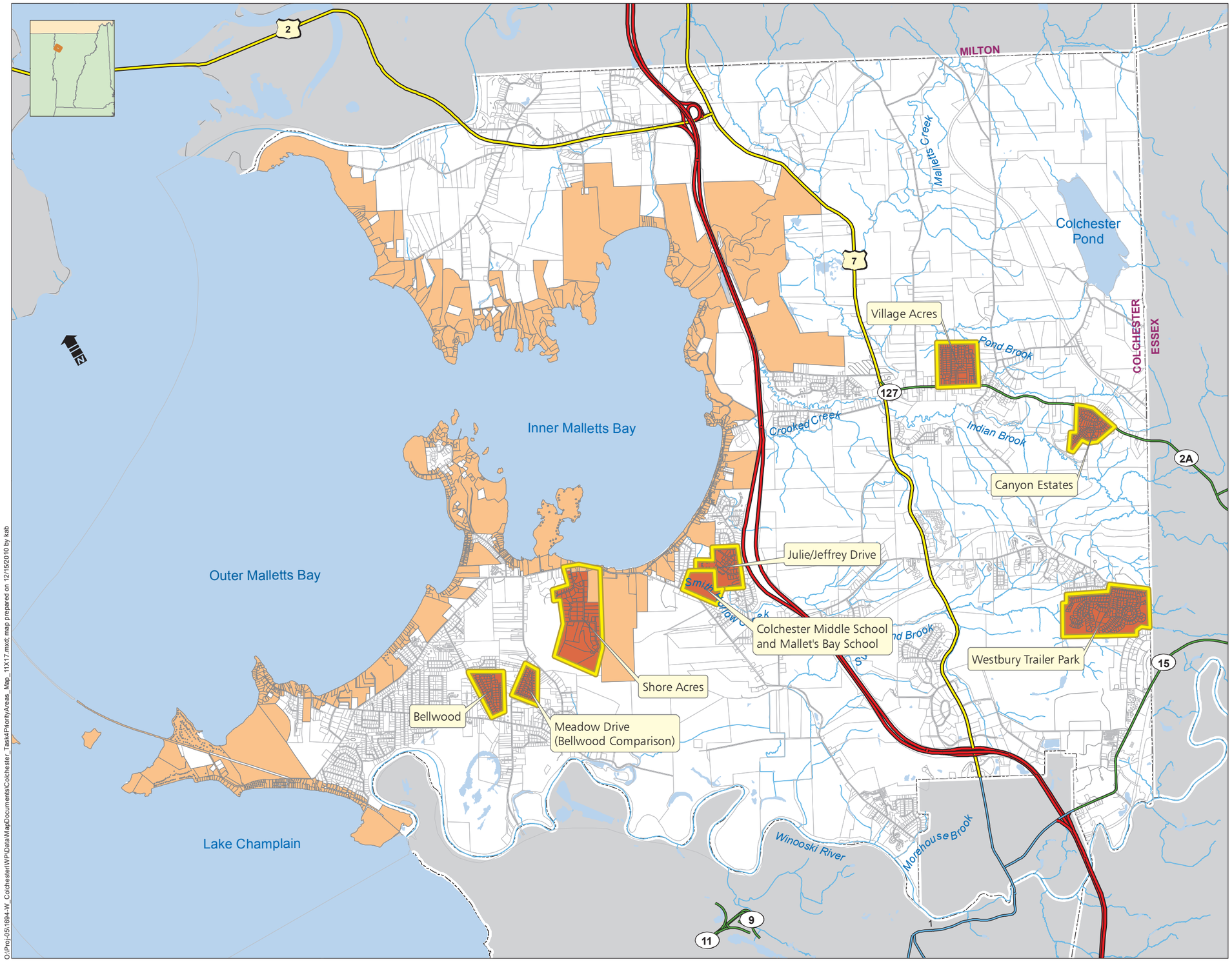
*Table 7. Recommended Priority Areas for Task 4 Site-Specific Assessments.*

| | Rationale by Workplan Task | | |
|---|---|---|---|
| **Area Name** | **Task 1 Infrastructure Inventory** | **Task 2 Water Resource Mapping & Assessment** | **Task 3 Current Condition Wastewater Needs Assessment** |
| Malletts Bay and Lake Champlain Lakeshore | | Phosphorus TMDL on Lake Champlain; long-standing concerns with bacteria levels at swimming beaches | Area-limited, groundwater-limited, and bedrock-limited parcels; severe limitations in some portions of lakeshore |
| Meadow Drive | | History of seasonal high groundwater issues | Most parcels are area-limited; area has not had benefit of subsurface groundwater drainage system |
| Shore Acres | Wastewater permit history suggests challenging conditions | | Majority of parcels have groundwater, available area, or bedrock limitations |
| Julie/Jeffrey Drive | Potential wastewater contribution to storm drain systems noted | | Majority of parcels in the northern portion of neighborhood are area-limited |
| Malletts Bay School, Colchester Middle School | Permit history suggests future expansions may be difficult | | |
| Westbury Trailer Park | Permit history extremely limited | | Scattered area-limited parcels; extremely small lot sizes overall |
| Village Acres | Potential wastewater contribution to storm drain systems noted | Elevated ammonia, E. coli, phosphorus in Pond Brook near this neighborhood | Most of northern portion of neighborhood is area or groundwater limited |
| Canyon Estates | | | Majority of parcels are area limited |

# Figure 2.
# Priority Areas for Site-Specific Assessments

Integrated Water Resources Management Program

Town of Colchester, Vermont




Other Task 4 Priority Areas

Parcels Within 300 ft of Lake Champlain

Parcels Within Other Task 4 Priority Areas

Colchester Parcels (2009)

Sources: VCGI: Streams, Roads; CCRPC: Parcel Boundaries; Stone Environmental and Forcier Aldrich & Associates: Task 4 Priority Areas

0 0.5 1 Miles

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O:\Proj-05\1694-W_Colchester\WP\Data\MapDocuments\Colchester_Task4PriorityAreas_Map_11X17.mxd; map prepared on 12/15/2010 by kab

# 4. TOWN-WIDE NEEDS ASSESSMENT AT BUILD-OUT

Following the premise described above and the task-specific protocol (Appendix A), an additional town-wide needs assessment for decentralized wastewater systems was understand the impacts and potential limitations of current zoning regulations as they relate to future development that utilizes onsite, soil-based wastewater treatment capacity. The assessment resulted in an identification of which parcels have adequate capacity to support both current and projected future growth based on both the current Vermont Wastewater System and Potable Water Supply Rules, and on estimated growth based on a build-out analysis.

A build-out analysis uses a municipality's current zoning regulations, along with existing infrastructure and environmental conditions, to assess the maximum extent of development possible. In 2006, the Chittenden County Regional Planning Commission (CCRPC) conducted a build-out analysis for the Town of Colchester using CommunityViz software. In 2009, the CCRPC updated the build out analysis by modifying density inputs for the Growth Center in the Town of Colchester. In 2010, another update to the analysis was completed by restricting development on conserved lands. The results of the build-out analysis report the number of additional dwelling units and commercial/industrial square footage within the Town that may be constructed in the future, mapped as point locations.

The build-out analysis enforces restrictions on the placement of new development. Some of these restrictions overlap with the area restrictions used in the onsite wastewater needs assessment for current conditions (Section 3). The following land is removed from the buildable area in the CCRPC build-out analysis:

- groundwater source protection areas,
- wetlands plus a 50 foot buffer,
- lakes and ponds plus a 100 foot buffer,
- streams plus an 85 foot buffer,
- soils rated as not suited for onsite systems by Natural Resources Conservation Service (NRCS), and
- prime agricultural soils.

While these constraints exclude much of the same land as does the needs assessment, there are some exclusions and one notable difference. The Vermont Significant Wetlands Inventory (VSWI) was updated in the summer of 2010 and was used in the current condition and build-out needs assessment; however, the 2010 wetlands data were not available during the initial development of CCRPC's build-out analysis. The 2010 VSWI layer contains an additional 800 acres of designated wetland within the Town of Colchester, decreasing the potential land area available within both the current condition and build-out condition needs assessments.

The 2010 build-out analysis from CCRPC was used to conduct a build-out condition needs assessment. This assessment incorporated a GIS analysis phase and a database analysis phase. The GIS analysis phase incorporated results from the current condition needs assessment (see Section 3) and the 2010 CCRPC build-out analysis, resulting in a revised "area available" for onsite wastewater dispersal. This area was further modified in the database analysis phase, based on the number of new buildings from the build-out analysis and associated assumptions regarding commercial and residential building footprint size and setbacks to accommodate private wells and/or property lines required for the new development. The "required area" for construction of an onsite system in the build-out condition assessment was determined based on the soil properties of the parcel and estimated design flow for each potential onsite system. For detailed description of the build-out analysis methodology, please refer to Appendix B.

The build-out condition needs assessment also assumes that centralized sewer service will not be extended to any new areas within the municipal sewer service areas in the future. Thus, the number of unsewered, assessed parcels is the same for both the current and build-out analyses.

## 4.1. Build-Out Condition Needs Assessment Results

The results of the analysis of parcels with potential onsite wastewater treatment limitations at the build-out condition in Town are represented on Plate 7 and summarized in Table 8. Of the 5,682 parcels that were assessed, there were 3,311 developed parcels that appear to be able to support conventional onsite wastewater treatment systems and may support a portion of proposed CCRPC build-out development under current conditions and regulations, within the assumptions and considerations described above.

There are 1,828 parcels that are currently developed and do not appear to be able to support a conventional onsite wastewater dispersal system that fully complies with current regulations and environmental conditions and, therefore, are potentially non-conforming. These parcels are also categorized as non-conforming for the current condition needs assessment in Table 5 and described in section 3.1.

Of the 502 parcels that were undeveloped at current condition, 186 have additional development potential based on the CCRPC build-out analysis and may be suitable for some amount of future development that is served by onsite wastewater treatment systems and are included in the developed, conforming category. Of these 186 parcels, there are 110 parcels that may support a portion of the CCRPC build-out projected development, but not all of the development would be accommodated by soils on that property at build-out. These parcels are shown as "Conforming" at build-out, in accord with the Town's policy of disallowing non-conforming development, though the full build-out density would not actually be constructed. These 110 parcels are categorized as 'Limited' in Tables 9 through 11 to summarize and illustrate their characteristics including number of additional buildings, dwelling units, and commercial square footage at build-out and zoning class.

The remaining 316 undeveloped parcels either do not have sufficient suitable soil area to support development and have no additional development according to the CCRPC build-out analysis, or are restricted from development in some other way (roads and rights-of-way, conserved lands, prime agricultural soils, etc.).

Finally, 227 parcels are currently served by a centralized sewer system; these parcels were not assessed for potential on-site wastewater treatment capacity or compliance with on-site wastewater treatment related regulations.

*Table 8. Summary of Build-Out Condition Needs Assessment Results, Conventional Dispersal.*

| Build-Out Condition–Filtrate Option Status | Total Parcels | Percent of Parcels | Total Acres | Percent of Acres |
|---|---|---|---|---|
| Developed, Conforming | 3,311 | 58% | 15,090 | 62% |
| Developed, Not Conforming | 1,828 | 32% | 1,579 | 7% |
| Undeveloped, Not Suitable for Conventional Onsite System | 316 | 6% | 5,880 | 24% |
| Sewered with Municipal Service | 227 | 4% | 1,674 | 7% |
| TOTAL | 5,682 | 100% | 24,223 | 100% |

Plate 8 and Table 9 summarize the build-out condition needs assessment results given the reduced land area required to site a filtrate dispersal system. The results of the filtrate system assessment were generally similar to those of the available area assessment for conventional systems (Plate 7). A total of 258 parcels were identified that did not meet environmental setbacks for a conventional system, but that did meet those same setback restrictions if a filtrate system were sited instead.

*Table 9 Summary of Build-Out Condition Needs Assessment Results, Filtrate Dispersal.*

| Build-Out Condition–Filtrate Option Status | Total Parcels | Percent of Parcels | Total Acres | Percent of Acres |
|---|---|---|---|---|
| Developed, Conforming | 3,569 | 63% | 15,319 | 63% |
| Developed, Not Conforming | 1,570 | 27% | 1,350 | 6% |
| Undeveloped, Not Suitable for Conventional Onsite System | 316 | 6% | 5,880 | 24% |
| Sewered with Municipal Service | 227 | 4% | 1,674 | 7% |
| TOTAL | 5,682 | 100% | 24,223 | 100% |

Table 10 summarizes the number of additional buildings at build-out as a result of the CCRPC build-out analysis. Of the 5,455 parcels assessed, 377 were marked by CCRPC as having capacity for additional

development at build-out. The majority of parcels with additional buildings at build-out (4.2% of assessed parcels) had only one additional building. A small percentage of parcels had greater than 11 new buildings (0.5% of assessed parcels).

Of the parcels assessed, 3,201 can fully support the proposed development at build-out condition and associated onsite wastewater treatment systems under current regulations and within the assumptions and considerations described above. As summarized in Table 10, the majority of parcels assessed had no additional development. The 1,778 parcels that are area restricted and that have zero additional buildings at build-out are also area restricted at the current condition.

*Table 10. Summary of New Buildings per Parcel at Build-Out Condition*

| Number of Additional Buildings at Build-Out | Number of Parcels | Percent of Parcels | Number of Non Limited Parcels at Build-Out | Number of Limited Parcels at Build-Out | Percent of Limited Parcels within Class |
|---|---|---|---|---|---|
| 0 | 4,762 | 83.8% | 2,984 | 1,778 | 37.3% |
| 1 | 231 | 4.1% | 121 | 110 | 47.6% |
| 2 | 16 | 0.3% | 8 | 8 | 50.0% |
| 3 to 5 | 70 | 1.2% | 43 | 27 | 38.6% |
| 6 to 11 | 31 | 0.5% | 23 | 8 | 25.8% |
| 12 to 327 | 29 | 0.5% | 22 | 7 | 24.1% |
| Undeveloped | 316 | 5.6% | - | - | - |
| Sewered | 227 | 4.0% | - | - | - |
| TOTAL | 5,682 | 100% | 3,201 | 1,938 | |

Table 11 further characterizes the parcels that have additional development potential at build-out. The CCRPC build-out analysis results in a total of 1,623 additional dwelling units, 1,785 additional total buildings, and 5,159,428 square feet of commercial and industrial space within the assessed area. Of the additional new dwelling units, 613 (38% of additional dwelling units in assessed parcels) are within parcels that can support an onsite system at build-out. Of all additional buildings, 681 (38% of additional dwelling units in assessed parcels) are within parcels that can support an onsite system. Of the additional potential commercial and industrial square footage, 3,523,582 square feet are within parcels that can support an onsite system.

A large portion of additional dwelling units (56%), buildings (51%), and commercial/industrial square footages (31%), that are on limited parcels at build-out fall within the Sewer Service Area. While these parcels are currently not sewered with municipal service, it may be that if these properties are developed in the future, that municipal sewer service will be extended to the new development. Thus, it may be

reasonable to assume that these properties could developed to the full capacity proposed by the CCRPC build-out analysis.

*Table 11. Summary of Build-Out Condition Needs Assessment Results*

| Limitation | Total Parcels with Additional Development at Build-Out | Number of Additional Dwelling Units | Number of Additional Dwelling Units: Sewer Service Area | Number of Additional Buildings | Number of Additional Buildings: Sewer Service Area | Total Additional Commercial/ Industrial Square Footage | Total Additional Commercial/ Industrial Square Footage: Sewer Service Area |
|---|---|---|---|---|---|---|---|
| No Environmental Limitations | 217 | 613 | 60 (10%) | 681 | 59 (9%) | 3,523,582 | 934,489 (27%) |
| Limitations at Current Condition and Build-Out | 50 | 61 | 8 (13%) | 77 | 8 (1%) | 102,142 | 28,988 (28%) |
| Limitations at Build-Out Only | 110 | 949 | 834 (88%) | 1,027 | 842 (82%) | 1,546,573 | 653,710 (42%) |
| Sewered (Not Assessed) | 51 | 585 | - | 701 | - | 3,513,576 | - |
| **TOTAL ASSESSED** | **377** | **1,623** | **902 (56%)** | **1,785** | **909 (51%)** | **5,172,297** | **1,617,188 (31%)** |
| **TOTAL** | **428** | **2,370** | **-** | **2,324** | **-** | **8,685,873** | **-** |

Table 12 summarizes the number of additional buildings at build-out for parcel-based limitation results by zoning class. The majority of the buildings with limitations at build-out fell into the General Development Three zoning class. All of the parcels with projected development within this class are located within the Sewer Service Area and if developed, will potentially be sewered with municipal service. Similarly, 100 percent, 86 percent, and 81 percent of the limited parcels at build-out only in the General Development Two, Industrial, and Residential Three zoning classes respectively are within Sewer Service Areas.

The Commercial zoning class was the only grouping where more buildings were on limited parcels than on non-limited parcels outside of the Sewer Service Area. The majority of the buildings (39) that are classified as commercial and within a limited parcel are tied to a single parcel where the new Vermont Significant Wetland Inventory dataset resulted in significantly more wetland coverage between the time the build-out analysis was completed and the onsite wastewater needs assessment implementation.

There were also a large number of buildings (42) within the General Development One zoning class that were in limited parcels. A significant number of these buildings (39) and associated parcels are within a planned development on Marble Island. This development has been constructed with shared onsite systems with any new development utilizing one of the existing shared systems rather than constructing parcel by parcel onsite systems. While the current condition needs assessment took shared systems into

consideration, there was no way to systematically assign design flows to shared systems at build-out and therefore these types of systems were not taken into consideration at the town-wide level.

*Table 12. Number of buildings by zoning type and parcel based needs assessment result.*

| Zoning Class | No Limitations | Limitations at Build-Out Only | Limitations at Build-Out Only – Sewer Service Area | Limitations at Current Condition and Build-Out |
|---|---|---|---|---|
| Agriculture | 27 | 5 | | 0 |
| Commercial | 24 | 48 | 1 (2%) | 7 |
| General Development One | 133 | 42 | | 13 |
| General Development Two | 29 | 8 | 8 (100%) | 0 |
| General Development Three | 6 | 791 | 791 (100%) | 2 |
| General Development Four | 13 | 1 | | 2 |
| Industrial | 62 | 7 | 6 (86%) | 2 |
| Mobile Home Park | 10 | 0 | | 0 |
| Residential One | 278 | 55 | | 38 |
| Residential Two | 49 | 21 | | 3 |
| Residential Three | 37 | 44 | 36 (81%) | 4 |
| Residential Five | 9 | 4 | | 4 |
| Residential Ten | 4 | 1 | | 2 |
| **TOTAL** | **681** | **1,027** | **842 (82%)** | **77** |

A large number of limited parcels and associated buildings fell within the Residential One and Residential Two zoning classes. Many of the limited parcels within these zoning classes closely followed the patterns of the needs assessment at current condition, falling within the priority areas described above in Section 3.2, such as Shore Acres, Meadow Drive, Village Acres, and Canyon Estates. Several parcels not following the trend of the current condition assessment lie east of Mill Pond Road and along the south side of Route 2A. This area is dominated by steep slopes (>30%), where replacement wastewater treatment systems may not be sited without site modification if feasible, even if soils are otherwise suitable. There is a significant amount of new Residential One development in northwest Colchester, off of Clay Point Road, that is also limited primarily by steep slopes.

## 4.2. Build-Out Condition Projection

A *Recreation Facility Impact Fee Analysis* was conducted in 2010 (Munson) that included a projected population growth in the Town of Colchester based on recent trends. Table 13 provides a yearly population and dwelling unit projection over thirty years based on the 2010 analysis.

The build-out analysis, which was based on current zoning regulations and environmental conditions, resulted in an estimated 2,370 new dwelling units at full build-out for the entire town. Based on this estimate and the Munson projections, full build-out would fall somewhere between 2037 and 2038.

The needs assessment results at build-out indicate that full build-out is limited by onsite wastewater system needs for some parcels. To understand the implications of these limitations, the additional dwelling units associated with parcels identified as restricted through the needs assessment were removed from the total of 2,370. There were a total of 1,010 dwelling units on limited parcels, 842 of which are within the Sewer Service Area. The needs assessment *adjusted* build-out results in 1,360 additional dwelling units for the entire town. This adjustment reduces the year of full build-out to as soon as 2023. If development on parcels within the Sewer Service Area is sewered with municipal service at the time of development, the needs assessment *adjusted* build-out results in 2,202 additional dwelling units. This adjustment results in a year of full build-out to as soon as 2035. The adjusted build-out years should be considered a worst case scenario, since some of the development on limited parcels may be possible, resulting in an actual build-out year somewhere between the adjusted and unadjusted build-out years.

*Table 13. Town of Colchester Build-Out 30 Year Projection*

| Year | Population Projection | Dwelling Unit Projection | Total Change in Housing Units |
|---|---|---|---|
| 2009 | 17,328 | 6,931 | 0 |
| 2010 | 17,623 | 7,049 | 118 |
| 2011 | 17,919 | 7,167 | 236 |
| 2012 | 18,214 | 7,286 | 355 |
| 2013 | 18,509 | 7,404 | 473 |
| 2014 | 18,805 | 7,522 | 591 |
| 2015 | 19,100 | 7,640 | 709 |
| 2016 | 19,286 | 7,714 | 783 |
| 2017 | 19,472 | 7,789 | 858 |
| 2018 | 19,658 | 7,863 | 932 |
| 2019 | 19,844 | 7,938 | 1,007 |
| 2020 | 20,030 | 8,012 | 1,081 |
| 2021 | 20,216 | 8,086 | 1,155 |
| 2022 | 20,402 | 8,161 | 1,230 |
| 2023 | 20,588 | 8,235 | 1,304 |
| **Adjusted Build-Out Additional DUs: Assumption – All new development in Sewer Service Area is NOT sewered** | | | **1,360** |
| 2024 | 20,774 | 8,310 | 1,379 |
| 2025 | 20,960 | 8,384 | 1,453 |
| 2026 | 21,146 | 8,458 | 1,527 |
| 2027 | 21,332 | 8,533 | 1,602 |
| 2028 | 21,518 | 8,607 | 1,676 |
| 2029 | 21,704 | 8,682 | 1,751 |
| 2030 | 21,890 | 8,756 | 1,825 |
| 2031 | 22,076 | 8,831 | 1,900 |
| 2032 | 22,262 | 8,905 | 1,974 |
| 2033 | 22,448 | 8,980 | 2,049 |
| 2034 | 22,634 | 9,054 | 2,123 |
| 2035 | 22,820 | 9,129 | 2,198 |
| **Adjusted Build-Out Additional DUs: Assumption – All new development in Sewer Service Area is sewered** | | | **2,202** |
| 2036 | 23,006 | 9,203 | 2,272 |
| 2037 | 23,192 | 9,278 | 2,347 |
| **Build-Out Additional DUs** | | | **2,370** |
| 2038 | 23,378 | 9,352 | 2,421 |

# 5. ONSITE SYSTEM LONGEVITY ANALYSIS

An analysis of onsite wastewater treatment system component longevity was completed in two steps: an initial screening analysis, followed by extraction of system and soil characteristics from electronic permit documents and completion of a targeted assessment of system and component replacements.

This task was described as failure analysis in the U.S. EPA demonstration grant application and in the task-specific protocol (Appendix A). However, the permitting data that were reviewed regarding system replacements do not generally document why components or systems were replaced. Replacement could potentially be due to incorrect soil and site evaluation, inadequate design, problematic construction practices, improper operation, lack of maintenance, hydraulic or wastewater strength overloading, or simply old age—but the specific mechanism of system or component failure that necessitated replacement was not recorded. This should not be construed as a shortcoming in the Town's permitting or review processes, as such information is only very rarely documented within permitting processes at the municipal or state levels. Given the information that was available from permit records, and thus, the types of analyses we were able to perform, this process is more reasonably described as an analysis of onsite wastewater system and component longevity, rather than of system or component failure.

## 5.1. Screening Analysis

Information needed to complete the screening analysis, including account number, permit type or reason, and permit or system construction date, was compiled from the wastewater permit inventory database to create a combined construction and permitting database for all single-family residential parcels in the Town of Colchester. The database was used to construct a summary of mean time between permits for each account, in years.

Figure 3 shows the mean time between wastewater permits, in years, for the 1,090 parcels where sufficient permit inventory information existed for us to complete the calculation. Roughly equivalent numbers of parcels were grouped into the relatively low classes of time between permits (15 years or less), while smaller numbers of parcels were grouped into time-between-permits classes of 15 years or more (Table 12).

*Table 12. Summary of mean time between permits by parcel.*

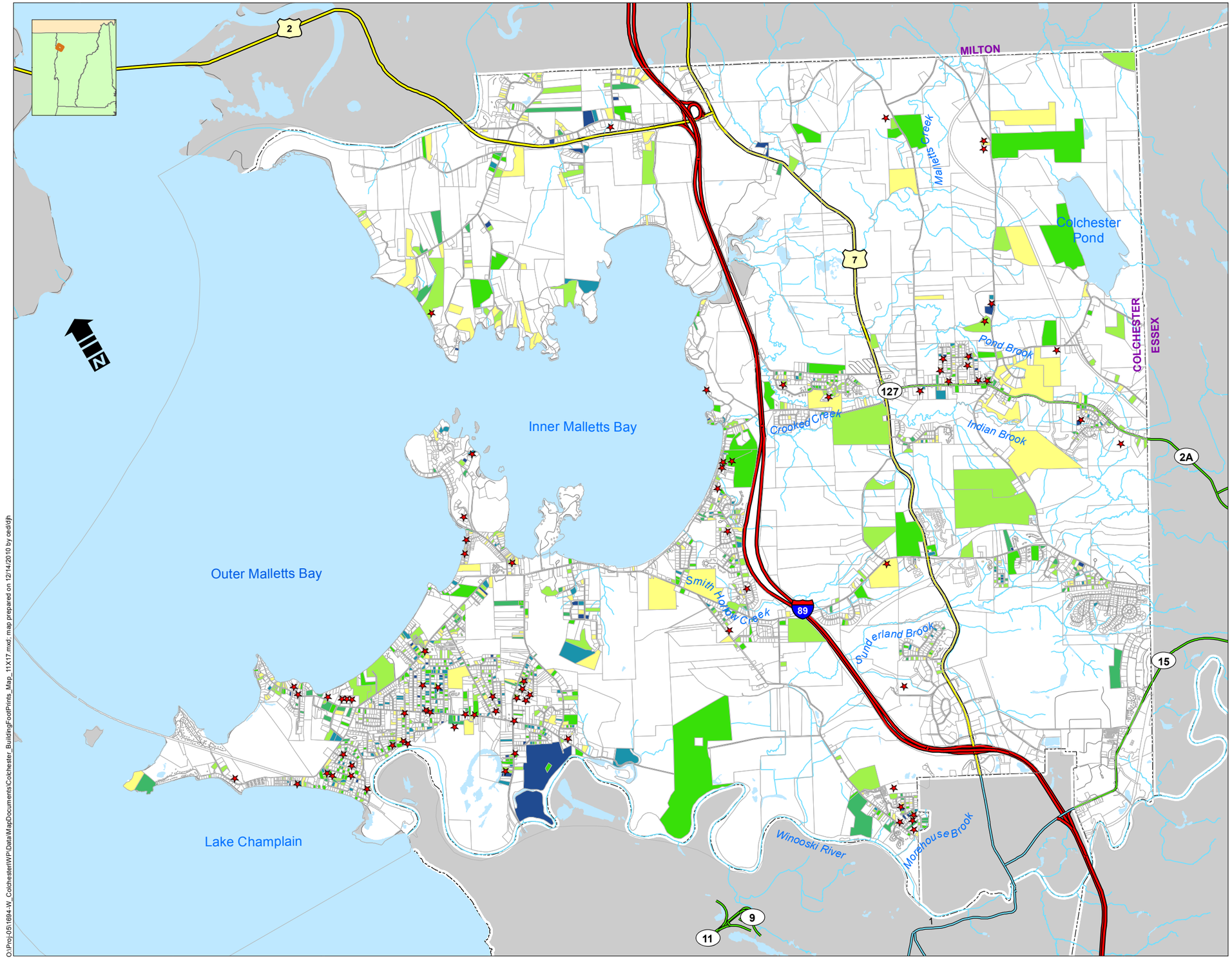
| Mean Time Between Permits | Total Parcels |
|---|---|
| 0 – 5 years | 260 |
| 5 – 10 years | 272 |
| 10 – 15 years | 262 |
| 15 – 20 years | 113 |
| 20 – 30 years | 138 |
| More than 30 years | 45 |
| No mean time between permits calculated | 4,592 |
| TOTAL | 5,682 |

Often, upon investigation of the permit history for parcels with the lowest mean times between permits (five years or less), these low mean times do not correspond to frequent malfunctions. Rather, these usually represent component adjustments, or changes to buildings that require changes to the system being installed. Parcels with mean times between permits of more than five years were more likely to have a permitting history that included at least one major component replacement.

There does not appear to be any clustering of permit mean time classes in any geographic area of town that might represent particular issues related to development density, age range of development, or soil characteristics (Figure 3).

Figure 3 also shows, for illustrative purposes, the documentation of onsite system malfunctions which was first presented in Forcier Aldrich & Associates' 1997 Town-Wide Wastewater Facility Plan Update, completed for the Town of Colchester. Differences in methodology between the 1997 failure assessment and the calculation of mean times between permits shown on this figure produce a result that not all parcels identified in the 1997 assessment as containing a historic malfunction also contain a value for mean times between permits. This is because the 1997 assessment evaluated only permits that were specifically for component replacement—and in some cases, the repair or replacement permit is the only record on file in the database for a parcel. If only one record was on file, a mean time between permits could not be calculated.

In light of this, in permit review and preparation for the detailed analysis, care was taken to select a subset of parcels that were also included in the 1997 assessment. Given that the geographic distribution of mean times between permits (Figure 3) did not show significant clustering, we also chose to focus effort on parcels were components were actually replaced, rather than focusing on a particular subdivision, age of system or residence, or soil texture.




# Figure 3.
# Average Time Between Wastewater Permits

Integrated Water Resources Management Program

Town of Colchester, Vermont

**1997 Failure Assessment Results**

★ Approx. Failure Location

**Average Years Between Permits**

- 0 to 5 years (260)
- 5 to 10 years (272)
- 10 to 15 years (262)
- 15 to 20 years (113)
- 20 to 30 years (138)
- 30+ years (45)
- No average calculated (5331)
- Colchester Parcels (2009)

Sources: VCGI: Streams, Roads; CCRPC: Parcel Boundaries; Town of Colchester: Permit Records; Stone Environmental: Time Between Permits Calculations; Forcier Aldrich & Associates: Failure Locations from 1997 Town-Wide Wastewater Facility Plan Update.

0 0.5 1 Miles

Time between permits was calculated in October 2010, based on permit history as of April, 2009. If no permit for new construction of an OWTS was available in the wastewater permits database, the construction year from the Assessor's database was used instead as the first historical record. Instances where time between permits less than seven days (for instance, a state and Town permit were issued on the same date) are excluded from the calculation.

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There were 1,090 parcels for which we were able to calculate mean time between permits. Our goal was to obtain more detailed information on at least 10% (or at least 110, we reviewed 130) of the parcels and systems for which a mean time between permits could be calculated.

## 5.2. Targeted Assessment and Longevity Calculations

A total of 472 permits (and linked scanned documents, where available) were reviewed on a total of 130 residential parcels. The permit histories for eight of the targeted parcels turned out, upon detailed review, to not include enough information in the wastewater permit inventory for determination of the reason for permit issuance—and thus, no reasonable estimation of time to replacement for any given component for the parcel's onsite wastewater system could be determined. Consequently, a total of 122 parcels were included in the detailed analysis. A significant subset of these 122 parcels contained multiple permitting events—for instance, one system might be installed, then be permitted for a leachfield replacement, and later permitted for a septic tank replacement. A total of 191 component relocations, expansions, repairs, or replacements were recorded for the 122 parcels. Table 13 summarizes the permits reviewed by reason for permit issuance, not including permits logged in the wastewater inventory database for which no issuing reason could be defined.

*Table 13. Summary of Permits Reviewed by Reason for Issuance.*

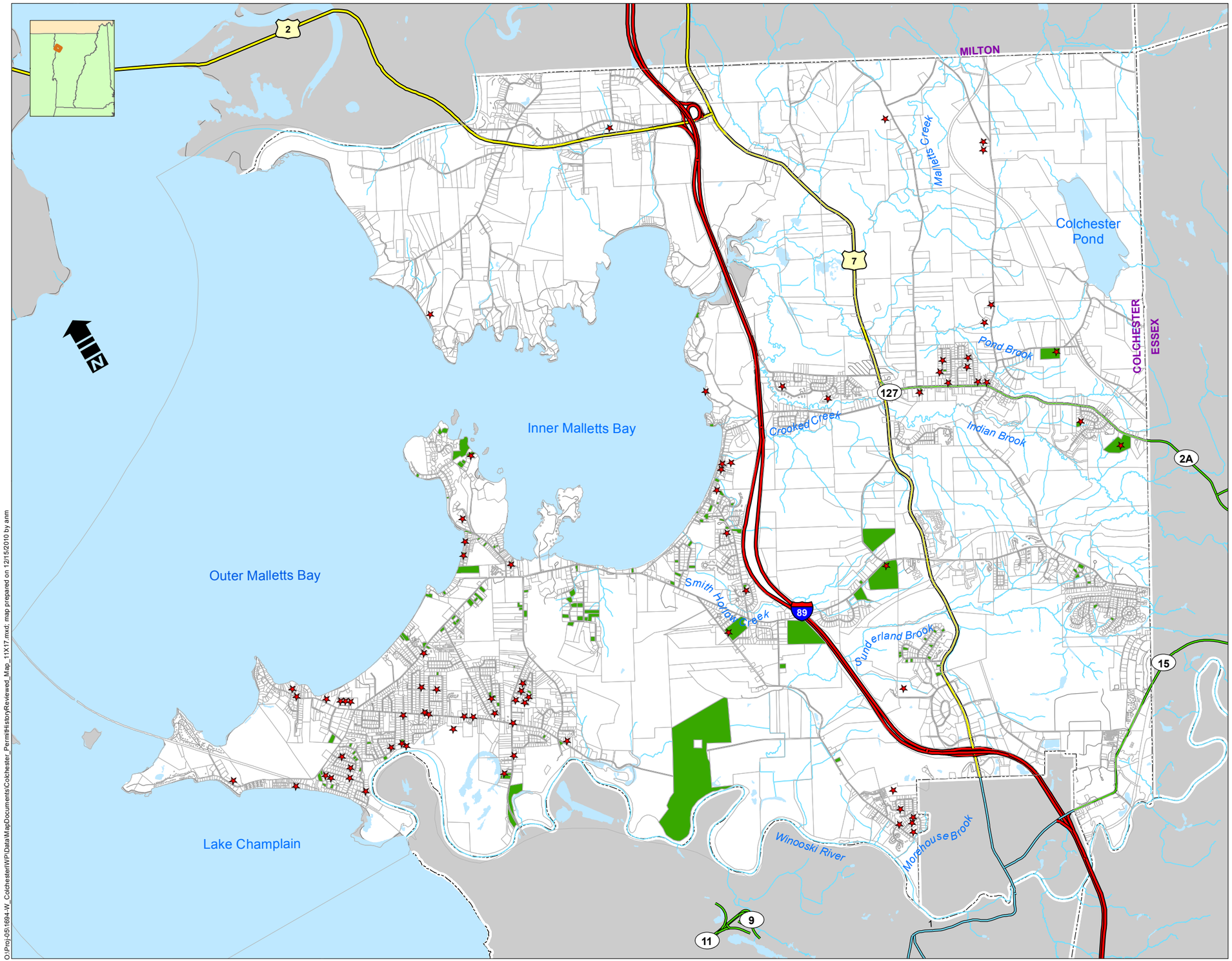
| Reason for Permit Issuance | Total Permits Reviewed |
|---|---|
| new construction or year built | 122 |
| component or system relocation | 1 |
| connect to centralized system | 3 |
| leachfield expansion | 12 |
| upgrade for seasonal conversion | 3 |
| drywell replacement (with like) | 2 |
| drywell upgrade | 5 |
| minor repair | 8 |
| tank replacement | 27 |
| leachfield replacement | 79 |
| whole system replacement | 51 |

The locations of the parcels containing onsite wastewater treatment systems that were included in detailed analysis are shown on Figure 4. The locations chosen ultimately represented a balance between richness of available permit documentation (e.g., whether upon cursory review, enough details were available for meaningful assessment), prior work by FA&A as part of the Town's 1997 Wastewater Master Plan (as

# Figure 4.
# Permit History Reviews Completed

Integrated Water Resources Management Program

Town of Colchester, Vermont




Colchester Parcels (2009)

Permit history reviewed

**1997 Failure Assessment Results**

Approx. Failure Location

Sources: VCGI: Streams, Roads; CCRPC: Parcel Boundaries; Town of Colchester: Permit Records; Stone Environmental: Permit History Review; Forcier Aldrich & Associates: Failure Locations from 1997 Town-Wide Wastewater Facility Plan Update.

0 0.5 1 Miles

Permit reviews were based on the Task 1 wastewater permits inventory and history as of April, 2009. If supplemental information was available from older DEC permits which have come on-line since the completion of the wastwater permit inventory database, that information was included in the permit review.

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shown by the starred map locations in Figures 3 and 4), and delineation of areas of interest from the inventory and needs assessment work (see Section 3.2).

Compared to the number of systems that are installed in the Town of Colchester, the sample size we were able to obtain detailed information on is not sufficient to compute actual failure rates in the classical sense of [Failure Rate = # failures / # systems installed]. However, a meaningful assessment of time to component replacement or system replacement (system longevity) can be reasonably completed using this dataset and will be useful in consideration of decentralized infrastructure management strategies.

### 5.2.1. Definition of system age-related cohorts

As might be expected, OWTS with a permitting history sufficient to calculate times to component replacement were generally more than 15 years old. No systems included in the analysis were newly constructed since the inclusion of sand filters in the state's wastewater system rules in 1994, and most systems (100 of the 122 included in the analysis) were originally constructed before the advent of scientifically-based, state-wide onsite wastewater system regulations in 1982. Figure 5 illustrates the overall age distribution of the systems included in the analysis by plotting the installation year versus the number of systems included in the analysis which were installed in that year.

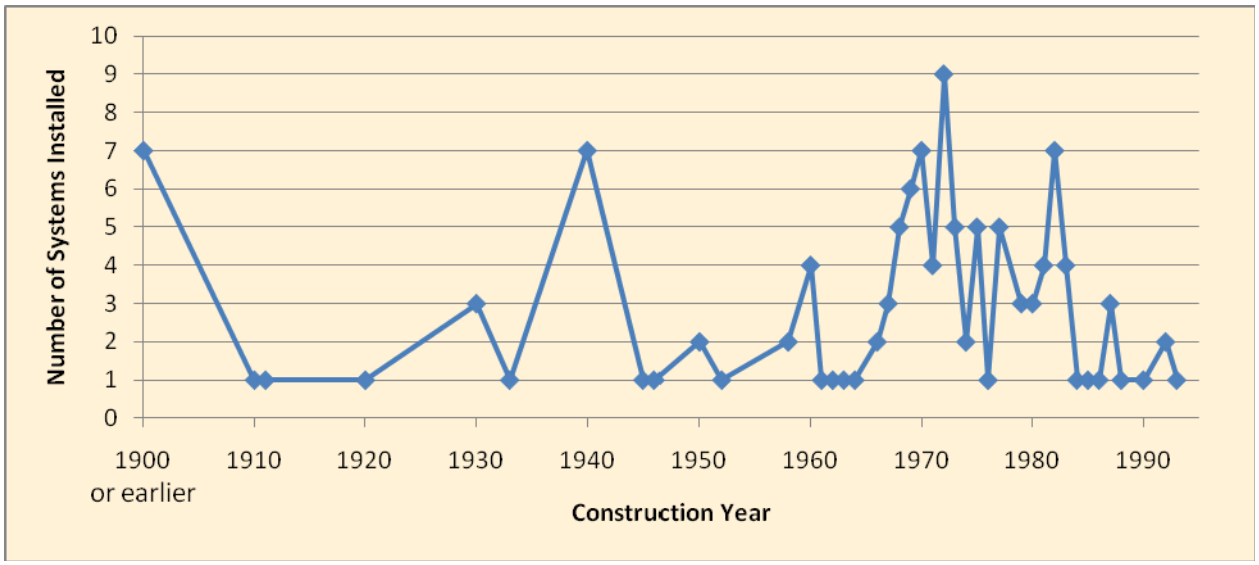


*Figure 5. Overall age distribution of residential onsite wastewater systems included in detailed review.*

### 5.2.2. Age cohorts and system component longevity

For the pre-1981 age cohort, a box and whiskers plot was created showing the distribution of times to OWTS component replacement for septic tanks, leachfields, and whole systems, respectively (Figure 6). This plot clearly shows that septic tanks for systems included in the detailed assessment have better

longevity than soil-based dispersal components. The median age at which dispersal components needed to be replaced is 17 years, while the median replacement age for septic tanks is about 31 years (Figure 6 and Table 14). The median age at which a whole system (septic tank and dispersal component) needed to be replaced is similar to that for septic tanks (also about 31 years).

Where the type of original dispersal component could be determined, the replaced component was almost always a drywell or an adsorption bed. Since these components were historically those that were most commonly installed in Town through the 1980s, it is no surprise that they should also be those that were most commonly found to malfunction. Adsorption beds, trenches, gravelless technologies, and mounds were all used as replacement components. The most common situation was that adsorption beds were replaced with adsorption trenches, but there were also several instances where adsorption trenches or beds were replaced by mounds. There was not a particular geographic pattern to the replacement component types, except that which might naturally be expected given the soils in Town. For instance, adsorption beds and trenches were typically used as replacement components where the Chittenden County Soil Survey indicated soil with sandy or sandy loam texture, and mound systems were typical replacement components where the soil survey indicated silt loam or finer texture.

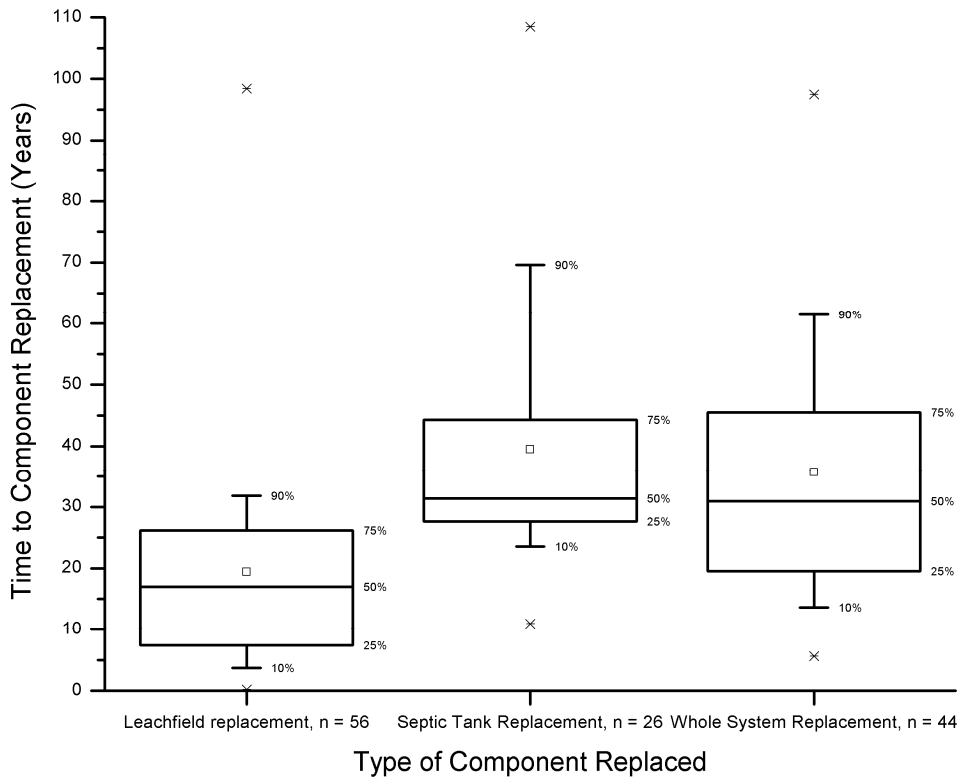


*Figure 6. Box and whiskers plot of times to component replacement for leachfields, septic tanks, and whole systems installed before 1982.*

*Table 14. Statistics for Component Replacements, Onsite Wastewater Systems Installed Before 1982.*

| | Time to Component Replacement (Years) | | |
|---|---|---|---|
| | **Leachfield Replacement** | **Septic Tank Replacement** | **Whole System Replacement** |
| Minimum | 0.2 | 11.0 | 5.6 |
| 10th Percentile | 3.8 | 23.6 | 13.6 |
| 25th Percentile | 7.5 | 27.5 | 19.6 |
| Median (50th Percentile) | 17.0 | 31.4 | 31.1 |
| Average | 19.4 | 39.3 | 35.6 |
| 75th Percentile | 26.3 | 44.2 | 45.6 |
| 90th Percentile | 31.9 | 69.6 | 61.4 |
| Maximum | 98.4 | 108.4 | 97.5 |
| Number of Events (n) | 56 | 26 | 44 |

A histogram of times to component replacement was also plotted, in order to better understand the overall distribution of the component replacements for systems installed before 1982 (Figure 7). For replacement events that only involved a system's dispersal component, the distribution of times to component replacement on pre-1982 systems were predominantly within the earlier age classes (0-30 years).

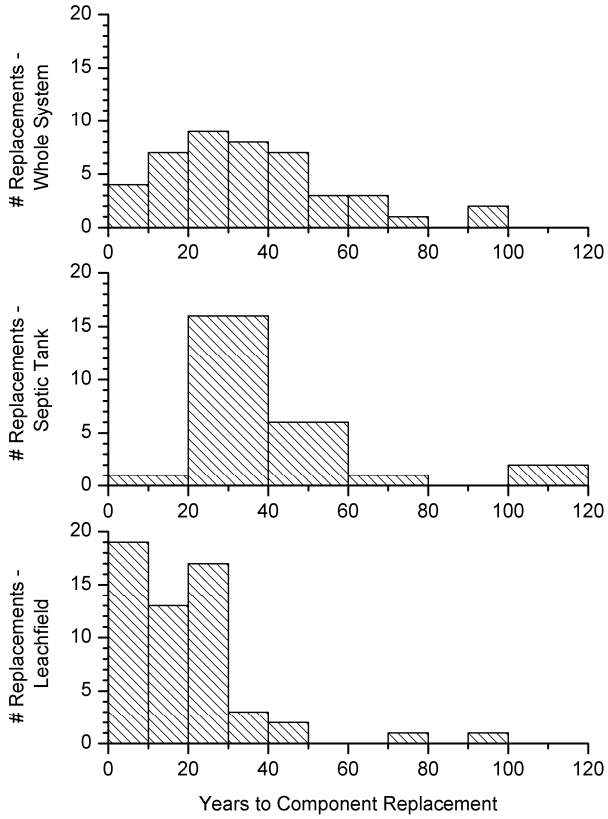


*Figure 7. Histogram of times to component replacement for systems installed before 1982.*

Most of the replacement events that only involved a system's septic tank occurred in the 20-40 year age range. The histogram for replacement events that required the whole onsite wastewater system to be replaced shows a more normal event distribution. For all three types of component replacement, a few outliers raise the average time to replacement as compared to the median time to replacement. These outliers represent older residences (construction date recorded as 1900 or earlier) that have had onsite wastewater systems or components replaced since the advent of modern wastewater permitting and electronic record-keeping in the Town.

For the 1982-1993 age cohort, a box and whiskers plot was created showing the distribution of times to OWTS component replacement for septic tanks, leachfields, and whole systems, respectively (Figure 8). Due to the smaller sample size in this age cohort, a meaningful plot could only be created for leachfield replacements. The numbers of septic tank and whole system replacements were very small (n = 1 for septic tank replacement and n = 3 for whole system replacement)—which is consistent with the longevity of septic tanks observed for the pre-1982 age cohort. The median age at which dispersal components needed to be replaced within the 1982-1993 cohort is 10 years (Figure 8 and Table 15).

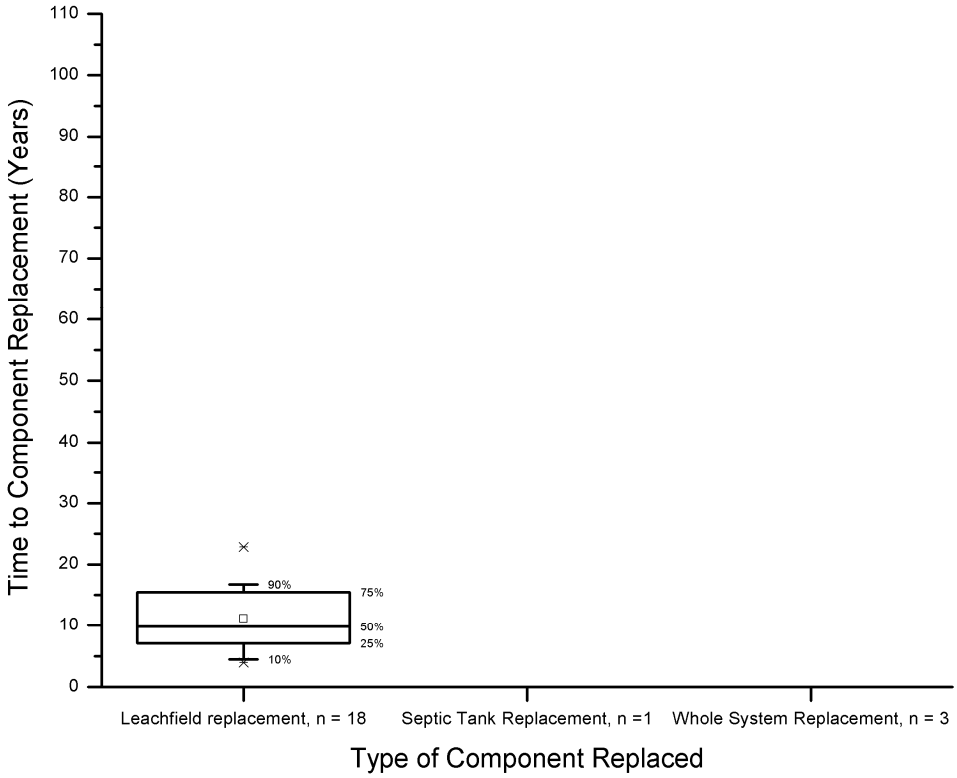


*Figure 8. Box and whiskers plot of times to component replacement for leachfields installed 1982-1993.*

*Table 15. Statistics for Component Replacements, Onsite Wastewater Systems Installed 1982-1993.*

| | Time to Component Replacement (Years) | | |
|---|---|---|---|
| | **Leachfield Replacement** | **Septic Tank Replacement** | **Whole System Replacement** |
| Minimum | 3.9 | n/a | n/a |
| 10th Percentile | 4.5 | n/a | n/a |
| 25th Percentile | 7.0 | n/a | n/a |
| Median (50th Percentile) | 10.0 | n/a | n/a |
| Average | 11.1 | n/a | n/a |
| 75th Percentile | 15.3 | n/a | n/a |
| 90th Percentile | 17.0 | n/a | n/a |
| Maximum | 22.9 | n/a | n/a |
| Number of Events (n) | 18 | 1 | 3 |

For the 1982-1993 age cohort, where the type of original dispersal component could be determined (15 of 18 cases), the replaced component was always an adsorption bed. The apparently malfunctioning adsorption beds were replaced with trenches (10 cases), gravelless technologies (three cases), and adsorption beds or mounds (one case each). As with the pre-1981 age cohort, there was not a particular geographic pattern to the replacement component types, except that which might naturally be expected given the soil conditions on the site.

A histogram of times to component replacement was also plotted, in order to better understand the overal distribution of the component replacements for leachfields installed between 1982 and 1993 (Figure 9). Again, the distribution of times to component replacement fell predominantly within earlier age classes (2-16 years).

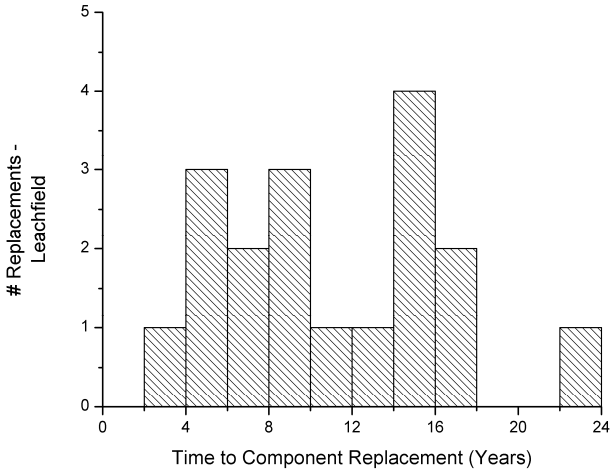


*Figure 9. Histogram of times to component replacement for systems installed 1982-1993.*

## 5.3. Longevity Assessment Findings and Recommendations

More than 70% of Colchester's 4,953 unsewered parcels were developed prior to the state-level adoption of scientifically based rules governing onsite wastewater treatment in 1982. This finding has both positive and negative implications. Many onsite wastewater systems in Town are more than 30 years old and therefore will be likely to need replacement or upgrade in the future. On the positive side, corrections will be implemented based on modern design and siting understandings, and will therefore result in more reliable systems.

The detailed longevity analysis indicates that leach fields appear to be the most vulnerable component of on-site systems, especially for older installations. This finding indicates that, in considering management program options, or in the Town's administration of state regulations for onsite wastewater systems, there may be a need to increase regulatory and administrative oversight (both review and inspection) of these systems to ensure good performance and long term operation. Increasing oversight would also increase the overall costs associated with wastewater system management.

Finally, soils and available area on individual properties are the prime factors in the location and type of suitable new or replacement on-site systems. Some replacements, such as mound systems and advanced treatment systems, are more costly to construct. If repairs are too costly, they may not be completed by property owners, especially if no cost-share or financial assistance program is in place to support upgrades and replacements. Additionally, while improvements in technology have allowed the use of more challenging soil types and smaller wastewater dispersal areas, eventually the availability of suitable soils will become a limiting factor to future growth and development (as discussed in Section 4).

Future assessments of component life and system replacement rates for onsite wastewater infrastructure in Colchester could be completed with efficiency if some key data about reason for permit issuance, system components, and key soil limitations were entered into a permitting database or similar application at time of permit approval. This key information is essentially what was described in the task protocol, and what was gathered from permits by Stone staff in preparation for the detailed analysis.

Periodic evaluations of component life expectancies such as the one completed in this task will improve the existing parcel level inventory of wastewater infrastructure, and will also improve the overall level of awareness regarding that infrastructure. For instance, including the details collected during this task in the wastewater permits inventory will start to build a record of where systems with pumps, blowers, or advanced treatment components, which may require a higher level of maintenance to function properly, are located. This type of information may be helpful as the Town moves forward with beginning to evaluate potential models for implementation strategies for management of decentralized infrastructure.

# APPENDICES

# APPENDIX A: TASK 3 ONSITE WASTEWATER NEEDS ASSESSMENT FINAL PROTOCOL

# Task 3: Needs Assessment for Onsite Wastewater Treatment Systems-Protocol

**INTEGRATED WATER RESOURCES MANAGEMENT PROGRAM**

**TOWN OF COLCHESTER, VERMONT**

**Project ID 05-1694-G**
**April 27, 2010**

This project is funded by a US EPA National Decentralized Wastewater Demonstration Grant #XP-83232201-1

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# 1. GENERAL APPROACH

Stone will utilize the data collected during Tasks 1 and 2, including the parcel level inventories of onsite wastewater treatment systems (OWTS), onsite water supplies, and water resource datasets as applicable, to complete a screening level, town-wide needs assessment. Stone will refine the existing parcel level OWTS permit and document inventory to include factors affecting design flows, such as number of bedrooms for residential properties, in a database importable to GIS.

The information will allow the assessment of the potential for lots to support well-functioning onsite wastewater treatment systems, where existing systems may be in need of upgrading, where an off-site wastewater treatment solution may be needed, where advanced/innovative systems may be required, and where the highest priority areas are for system management.

# 2. NEEDS ASSESSMENT PROCESSES AND METHODS

## 2.1. Data Compilation

The first step of a planning level needs assessment is to compile the various datasets that are needed to complete the analysis. Most of these datasets were acquired during Tasks 1 and 2, and will require little, if any, additional manipulation for use in the onsite wastewater needs assessment. The necessary and optional/secondary datasets are listed below, along with any additional work needed to prepare the datasets for use in the needs assessment.

*Table 1: List of Datasets for Needs Assessment*

| Dataset | Source | Additional Work Needed? |
|---|---|---|
| Administrative | | |
| Town boundary | VCGI | |
| Planning | | |
| Neighborhoods | Town | |
| Colchester build-out 2006 | CCRPC | |
| Colchester build-out 2009 | CCRPC | ★ (2.1.1) |
| Colchester zoning 2009 | Town | |
| Colchester zoning 2010 | Town | |
| Built Environment | | |
| Building footprints | Stone/UVM | |
| Land use | Stone/UVM | |

| Dataset | Source | Additional Work Needed? |
|---|---|---|
| Onsite sewage disposal ratings | Stone | ★ (2.1.2) |
| Outfalls (2009) | Stone | |
| Private water supply points | Stone | |
| Zone I Wellhead Protection Areas | ANR | |
| Retention ponds (2009) | Stone | |
| Stormlines (2009) | Stone | |
| Stormwater structures (2009) | Stone | |
| Structures (E911 sites) | VCGI | |
| Assessors Data | Colchester | ★ (2.1.3) |
| Parking lot | CCRPC | |
| Wastewater Permits | Colchester/DEC | |
| Wastewater Design Flows | DEC/Town/Stone | ★ (2.1.3) |
| Conserved Lands | | |
| Private conserved lands | VCGI | |
| Public conserved lands | VCGI | |
| Sensitive Areas | | |
| Rare/Thrtnd/Endangered species | VCGI/ANR | |
| Areas of high biological diversity | VCGI/ANR | |
| Deer wintering areas | VCGI/ANR | |
| Endangered species type | VCGI/ANR | |
| Physical | | |
| Hydric Soils | VCGI | |
| Soils | VCGI/NRCS | |
| Bedrock geology | VCGI/ANR | |
| Bedrock geology 1961 | ANR | |
| Ecological Land Type | VCGI/NRCS | |
| Nitrate leaching index | VCGI/NRCS | |
| Prime agricultural soil | VCGI/NRCS | |
| Rocklines | VCGI/ANR | |
| Surficial geology | VCGI/ANR | |
| Utility | | |
| Sewer service areas | CCRPC | |
| Water district service area | CCRPC | |
| Municipal water transmission mains | Forcier Aldrich & Assoc. | ★ (2.1.4) |

| Dataset | Source | Additional Work Needed? |
|---|---|---|
| Water service type by parcel | Assessor/Stone | |
| Wastewater service type by parcel | Assessor/Stone | |
| Transportation | | |
| Railroad | VCGI | |
| Roads | VCGI | |
| Trails | VCGI/ANR | |
| Hydrography | | |
| Griffin watershed | Griffin Environmental | |
| Impaired Stream Areas | Engineered Solutions | |
| National Wetland Inventory | VCGI/ANR | |
| Potential wetland restoration sites | Stone | |
| Proposed Significant Wetlands | VCGI/ANR | |
| Stormwater impaired watersheds | VCGI/ANR | |
| SWAT DEM Derived Watershed | Stone | |
| VHD Regions | VCGI/ANR | |
| VHD Routes | VCGI/ANR | |
| NHD+ catchment | USGS | |
| Vermont Significant Wetlands | VCGI/ANR | |
| Watersheds (12 digit) | VCGI/ANR | |
| Parcels | | |
| Colchester 2008 | CCRPC | |
| Colchester 2009 | CCRPC | ★ (2.1.5) |
| Elevation | | |
| LiDAR Bare Earth DEM and contours (10 Ft.) | VCGI | |
| LiDAR based hillshade | VCGI | |
| Slope % (based on 10 ft contours) | Stone | ★ (2.1.6) |
| Imagery | | |
| Orthos 2004 color | VCGI | |
| NAIP (2008) | VCGI | |

### 2.1.1. Colchester Build-out Analysis

Stone will use the results of the build-out analysis conducted in 2009 by the Chittenden County Regional Planning Commission (CCRPC) in conducting the Task 3 onsite wastewater needs assessment. This

database provides the number of buildings (both residential and commercial square footage) potentially available for development. In Task 2.3, we describe the method we will use to incorporate this information into the town-wide assessment.

### 2.1.2. Onsite sewage disposal ratings

The onsite sewage disposal ratings created by VCGI describe limitations to onsite wastewater dispersal, but do not indicate what kinds of dispersal systems can potentially be utilized on a particular soil series. Stone will create a series of onsite sewage disposal rankings that are based on the type of system which can be sited under the current Wastewater System and Potable Water Supply Rules (effective September 2007) given a soil series' soil texture, hydric status, depth to groundwater, and depth to bedrock.

### 2.1.3. Assessors Data and Wastewater design flows

Stone will perform minor additional clean-up of the Assessor's account-level data on number of bedrooms for residential properties and condominiums, and will use the bedrooms data to estimate wastewater design flows for residential and residential condominium properties. This information will then be used in the Needs Assessment to calculate the area which would be required to site a replacement onsite system on a given property if the existing system were to malfunction in the future (see Section 2.2.2.2).

Stone will derive design flows for commercial properties, and calculate the land area required for onsite wastewater dispersal on commercial properties, using a three-tier process as follows:

1. If wastewater design flow / specific design information is available from the Task 1 wastewater permits inventory, it will be transcribed during permit review and used to calculate the required wastewater dispersal area. To accomplish this task, we will conduct a limited review of onsite wastewater permits for commercial properties, to determine wastewater design flow requirements and/or land requirements as appropriate on a parcel basis for use in the screening level assessment. The Task 1 wastewater permits inventory contains Town septic permits or wastewater permits recorded in the ACS electronic land records for 207 of the 530 parcels that are listed as Commercial, Industrial, Government, or Religious/Non-Profit land uses. For developed commercial accounts where permits are already linked to accounts, we will extract design flow (and leachfield area/design information if available) from each parcel's scanned permit document records.

2. Where no electronic permit is available for review, site specific water use data will be used to determine average daily usage and design flow; the estimated design flow will be used to calculate the required wastewater dispersal area. The staff of Colchester Fire Districts #2 and #3, where the majority of the currently developed, unsewered commercial parcels are located, have

agreed to provide copies of water meter log books such that Forcier Aldrich & Associates staff can enter recent water usage into a spreadsheet on an individual account basis. Stone will then use the long-term average water usage to calculate an estimated wastewater design flow. Where both design flow from permits and water usage data are available, we will check the accuracy of the calculation based on water usage against the permitted design flow.

3. If neither information source above is available for a currently developed commercial property, wastewater design flow will be estimated on a site basis, based on the type of commercial development as derived from the Assessor's database and the design flow criteria of the 2007 Wastewater System and Potable Water Supply Rules. Alternately, we can use FA&A's water consumption projections as developed for the Water Storage Tank project as approximations for water use on commercial properties—particularly for the Needs Assessment at Build-Out (see Section 2.3).

Design flows, system details, and calculation methods entered into the wastewater permits inventory during this task will be retained in the inventory database for delivery to the Town.

Although commercial parcels are likely to have DEC permits for public buildings that are not linked to accounts in the inventory, no attempt will be made to review these permits or link them to accounts at the screening stage. It may be useful to establish this linkage in the future, perhaps as the Town implements its management program, but it is not a necessary task in order to conduct the Town-wide needs assessment.

### 2.1.4. Municipal water transmission mains

Stone recently received CAD drawings of the municipal water transmission lines in Colchester. We will convert these files into a GIS feature class so that the water transmission lines can be appropriately buffered in the available area portion of the wastewater needs assessment (see Section 2.2.1).

### 2.1.5. Colchester Parcels 2009

Stone recently received the 2009 parcels dataset from the Town of Colchester/VCGI. The new parcel layers joins with the Task 1 water supply and wastewater inventory tables and feature classes relatively well. There appear to be two small issues.

1. The 2007 parcel does not exist in the 2009 layer. This means that wastewater permit records and water supply data associated with the 2007 parcel will be lost in data space if the associated account number is not updated.
2. The 2009 parcel has a different number from 2007.

Aside from those two issues, the Account Field needs a bit more standardizing, but only on 22 records where the account numbers do not follow the MM-LL-BBBBBBB format.

Each of the above issues will be resolved before work commences on subsequent tasks.

### 2.1.6. Slope % (based on 10 ft contours)

Stone has previously calculated slope percentages based on the 1:24,000 digital elevation model and resulting 20-foot elevation contours, but higher-resolution LIDAR data are available for our use. We will re-calculate slope percentages across the Town, based on the higher-resolution data, for use in the Needs Assessment.

## 2.2. Townwide GIS-based Current Conditions Needs Assessment

Based on the criteria developed in coordination with the Town during the task start-up meeting, and using information collected in this task and in Tasks 1 and 2, Stone will conduct a townwide GIS-based planning level onsite needs assessment. The assessment will result in an identification of which parcels have limitations, based on soils, lot size, flood plains, surface waters, wellhead protection areas, setbacks, and other permitting and natural resource protection criteria. The results from this task will be used to help identify critical areas for further on-the-ground assessment planned in Task 4. The Needs Assessment will only include parcels that were designated as being served by onsite wastewater treatment systems during the Task 1 infrastructure inventory. Parcels that are designated as being served by a centralized sewer system will not be assessed.

A Needs Assessment is generally performed to identify parcels that may not be suitable for onsite septic systems. There are two main components to the needs analysis: an “available area” analysis and a “required area” analysis, each of which is described below.

The objective of the available area analysis is to identify which developed parcels would be constrained by inadequate lot size if required to install an onsite system that complies with all horizontal setbacks as set forth in current rules, regulations, and local ordinances. There are many factors that result in areas of a parcel being unavailable for construction of an onsite system. For example, state and local regulations require that certain "setbacks" or distances from natural or artificial features be maintained in order to protect those resources. One such setback is a required separation of 50 feet from surface waters such as ponds or streams. It is because of setback regulations that the total area on a parcel is significantly reduced when determining which areas are suitable for onsite systems.

A second and equally important part of determining if a parcel has enough suitable land area to support an onsite system is an analysis of the soil conditions on the parcel to determine the area required to treat the

wastewater flows generated on the parcel. Both the determination of available area and that of required area for onsite systems for each developed parcel will be addressed.

The last step identifies those properties with soil conditions where the seasonal high groundwater table is 24 inches or less below ground surface, or where the depth to bedrock is less than 24 inches below ground surface. Both of these conditions impact the type of onsite system that may be built.

The following assumptions and criteria will be used to conduct the needs analysis.

### 2.2.1. Available Area Analysis

The first step in the assessment of suitable areas is to determine the available area on each developed parcel. This process involves both analyses of GIS data to identify areas unsuitable for onsite system development, as well as complex database operations to identify parcel features that might further limit onsite system development. The table below lists each of the setbacks of features that will be examined in the available area analysis. Each of these features will be briefly discussed.

*Table 1: Available Area Assessment Criteria*

| Limiting Features | Horizontal Setback (ft) |
|---|---|
| Surface waters (ponds and streams) | 50 |
| Wetlands | 50 |
| Top of embankment, or slope greater than 30% | 25 |
| Bedrock Escarpments | 25 |
| Property line | 25 |
| Zone 1 Wellhead Protection Area | Extent of defined Wellhead Protection Area |
| Private Drilled Wells | 100 |
| Private Shallow Wells or Springs | 150 |
| Main or Municipal Water Lines | 50 |
| Foundation, Footing, or Curtain Drains | 35 |
| Stormwater Infiltration Features* | 35 |

** Stormwater infiltration features, such as drywells or infiltration basins, are not explicitly defined as requiring a horizontal setback from wastewater dispersal systems in the WSPWSRs.*

*Source: Vermont Environmental Protection Rules, Wastewater System and Potable Water Supply Rules, eff. September 2007.*

1. Surface Waters: Lakes and ponds will be identified from the Vermont Hydrography Regions dataset, and streams will be identified from the Vermont Hydrography Routes dataset. These lines and areas will be spatially buffered with the indicated setback distance using GIS.
2. Wetlands: Wetlands will be identified from the Proposed Significant Wetlands dataset. The features in this dataset will be spatially buffered with the indicated setback distance using GIS.
3. Top of Embankment, or Slope greater than 30%: Areas with slopes of greater than 30% will be identified from the LiDAR Bare Earth DEM and calculated slope % dataset (see Section 2.1.6). These areas will be spatially buffered with the indicated setback distance using GIS.
4. Bedrock Escarpments: Bedrock Escarpments will be obtained from the Chittenden County soils dataset. Escarpments will be spatially buffered with the indicated setback distance using GIS.
5. Property Lines: Property lines will be obtained from the 2009 Colchester Parcels dataset. Property lines will be spatially buffered with the indicated setback distance using GIS.
6. Zone I Wellhead Protection Areas: Wellhead protection areas (for permitted community water supplies) were obtained from the State Water Supply GIS dataset during Task 1. These areas will be used as-is with no additional spatial buffering in GIS.
7. Private Water Supplies: All known drilled and shallow wells will be included in the available area analysis. Water supply information was collected from spatial data sources, from permit files, and from field mapping activities during Task 1. Each water supply point will be spatially buffered with the indicated setback distance using GIS. Where the Task 1 inventory indicates that a parcel is served by a private water supply, but the location of the water supply is not available, an area equivalent to half of the setback distance will be subtracted from the parcel's available area. This reduction in the well setback is equivalent to assuming that a portion of the area resulting from a standard setback would overlap adjacent parcels and other buffer areas on a small lot. It is likely that overall, this method underestimates the well shield areas required by the state's Water Supply Rules for the protection of drinking water supplies. Under these rules, a shield-shaped area that extends uphill from the circular buffer shown on the maps (200 feet uphill for drilled wells, 500 feet uphill for shallow wells or springs) is required to be set aside for groundwater protection. The GIS analysis tools are not capable of drawing such shields for each water supply, so the circular "radius" buffer is used instead. This assumption will result in some properties with private water supplies appearing to have more area available for an onsite system than is actually the case. For undeveloped properties without water supply information, no water supply or buffer is assumed to exist.

8. Main or Municipal Water Lines: Municipal water mains will be spatially buffered with the indicated setback distance using GIS. The screening level assessment will not account for setbacks from service lines to individual structures. This assumption may result in slightly less conservative estimates of the area available to site a fully complying onsite dispersal system, especially on small parcels.
9. Building Footprints: Building footprints were digitized from the available orthophotographs and E911 structure locations (eSites) during Task 1. The building footprints will buffered using GIS, making a conservative assumption that structures generally have footing drains. The building footprint areas will be included in the analysis as areas unavailable for onsite systems.
10. Stormwater Infiltration Features: Stormwater infiltration features, such as drywells or infiltration basins, are not explicitly defined as requiring a horizontal setback from wastewater dispersal systems in the WSPWSRs. For the purpose of the screening level assessment, Stone will buffer Task 1, 2009 stormwater infrastructure inventory features such as retention ponds, stormlines, and stormwater similarly to foundation, footing, or curtain drains, wherever the stormwater features are flagged as infiltration structures. Similarly, in the Belwood neighborhood, a network of subsurface drainage lines exist that locally lower the water table. Where we are aware that such features exist, we will treat them similarly to foundation, footing, or curtain drains and apply the appropriate buffer distance using GIS.
11. Available Area Calculation: The total available area for a parcel was determined by subtracting an assumed building footprint area from the area of the parcel outside the required setback buffers as calculated by the GIS analysis. This calculation is shown in the following equation:

    Area Available = Parcel Area – Required Setback Buffers – Building Footprint – Wellhead Protection Area Buffer

## 2.2.2. Required Area Analysis

The required area for construction of an onsite system will be determined from two primary pieces of information: 1) soil properties (percolation rates and long-term acceptance rates) for each parcel, 2) design parameters for each onsite system. Assumptions we will make regarding the determination of each of the inputs to the required area calculation are described below.

### *2.2.2.1. Soil Properties*

Percolation rates and long-term acceptance rates (LTAR) will be calculated for each soil type within the study area. We will assign average percolation rates using the soil textures from the NRCS soils data and

the average rates listed in the Vermont Indirect Discharge Rules. Each parcel will be assigned the properties of the predominant soil type for purposes of determining required area.

#### *2.2.2.2. Onsite System Design Assumptions*

Design flows for residential parcels will be estimated based on the number of bedrooms recorded for each property in the Colchester Assessor's database, as received by Stone during the Task 1 inventory and as modified during the Data Compilation phase (see Section 2.1). Where suitable soils exist, the onsite system will be assumed to be a standard trench leach field design. The standard Vermont Wastewater System and Potable Water Supply Rules long-term application rate (LTAR) effluent loading rates will used in the sizing of the leach field. A standard three-foot wide trench, with four feet separation will be used as the typical layout. This results in a range of areas needed for the leach field depending on the soil's assumed percolation rate. For soils where only mound systems would be feasible, an estimate of the required area for a mound dispersal system will be calculated using the LTAR values for mounds specified in the Rules. It will be assumed that if a leach field (or mound) could be successfully sited on the property, there is adequate area for other system components, such as septic tanks and distribution boxes.

Design flows for parcels containing residential condominiums will be estimated using a process similar to that used for single family detached residences. However, for condominium units on common land, the parcel polygons denoting individual condominium units will be merged with the surrounding common land, and the bedrooms for each condominium unit will be summed to a total number of bedrooms which applies to the entire common parcel of land. If any wastewater design flows are calculated for condominium parcels that are 6,500 gpd or larger, we will evaluate those parcels individually to see if the existing wastewater systems were permitted under the Indirect Discharge Rules. If they were, we will exclude the parcel from further GIS assessment and make a suitability determination based on permit and document review. The planning level GIS wastewater needs assessment is not intended to accurately assess potential limitations of large or shared onsite wastewater treatment systems.

Design flows and required dispersal system areas for commercial, industrial, and institutional (religious, municipal, etc.) properties will be extracted from electronic permit records or on site-specific water usage where such records exist (see Section 2.1.3). Where no electronic permit information is available for a developed commercial, industrial, or institutional parcel, we will estimate design flow based on current regulations or based on FA&A's water consumption projections calculated during the Town's Water Storage Tank Project.

### 2.2.3. Area Analysis Assessment

The available area for an onsite system will compared to the required area for each parcel. The required area for a system is based on the predominant soil type on the parcel. Parcels will be identified as area limited if the available area is less than the required area. Parcels will be identified as being unconstrained by area when the available area is greater than or equal to the required area.

### 2.2.4. Seasonal High Groundwater Analysis

An additional GIS analysis will be conducted to understand which parcels have potential groundwater limitations. Soils with groundwater depths of 18-24 inches below ground surface would require performance-based system, such as a mound, and would indicate a constraint to a typical subsurface system. A parcel will be identified as having a groundwater limitation if the area of the parcel with a groundwater depth of greater than 24 inches represents an area smaller than that required for a conventional or mound onsite system.

This analysis may overestimate site limitations regarding depth to groundwater, as it does not account for filtrate systems, alternative systems, or desktop hydrogeologic analyses that may be used under the Wastewater System and Potable Water Supply Rules.

### 2.2.5. Depth to Bedrock Analysis

Depth to bedrock will be assessed to identify parcels with potential bedrock limitations. Parcels with shallow bedrock (less than 24 inches below ground surface) would require a performance-based dispersal system and significant additional fill to allow an onsite system to function properly. A parcel was identified as having a bedrock limitation if the area of the parcel with a depth to bedrock of greater than 24 inches represents an area smaller than that required for a conventional onsite system. Areas with bedrock (between 18 and 24 inches below ground surface) would require a performance-based system, that would most likely require an advanced treatment system and a mound system. Areas with bedrock less than 18 inches below ground surface are not suitable for onsite wastewater dispersal systems.

### 2.2.6. Screening Level Review and Suitability Determinations

Once the results of the GIS analyses are produced, a screening level review will be conducted on a subset of the parcel-level results. This review includes using all of the additional information known about the properties (permits, test pit and percolation test results if included in the document inventory, etc.), and confirming the results of the GIS analyses. The final outcome of this assessment will be a summary map that shows whether or not each parcel has limitation that may preclude onsite system replacement in the future, and the specific limitation or limitations (setbacks, groundwater, or bedrock) that apply to the limited parcels.

## 2.3. Town-Wide Needs Assessment at Build-Out

Stone will use the 2009 CCRPC build-out analysis results in conducting the onsite wastewater needs assessment. This database provides the number of buildings (both residential and commercial square footage) potentially available for development. A second town-wide screening assessment will be conducted using the CCRPC 2009 build-out analysis results. The assessment will result in an identification of which parcels have potential limitations, based on both the current Vermont WSPWSRs as outlined in section 2.3, and growth based on the 2009 CCRPC build-out analysis. The result of this assessment can provide useful information on the impacts of current zoning designations as they relate to onsite wastewater treatment capacity.

This assessment will incorporate a GIS analysis phase and a database analysis phase. The GIS analysis phase will incorporate results from the current condition needs assessment (see Section 2.2.) and the 2009 CCRPC build-out analysis, resulting in a revised "area available" for onsite wastewater dispersal. This area will be further modified in the database analysis phase, based on the number of new buildings from the build-out analysis and associated assumptions regarding residential building footprint size and setbacks to accommodate private wells and/or property lines required for the new development. The "required area" for construction of an onsite system in the build-out condition assessment will be determined based on the soil properties of the parcel and estimated design flow for each potential onsite system. The build-out condition needs assessment will be calculated for two different growth scenarios including the 100% build-out scenario provided by CCRPC and at least one other, such as a 20-year growth scenario. Stone will work with the Planning & Zoning and Public Works departments to characterize the 20-year growth scenario. The database analysis results will be rejoined to the parcel boundaries to provide a map of potentially limited parcels under the two potential future development conditions.

## 2.4. Onsite Failure Rate Analysis

Using existing Town permitting records in electronic format as compiled during the Task 1 data inventory, Stone will estimate the range of probable failure rates of on-site wastewater treatment infrastructure in Colchester. We will use, as appropriate, the methods of cohort analysis that were described by Etnier et al. (2005) for use with decentralized wastewater systems. A "cohort", simply defined, is a group of individuals (in this case, onsite wastewater treatment systems) that share similar characteristics.

### 2.4.1. Questions and Initial Cohort Definition

The first step in assessing failure rates is to define criteria for failure, to determine the questions the analysis is to answer, and to determine which systems are of interest.

Given the limited detailed information that is available in the electronic wastewater permits database, we propose to initially define "failure" as any instance where more than one permit has been issued for a given parcel or account number. If only one wastewater permit was issued for a parcel or account number, for purposes of this assessment we will assume that no significant malfunction has been documented. In the Task 1 wastewater permit inventory database, there are records for 4,142 account numbers, 1,250 of which have entries for more than one Town septic or State wastewater permit.

Within this dataset, if possible, we will further define a specific performance standard for use in the failure rate analysis. A reasonable functional performance standard would be "no surfacing effluent from soil-based dispersal components". A system that received a permit to correct a surfacing dispersal system would then be classified as a "failure" for the purposes of the analysis, even though the malfunction has since been remedied. Note, however, that the level of information available electronically in the wastewater permits database is not currently sufficient to easily determine permitting reasons, especially prior to 1995.

At least initially, all onsite wastewater treatment systems on parcels for which permits have been issued are of interest.

The questions the analysis is intended to answer are:

1. On average, how long does it take for a soil-based dispersal system to surface or otherwise significantly malfunction in Colchester?
2. Does system age, as related to permitting date and the regulations in force at the time the system was installed, have an influence on failure rates?
3. Do soil-related limitations such as silt or clay soil texture, shallow seasonal high groundwater, or shallow bedrock result in higher failure rates?

### 2.4.2. Available Data and Data Reduction Methods

We will conduct the failure rate analysis in two steps: an initial screening analysis, followed by extraction of more detailed information from a subset of permits and calculation of failure rates.

Information needed to conduct the screening analysis includes the following, which will be imported from the Task 1 wastewater permits inventory and from the Assessor's database:

- Account number (obtain from existing permit inventory database)
- Type of permit (Town septic or State wastewater) (obtain from existing permit inventory database)
- Date system was initially permitted or constructed (obtain from existing permit inventory database)

We will use this information to create a combined account/parcel history database. The first entry in the database for each account will be the residential structure construction date from the Assessor's database. The next entry will be the date of the first onsite wastewater system permit issued for the property as recorded in the Task 1 wastewater permits inventory database, then the second onsite wastewater permit issued, etc. The database will be used to construct a summary of mean time between permits for each account, in years. We will summarize this information in tables as appropriate, and create a map showing mean time between permits by account. We will assess the map for clusters of low mean times between permits, to determine whether they correspond to particular building densities, age ranges, or soil characteristics. We will also compare this map to the documentation of onsite system malfunctions included in Forcier Aldrich & Associates' 1997 *Town-Wide Wastewater Facility Plan Update*.

For a reasonable subset of the permit history records, we will extract system and soil characteristics from electronic permit documents and conduct targeted failure rate calculations. The following information will be manually entered from imageWARE/ACS scanned documents for further use in the failure rate analysis.

- Reason for permit: Categorize to a sufficient level for failure rate analysis (specify new construction, tank replacement, other minor repair, leachfield or whole system replacement, upgrade for seasonal conversion, connect to centralized system, drywell replacement (with like), component or system relocation. For post-1995 permits records, this can often be determined from the narrative entry in the wastewater permit inventory database. If this information is not available in database, we will obtain it from electronic Town Septic permits stored in imageWARE, or from ACS scanned permits, as appropriate.
- Type of treatment component: cesspool, septic tank, pre-treatment (specify sand filter, textile filter, Septitech, etc. if applicable). Town septic permits contain information about required tank volume, and sometimes contain construction material details. Newer permits contain more details.
- Type of dispersal component: drywell, adsorption trenches, adsorption bed, at-grade system, mound system, gravelless absorption system (and specific manufacturer/type: Infiltrator, Presby, etc.), subsurface drip distribution system. Also note if the component is intended as a "filtrate system" under the recent WSPWSR. Town septic permit documents contain information about required leachfield area, and whether system is adsorption trenches or bed can usually be determined.
- Soil series, soil texture, depth to groundwater, depth to bedrock: Where information exists in the electronic permit document regarding soil characteristics including percolation rate, soil type, depth of ledge, and depth of groundwater, we will enter it into the database. If this information does not exist in the permit, we will populate soil type, depth of groundwater, and depth of ledge based on the VCGI/NRCS Chittenden County Soils dataset.

### 2.4.3. Cohort Definition

A "cohort" of wastewater treatment systems is a group of systems that shares one or more common properties. We anticipate defining the following age-related cohorts based on the history of wastewater system permitting in the Town and at the State level. Depending upon the make-up of the permits that are actually reviewed, these cohorts may be adjusted.

- 1981 or earlier: Empirical state-level wastewater regulations in force
- 1982-1993: Scientifically based state-wide regulations in force for conventional trenches, absorption beds, mounds
- 1994-2001: Sand filters added to state-wide regulations
- 2002-present: Wider variety of innovative/alternative technologies and alternate dispersal field designs allowed under state-wide regulations

We anticipate defining system-related cohorts, particularly as related to dispersal component technology (conventional absorption trenches, absorption beds, etc.)

Where sufficient information exists, we will define soil-related cohorts, with respect to soil texture, depth to bedrock, and depth to seasonal groundwater. These cohorts will be determined based on the limitations highlighted by the results of the Task 2.2 Needs Assessment, and on the results of the permit history analysis described above.

### 2.4.4. Failure Rate Calculation

For each cohort of systems, we will calculate a raw failure rate by dividing the number of failures reported by the number of systems constructed. Depending upon the results of this initial set of analyses, we may add or adjust criteria or change the composition of individual cohorts (for example, it might make sense to consider failure rates by type of dispersal system or to evaluate differing dispersal technologies sited on soils with clay texture) and re-calculate the failure rates as appropriate.

## 2.5. Draft and Final Reports

A draft report, including methods summarized from this protocol, descriptions of the results of each analysis, and supporting maps and tables for each assessment, will be produced for review and comment by the Town. A final report will be produced that addresses all comments and corrections. The results of any data reduction activities completed during Task 3 will be retained in the wastewater permits inventory database for eventual delivery to the Town.

Maps included in the draft and final reports will include:

- Base/Study Area map

- Environmental Sensitivities
- Onsite System Feasibility / Current Condition Needs Assessment Results
- Build-out Condition Needs Assessment Results

Tables will include:

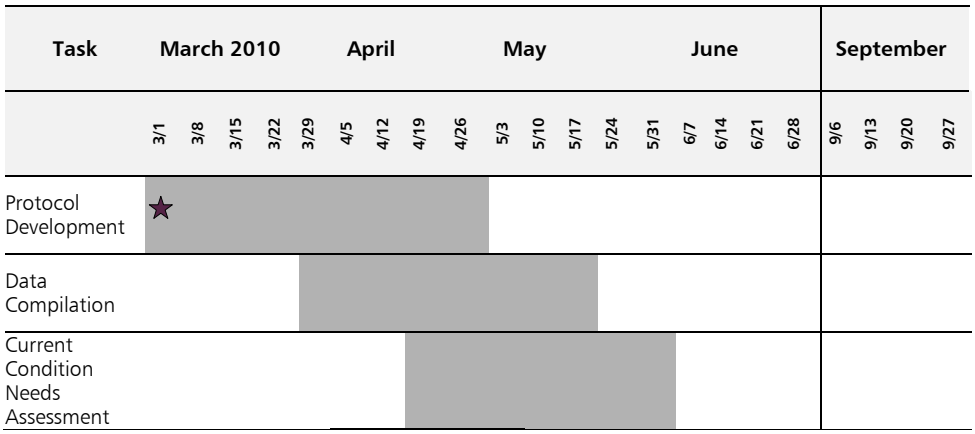
- Study Area Description
- Summary of Soil Characteristics Regarding Onsite Wastewater Dispersal Within Study Area
- Permit Information Summary
- Summary of Current Condition Needs Assessment Results
- Summary of Build-out Condition Needs Assessment
- Failure Rate Assessment Results

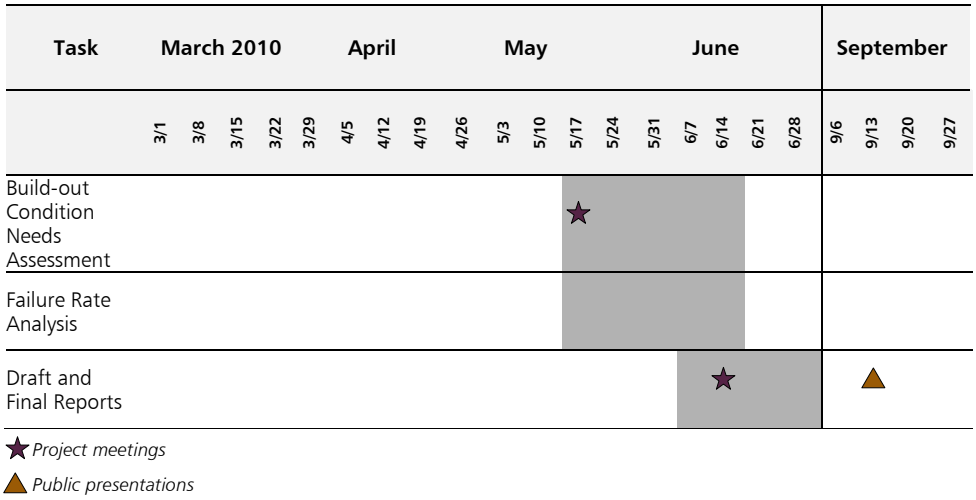
## 3. STAFFING ASSIGNMENTS

Amy Macrellis and David Healy of Stone Environmental, Inc. will collaboratively manage the wastewater needs assessment. Ms. Macrellis will be responsible for overall task management. Mr. Healy will provide task oversight and provide technical and managerial review of all deliverables. Katie Budreski and Christine DeLeo of Stone will assist with data compilation, GIS model development, and data management for the needs assessment.

## 4. NEEDS ASSESSMENT SCHEDULE

The current schedule for completing the planning level onsite wastewater needs assessment is included below.






## 5. REFERENCES

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Stone Environmental, Inc. 2010. Distributed Infrastructure Inventory, Integrated Water Resources Management Program, Task 1 Interim Final Report For The Town Of Colchester, Vermont. Project ID 05-1694-G, January 2010.

Vermont Department of Environmental Conservation. 2003. Environmental Protection Rules, Chapter 14: Indirect Discharge Rules. Effective April 30, 2003. Accessed online at http://www.anr.state.vt.us/dec/ww/Rules/IDR/Adopted-IDR-4-30-03.pdf on March 23, 2010.

Vermont Department of Environmental Conservation. 2007. Environmental Protection Rules, Chapter 1: Wastewater System and Potable Water Supply Rules. Effective September 29, 2007. Accessed online at http://www.anr.state.vt.us/dec/ww/Rules/OS/2007/FinalWSPWSRuleEffective20070929.pdf on March 23, 2010.

# APPENDIX B: DETAILED METHODOLOGY FOR NEEDS ASSESSMENT AT BUILD-OUT CONDITION

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# Technical Note

Project: 051694-G

Date: 8/5/2010, rev.
11/4/2010, rev.
4/29/2011

Client Study #:

SEI Study #:

Subject: Town of Colchester Build-out Analysis for Onsite Wastewater Systems

PURPOSE/OBJECTIVE:

Analysis of build-out needs assessment for onsite wastewater.

Stone will use the 2010 CCRPC build-out analysis results in conducting the onsite wastewater needs assessment. This database provides the number of buildings (both residential and commercial square footage) potentially available for development. The assessment will result in an identification of which parcels have potential limitations, based on both the current Vermont WSPWSRs as outlined in section 2.3, and growth based on the 2010 CCRPC build-out analysis. The result of this assessment can provide useful information on the impacts of current zoning designations as they relate to onsite wastewater treatment capacity.

This assessment will incorporate a GIS analysis phase and a database analysis phase. The GIS analysis phase will incorporate results from the current condition needs assessment and the 2010 CCRPC build-out analysis, resulting in a revised "area available" for onsite wastewater dispersal. This area will be further modified in the database analysis phase, based on the number of new buildings from the build-out analysis and associated assumptions regarding residential building footprint size and setbacks to accommodate private wells and/or property lines required for the new development. The "required area" for construction of an onsite system in the build-out condition assessment will be determined based on the soil properties of the parcel and estimated design flow for each potential onsite system. The database analysis results will be rejoined to the parcel boundaries to provide a map of potentially limited parcels under the two potential future development conditions.

PROCEDURE:

1) Summarize the number of CCRPC build-out building points for each parcel (using both the parcel boundaries used in the Needs Assessment and the original parcel boundaries).
    a. Create a spatial join between the building points and parcels (Needs Assessment Parcels)
        i. Input data
            1. Used Build-out Building Points (O:\Proj-05\1694-W_ColchesterIWP\Data\GISData\CCRPC\2010GrowthCenterBuildout_v2\2010GrowthCenterBuildout.gdb\CVBO_BUILDINGS122010)

2. Needs Assessment Parcels: O:\Proj-05\1694-W_ColchesterIWP\Data\NeedsAssessment\GISData\Assessor_Parcel_NeedsAssess.mdb\ColchesterParcels2009_Condo_NA
    a. The parcel boundaries for the Needs Assessment (ColchesterParcels2009_Condo_NA) exclude all sewered parcels. All condo properties have also been merged to create one parcel for each condo development.

ii. Output data
1. Building footprints with Account Number (AcctNumCondo)
    a. O:\Proj-05\1694-W_ColchesterIWP\Data\NeedsAssessment\GISData\NeedsAssessment_BuildOut_GIS.mdb\CVBO_Buildings_Parcels_Condo

iii. Added field: LAND_USE_CODE2 and updated with first 3 letters of the LAND_USE_CODE field

2) Determine the 'Available Area' for each lot. This will be done by first using the available area for each parcel based on the current condition needs assessment. Second, the setbacks for new development will be applied. These will include building footprints and associated foundation drain setbacks, parcel boundary setbacks, and private well setbacks. Assuming that there will be overlap among the various setbacks, 50% of each of the area for each setback will be subtracted rather than the full area.
    a. Available Area based on the Current Condition Needs Assessment conducted as a part of Task 2.2. During this task various setbacks were applied to each parcel to identify unsuitable areas for onsite system development based on the Vermont Environmental Protection Rules. See table below for setbacks applied.

**Table 1. Available Area Assessment Criteria**

| Limiting Features | Horizontal Setback (ft) |
|---|---|
| Surface waters (ponds and streams) | 50 |
| Wetlands | 50 |
| Top of embankment, or slope greater than 30% | 25 |
| Bedrock Escarpments | 25 |
| Property line | 25 |
| Zone 1 Wellhead Protection Area | Extent of defined Wellhead Protection Area |
| Private Drilled Wells | 100 |
| Private Shallow Wells or Springs | 150 |
| Main or Municipal Water Lines | 50 |
| Foundation, Footing, or Curtain Drains | 35 |
| Stormwater Infiltration Features* | 35 |

** Stormwater infiltration features, such as drywells or infiltration basins, are not explicitly defined as requiring a horizontal setback from wastewater dispersal systems in the WSPWSRs.*

*Source: Vermont Environmental Protection Rules, Wastewater System and Potable Water Supply Rules, eff. September 2007.*

b. Minus average setbacks for the new development

i. Minus 50% of 25 ft for parcel line setback (based on minimum lot area from Town of Colchester zoning. See table below for Minimum Lot Sizes from Town of Colchester zoning),

1. Parcel line setback area (25 ft setback) was calculated based on the minimum lot size for the zoning class of each building and assuming perfectly square lots.

**Table 2. Minimum lot size based on the Town of Colchester zoning rules and associated buffer area assuming square lots.**

| Zoning Class | Min LotS ize (sqft) | Full Buffer Area (sqft) |
|---|---|---|
| BUS | 10000 | 7500.8 |
| GD3 | 10000 | 7500.8 |
| GD4 | 10000 | 7500.8 |
| GD2 | 10890 | 7936.3 |
| MHP | 15000 | 9747.3 |
| R3 | 15000 | 9747.3 |
| COM | 20000 | 11643.7 |
| GD1 | 20000 | 11643.7 |
| R2 | 20000 | 11643.7 |
| FP | 40000 | 17500.0 |
| IND | 40000 | 17500.0 |
| R1 | 40000 | 17500.0 |
| R5 | 217800 | 44169.8 |
| R10 | 435600 | 63500.4 |
| AGR | 1089000 | 101853.3 |

ii. Minus 50% of area of building footprints and 35 ft foundation drain setback

1. Building footprints and foundation drain setback area were calculated. The CCRPC build-out analysis estimated building footprints of new buildings for many records. In some cases, the value was not estimated and given a value of zero (0). Where CCRPC estimates existed, that value was excluded from the available area. Where they did not exist, an average value for the zoning class was calculated based on existing building footprint data (See a below).

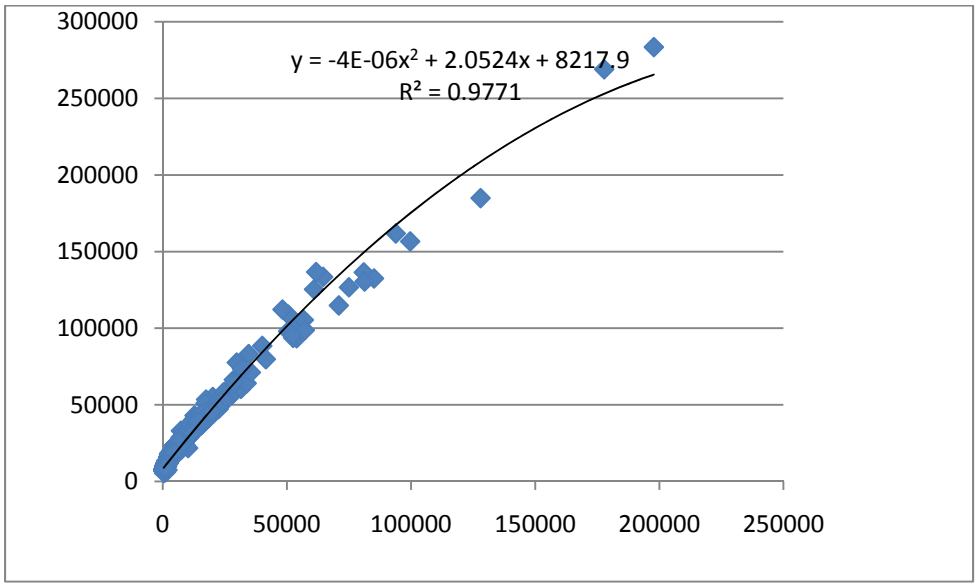
a. Calculated average building footprint per zoning class based on existing buildings in the Town of Colchester (digitized building footprints)
    i. A spatial join between building footprints (UVM, 2007) and Zoning polygons was created (O:\Proj-05\1694-W_ColchesterIWP\Data\GISData\ColchesterZoning09.shp)
    ii. The average building size for each zoning class was calculated. **Only buildings greater than 350 sq feet were included in the averages to exclude sheds and other small out buildings.**

Table 3. Average building footprint area by zoning class.

| ABBREV | DISTRICT | AveFootprint_Sqft | StDevFootprint_Sqft |
|---|---|---|---|
| AGR | AGRICULTURAL | 3,058 | 4,853 |
| BUS | BUSINESS | 11,770 | 16,186 |
| COM | COMMERCIAL | 4,270 | 9,535 |
| FP | FLOODPLAIN | 1,547 | 942 |
| GD1 | GENERAL DEVELOPMENT ONE | 2,073 | 5,025 |
| GD2 | GENERAL DEVELOPMENT TWO | 5,538 | 9,694 |
| GD3 | GENERAL DEVELOPMENT THREE | 3,234 | 3,612 |
| GD4 | GENERAL DEVELOPMENT FOUR | 4,705 | 5,197 |
| IND | INDUSTRIAL | 14,957 | 33,816 |
| MHP | MOBILE HOME PARK | 1,131 | 306 |
| R1 | RESIDENTIAL ONE | 1,951 | 2,607 |
| R10 | RESIDENTIAL TEN | 1,862 | 1,043 |
| R2 | RESIDENTIAL TWO | 1,841 | 972 |
| R3 | RESIDENTIAL THREE | 1,949 | 1,214 |
| R5 | RESIDENTIAL FIVE | 2,249 | 3,019 |

2. Building footprint area plus associated foundation drain setback area was estimated based on the current data.
    a. The relationship between building footprint area to building footprint area plus setback (35 ft) for existing buildings in Colchester was plotted. **Only buildings greater than 350 sq feet were used in the equation to exclude small out buildings such as sheds.** A 2nd order polynomial trend line was fit to the data having an $R^2$ of 0.9771. See below for graph and equation. The resulting equation was used to estimate the total setback area of the building footprint and foundation drain setbacks for all new buildings using the footprint area resulting from step ii.1 above as variable $x$. 50%

of the calculated building/drain area for each new building was excluded from the available area for each parcel.




iii. Minus 50% of setback for individual wells for parcels not served by municipal water (undeveloped only).

1. Create a table of all parcels (NeedsAssessment Parcels: O:\Proj-05\1694-W_ColchesterIWP\Data\NeedsAssessment\GISData\Assessor_Parcel_NeedsAssess.mdb\ColchesterParcels2009_Condo_NA) that do not touch the water service area (O:\Proj-05\1694-W_ColchesterIWP\Data\DataDelivery\Colchester_Administrative.gdb\Boundaries\WaterDistrictServiceArea)
    a. Output: O:\Proj-05\1694-W_ColchesterIWP\Data\NeedsAssessment\GISData\NeedsAssessment_BuildOut.mdb\ tblParcels_Condo_NoMunicipalWater
2. Create a query to select only those parcels from the above table (tblParcels_Condo_NoMunicipalWater) that were 'undeveloped' for the current condition assessment (Undeveloped = -1 for commercial parcels and Bedrooms = 0 for residential parcels).
    a. Query: O:\Proj-05\1694-W_ColchesterIWP\Data\NeedsAssessment\GISData\NeedsAssessment_BuildOut.mdb\ qryUndevelopedParcels_NoMunicipalWater
3. Assume individual drilled wells and 50% of setback area (area reduction of 15,708 square feet)

iv. The Required Area for each parcel is given in the following query:

1. NeedsAssessment_BuildOut.mdb\qryBO_AvailableArea (BO_AvailArea)

3) Determine the 'Required Area':

a. Current condition required area + required area for additional dwellings/buildings

i. We will use the predominant soil per parcel from the current condition assessment
ii. We will assume 3 bedrooms for all dwelling units.
iii. We will assume the average area required for commercial parcels by zoning class. *For R10 – Averaged over all zoning classes since there were 0 parcels with this zoning class.

| Zoning Class | Average Required Area | St Dev of Required Area | Sample size (parcels) |
|---|---|---|---|
| AGR | 104 | | 1 |
| BUS | 581 | 1,357 | 13 |
| COM | 2,174 | 3,484 | 69 |
| GD1 | 855 | 1,046 | 19 |
| GD2 | 78 | 221 | 8 |
| GD3 | 221 | 303 | 5 |
| GD4 | 3,582 | 17,929 | 36 |
| IND | 977 | 1,387 | 9 |
| MHP | 400 | | 1 |
| R1 | 2,285 | 3,511 | 9 |
| R2 | 928 | 1,696 | 9 |
| R3 | 1,027 | 1,453 | 12 |
| R5 | 5,067 | 6,020 | 2 |
| R10* | 2,053 | 7,872 | 0 |

iv. The SepticAreaNeed for each parcel is given in the following query:
    1. NeedsAssessment_BuildOut.mdb\qry3SepticAreaNeedByParcel_BO (TotalSepticAreaNeed_BO)

4) Determine parcels with area restrictions based on build-out:
    a. If there were no 'New' buildings as a result of the CCRPC build-out analysis, use current condition result for area restriction.
    b. If the Build-out area available is less than build-out area needed, then area restriction = "yes", otherwise, "no".
    c. The resulting table is
        i. NeedsAssessment_BuildOut.mdb\OnsiteSuitability_BO.