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TOWN OF EAST MONTPELIER

NEEDS ASSESSMENT AND FEASIBILITY STUDY -

WASTEWATER TREATMENT FOR THE VILLAGES

FINAL REPORT

MAY 2007

VOLUME 1 OF 2

2 of 2A
2 of 2B

TOWN OF EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY STUDY -
WASTEWATER TREATMENT FOR THE VILLAGES

Final Report

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List of Abbreviations and Acronyms

ANR	State of Vermont Agency of Natural Resources
BOD_5	Five-day biochemical oxygen demand
CVRPC	Central Vermont Regional Planning Commission
DEC	State of Vermont Department of Environmental Conservation
DEM	Digital Elevation Model
ENR	Engineering News Record
EPR	State of Vermont Environmental Protection Rules, Chapter 1 - Wastewater System and Potable Water Supply Rules, Effective January 1, 2005
EU	Equivalent User
FA&A	Forcier Aldrich & Associates, Inc.
FEMA	Federal Emergency Management Agency
GIS	Geographic Information Systems
ID	Indirect Discharge
IDR	State of Vermont Indirect Discharge Rules
LULC	Land Use Land Cover
NA	Not Applicable
NRCS	United States Department of Agriculture, Natural Resources Conservation Service
O&M	Operation and Maintenance
RME	Responsible management entity
SRF	State Revolving Fund
STEP	Septic tank effluent pumping
TPC	Total project costs
TSS	Total suspended solids
USDA	United States Department of Agriculture
USEPA	United State Environmental Protection Agency
UVM	University of Vermont
VCGI	Vermont Center for Geographic Information
VSWI	Vermont Significant Wetland Inventory
WAC	East Montpelier Wastewater Advisory Committee
Y2	Year 2
Y3	Year 3
Y4	Year 4
Y5-Y20	Year 5 through Year 20

Units of measure

CY	Cubic yard
EA	Each
gpd	Gallons per day
HP	Horsepower
LF	Linear feet
mg/L	Milligrams per liter
SF	Square feet
SY	Square yard

1 CONCLUSIONS

Based on the investigations and analyses performed as part of this Study, the following conclusions have been reached. These conclusions are grouped by section in this report (noted in parentheses) to enable the reader to reference the source of the conclusions within the full text of the report.

1.1 Village Study Areas (Section 4.1)

1.1.1 The East Montpelier village study area has a total of 141 parcels, 126 of which are developed and 15 are undeveloped.

1.1.2 The North Montpelier village study area has a total of 32 parcels of which 31 are developed and 1 is undeveloped.

1.1.3 Both study areas were expanded to the above numbers of parcels after the completion of the Needs Assessment. The study areas were expanded in the vicinity of Carleton Road in East Montpelier and on the east side of the pond in North Montpelier.

1.1.4 Potable Water for most of the parcels in the East Montpelier Study Area is supplied by the Crystal Springs Water Company.

1.1.5 Potable Water in the North Montpelier Study Area is supplied by a combination of individual water systems and 7 dwellings on a shared private water system.

1.2 Property Owner Survey Questionnaire (Section 4.2)

1.2.1 Questionnaires regarding wastewater management were sent to approximately 162 owners of 226 parcels in East Montpelier and North Montpelier villages. Forty-three questionnaires (26% of total sent) were filled out and returned. Thirty-five of the responses were filled out by owners of properties in the study areas (27 in East Montpelier and 8 in North Montpelier).

1.2.2 The individual questionnaire results are confidential, however the overall results are summarized in Appendix B. .

1.2.3 Due to the small number of questionnaire responses, it is difficult to extrapolate the results to the remainder of the recipients.

1.2.4 Key outcomes of the questionnaires were:

1.2.4.1 Owner's perception of the condition of their systems as "pretty good" to "excellent" were 45% in East Montpelier Village, and 100% in North Montpelier Village.

1.2.4.2 Construction costs of wastewater system replacement over the past ten years were generally in the range of approximately $9,000 to $12,000.

1.2.4.3 In East Montpelier Village, interest in a shared or community system was relatively evenly split between yes (19%), no (22%), and need more information (22%). Thirty-seven percent of the East Montpelier surveys returned did not have a response to this question.

1.2.4.4 In North Montpelier Village interest in a shared or community system was tentative, with yes (13%) no (38%) and need more information (50%). All North Montpelier surveys returned had a response to this question.

1.3 Build Out Analysis (Section 4.3)

1.3.1 Development and build out analyses were conducted for each village by Central Vermont Regional Planning Commission (CVRPC) using assumptions based on guidance from the East Montpelier Planning Commission. The build out analyses revealed that the core areas of each village is essentially built-out along main thoroughfares in each of the study areas.

1.3.2 The build out analysis revealed significant growth potential in the large undeveloped parcels in the East Montpelier Study Area. This is partially because of the inclusion of large undeveloped lots in the East Montpelier Study Area. These undeveloped parcels were evaluated later in the study for cluster wastewater system suitability.

1.3.3 In the North Montpelier Study Area, the build out analysis revealed limited growth potential.

1.4 Wastewater Needs Investigation (Section 4.4)

1.4.1 State or Town wastewater permit data was found for 25 systems in the study area (21 in East Montpelier and 4 in North Montpelier).

1.4.2 Field investigations were conducted at 9 properties, 4 in East Montpelier Study Area, 3 in North Montpelier Study Area and 2 properties just outside of the East Montpelier study area. The investigations revealed both functioning and marginal systems in the vicinity of each study area. Each parcel, in both study areas, was evaluated from the street by a walk-through reconnaissance.

1.4.3 One system in East Montpelier village appeared to be failing by surfacing and flowing to the Winooski River at the time of the site visit.

1.4.4 Onsite wastewater systems need suitable soils to safely treat and disperse wastewater. The soil suitability is based on depth to estimated seasonal high groundwater, depth to bedrock, and the apparent permeability of the soil. There was a significant difference between published soil survey data and site specific test pit results for the East Montpelier Study Area. Most areas in the East Montpelier Study Area appear to require mound or at-grade systems based on onsite soil investigations. More field data is needed to be able to conclusively determine lot-by-lot suitability for onsite wastewater systems.

1.4.5 Marginal parcels were identified based on consideration of design flows, soils, lot area, required setbacks, and topography. The East Montpelier Study Area had approximately 28 parcels with area limitations, and approximately 8 parcels with soil limitations - for a total of 32 % of the developed parcels in the village area having onsite wastewater limitations.

1.4.6 The North Montpelier Study Area had approximately 13 parcels with area limitations, and approximately 8 parcels with soil limitations - for a total of 45% of the developed parcels in the village area having onsite wastewater limitations.

1.4.7 Potential sites for off-site cluster wastewater dispersal systems were identified in each village area based on soils mapping and/or soil descriptions provided by the current and past East Montpelier Sewage Officers . All of these sites are currently under private ownership and no additional field work on these sites was conducted.

1.5 Screening Level Analysis of Indirect Discharge Alternatives (Section 5.1)

1.5.1 Water conservation can have significant impact on hydraulic loading to a leachfield. A wide variety of individual household water conservation approaches are described, their application needs to be appropriate to the household and users of the system. The report describes individual water conservation opportunities the individual household level. Water conservation can be an effective first line of defense for marginal onsite wastewater systems.

1.5.2 On July 1, 2007, the State of Vermont Department of Environmental Conservation will have jurisdiction over all potable water supplies and wastewater treatment and dispersal systems. All upgrades, repairs and new systems in East Montpelier will be permitted out of the VT DEC Regional Office in Barre. The Town of East Montpelier will generally not be able to have any technical standards that are different from Chapter 1 of the State of Vermont's Environmental Protection Rules (EPR).

1.5.3 The role of the East Montpelier Sewage Officer will change significantly as of July 1, 2007. The Town should therefore revisit Sewage Ordinance changes and revise the role of the Town in onsite wastewater system management according the the Wastewater Management Action Plan Framework (described in Sections 2.4 and 5.2.2).

1.5.4 If a site is constrained for a conventional onsite wastewater system, alternatives systems may enable a solution for an otherwise constrained area. Under the current EPR innovative/alternative onsite wastewater treatment system components are available. Many of these components can decrease the area required for a dispersal system (in-ground leachfield, at-grade system, or mound system); and decrease the minimum required vertical separation to estimated seasonal high groundwater from 36 inches to 18 inches.

1.5.5 Another option for marginal sites is greywater separation and composting toilets. Although composting toilets are not explicitly mentioned in the EPR, they decrease both hydraulic and organic loads to wastewater treatment and dispersal systems. and are approved by the state on a case-by-case basis. For new installations, if a site is fully complying with the EPR, the state may allow a decrease of the application area of the dispersal system that needs to be built by up to 35%. Greywater and non-toilet black water need to be treated in a fashion similar to household wastewater due to presence of pathogens in these waters.

1.5.6 Emerging technologies, that have potential application in Vermont, include drip dispersal systems and shallow gravelless trenches. These and other emerging technologies will need State of Vermont approval for use in new construction.

1.5.7 Collection alternatives evaluated for cluster wastewater systems include gravity sewer/pump station/forcemains, grinder pump/low pressure sewers, and septic tank effluent pump/low pressure sewer (STEP). STEP systems for collection appear to be the most appropriate for East Montpelier Study Area and North Montpelier Study Area if cluster systems are utilized.

1.6 Community Alternatives for the Villages (Section 5.2)

1.6.1 Wastewater management alternatives (see Table 3, page 43 for details) evaluated included:

1.6.1.1 Alternative 1 - Manage Existing Systems with Individual Solutions for Failed Systems. (Alternative 1-A is a small cluster soil-based dispersal system for an existing failed cluster system in the Study Area).

1.6.1.2 Alternative 2 - Manage Existing Systems with Individual Solutions for Marginal and Failed Sites.

1.6.1.3 Alternative 3 - Onsite Management Plus Off-Site Solutions for Individual Marginal and Failed Sites.

1.6.1.4 Alternative 4 - Onsite Management Plus Small Clusters for Marginal and Failed Sites.

1.6.1.5 Alternative 5 - Onsite Management Plus Large Clusters for Marginal and Failed Sites.

1.6.1.6 Alternative 6 - Off-site Management with a Large Cluster for All Sites.

1.6.1.7 Alternative 7 - Off-Site Management with Direct Discharging Systems (discharging treated effluent directly to surface waters) for All Sites.

1.6.2 Wastewater Management models for onsite, off-site, and cluster systems were analyzed and based on local conditions and needs. The onsite wastewater action plan framework was developed to be utilized for the individual systems under alternatives 1, 2, 3, 4, and 5 above.

1.6.3 Alternatives for all wastewater management models can be carried out by the following range of responsible management entities: the Town; establishment of a fire district(s); or a private organization - analogous to a homeowner's association.

1.6.4 High construction costs of clustered wastewater system options have led to the development of a wastewater management action plan framework (described in Sections 2.4 and 5.2.2) which provides a template for the Town to address wastewater needs.

1.6.5 Existing wastewater flows for the cluster system and direct discharge options are based on EPR design flows. Future wastewater flows in the study area were based on an estimated 16 percent increase in population in the Town of East Montpelier over the next 20 years.

1.6.6 Preliminary construction and operation/maintenance cost estimates were prepared for the alternatives.

1.6.6.1 Total costs were estimated for 2009, the expected earliest year on which a municipal infrastructure project is likely to be implemented.

1.6.6.2 Total Project Costs for infrastructure alternatives range from $330,000 to $9,500,000 (Alternatives 1A and 6 respectively; see Appendix G, Tables G-5, G-6, G-7 and G-8).

1.6.6.3 Estimated annual costs per equivalent users of these systems range from approximately $1700 to $1979 (Alternatives 1A and 6, respectively; see Appendix G, Table G-9), under best-case conditions for receiving grants and loans.

1.6.7 Alternatives 1 through 6 include individual onsite wastewater systems with replacement costs that may range from $7,500 to $38,000 for each parcel (see Appendix H, Table H-1).

1.6.8 Financing options for individual onsite system replacement include establishment of a municipal revolving loan program (borrowing from the Vermont Department of Environmental Conservation at 2% and loaning out money at 3%); individual low income loans from the United State Department of Agriculture Rural Development; or private financing through banks or credit unions.

1.6.9 For individual wastewater system replacement, estimated annual payments for a 20-year loan range from $538 for a $8,000 loan at 3% interest to $3,587 for a $38,000 loan at 7% interest.

1.6.10 Implementation of the Wastewater Management Action Plan without grant or loans would have an annual cost ranging from a maximum of $368 to $371 in the first four years while the program is set up and the systems are inspected. For the 5th through the 20th year, the annual cost per user would range from approximately $148 to $154 dollars per year. These costs may be reduced by grants and loans, as available.

2 RECOMMENDATIONS

Based on the findings of the Study, and conclusions presented above, it is hereby recommended that:

2.1 The Town carefully review the findings and recommendations presented in this report titled: Needs Assessment and Feasibility Study - Wastewater Treatment for the Village of the Town of East Montpelier. If the Town is in concurrence with the findings and recommendations, the Town should approve this report.

2.2 Alternative 2 is recommended for the Town to proceed and manage wastewater while refining wastewater needs in the villages. Other alternatives appear too costly under present funding scenarios.

2.3 Establish an approach to educate property owners regarding the transition from Town to State permitting of all small scale wastewater systems.

2.4 Seek grants to develop and implement the Wastewater Management Action Plan Framework. The first step is to develop a specific plan based on the elements in the framework (see Sections 2.4 and 5.2.2).

2.5 Implement the Wastewater Management Action Plan, as follows:

- 2.5.1 Provide public outreach, information and education of onsite wastewater system owners and users.
- 2.5.2 Inventory of onsite wastewater treatment systems
  - 2.5.2.1 Field inspection of onsite wastewater treatment systems
  - 2.5.2.2 Evaluation of soils in vicinity of existing onsite wastewater systems
  - 2.5.2.3 Locate failed systems and potential points of pollution
- 2.5.3 Continue to pursue best-fix approaches for marginal or failed systems as they become known
- 2.5.4 Develop and maintain a record-keeping program to track installed systems.
- 2.5.5 Provide and expand on information regarding potential sources of funding for individual onsite wastewater treatment system repairs and upgrades.
- 2.5.6 Promote public health protection, land use planning, and water qualtiy protection coordination among the following: Selectboard, Wastewater Advisory Committee, Sewage Officer, Health Officer, Planning Commission, and other appropriate local entities, regarding wastewater treatment capacity and compatibility with soil types.
- 2.5.6 Continue local discussion of establishing onsite wastewater management entities in the Villages as a potential model for implementing the Action Plan.
- 2.5.7 Participate in the ongoing revision of the Vermont Wastewater System and Potable Water Supply Rule (Environmental Protection Rules, Chapter 1) in advance of the July 1, 2007 jurisdictional changes, with specific emphasis on management and best fix systems.

2.6 From an overarching perspective, the Town can use this wastewater feasibility study as a springboard to move forward in:

2.6.1 Building local understanding of wastewater needs;

2.6.2 Developing a comprehensive documentation of the wastewater needs on all properties in the Villages; and

2.6.3 Increasing the property owners', residents', and business owners' role in addressing the management of wastewater at the local level.

3 INTRODUCTION

3.1 Purpose

The Town of East Montpelier retained Forcier Aldrich & Associates, Inc. (FA&A) to conduct a feasibility study to investigate the need for and feasibility of a range of wastewater management alternatives in the Villages of East Montpelier and North Montpelier.

Wastewater needs to be managed properly to enable the Town to protect water quality, protect public health, maintain or enhance quality of life and property value, and enable the community's desired level of future growth. Infrastructure is one element of wastewater management; that infrastructure can be individual onsite wastewater treatment systems (septic systems), shared or cluster systems, and community systems. Decentralized wastewater management involves equal consideration of all these options with an objective of finding the optimal solution or combination of solutions that is appropriate to the specific location.

The Town has four main goals, as directly quoted from the Request for Proposals:

- *To protect and improve surface and groundwater quality in Town.*
- *To address and fix any currently failed systems in the villages.*
- *To provide long-term sewage treatment solutions that would allow commercial and residential growth within the village areas.*
- *To proactively address the potential for failed septic systems in the villages, where many of the small lots have insufficient space to install new septic systems that would comply with current state regulations.*

To address these goals, the questions to be asked for each village are:

- What is the actual extent of wastewater needs from both a water quality and public health perspective, now and in the future?
- What are the technically and financially feasible means to address wastewater alternatives for infrastructure and/or management?
- What wastewater infrastructure and/or management alternatives most closely match the Town's priorities for the villages in the form of a sustainable long-term solution?

To answer these questions, we have developed a hands-on approach to understand the site, soil, and water quality conditions in each village, as described in the Scope of Services (Section 3.3). The State of Vermont Department of Environmental Conservation (DEC) is involved in the project as they are providing funding and will provide regulatory approval of solutions that are under their jurisdiction.

3.2 Background

The Town of East Montpelier is a community of approximately 2,578 residents (2000 US Census), located in Washington County, Vermont, approximately six miles northeast of the City of Montpelier, Vermont. The Town had a median household income of $46,469 in 1999. Two historic village centers, East Montpelier village and North Montpelier, are located along major transportation arteries Routes 2 & 14, and Route 14, respectively.

The developed parcels in the village primarily rely upon individual onsite wastewater treatment systems, with the exception of a few off-site individual systems located in each village and a small cluster system located in East Montpelier Village.

Soils can act as both a treatment media and a dispersal media for land-based wastewater systems. The soils in the village areas are variable, with glacial tills generally on uplands with lake-bed and floodplain deposits in the valley bottom. Although some failures have been reported, as noted above, suitable soils for onsite wastewater systems have been found on some parcels in the villages that have been able to accommodate new development. Other parcels have had depth to groundwater or space limitations for new or replacement onsite systems. Inadequately managed wastewater can impact both groundwater, and surface waters. The groundwater is tapped for drinking water by both individual, shared and community water systems in the village areas. The groundwater also recharges the down-gradient surface waters.. Intermittent and year-round tributary streams also join the Kingsbury Branch and the Winooski River in the village areas.

Since approximately 1987, the Town of East Montpelier has had an onsite sewage ordinance to protect water quality and public health, as well as to prevent nuisance conditions. The village areas rely on individual onsite and private cluster wastewater treatment and dispersal systems. Reportedly, there have been failures of septic systems in East Montpelier village that either have been either addressed by building a complying or best-fix wastewater dispersal system or are not being addressed due to lack of suitable and available land. However, the number of parcels with wastewater systems where the system and soil conditions are known are outnumbered by the parcels where there is no onsite information regarding soil suitability and system design.

Public health is a priority, as failed onsite systems can contribute to transmission of waterborne diseases and diminish the quality of life for the residents. The Town has designated both East Montpelier village and North Montpelier village as growth centers. There is a desire for growth that is compatible with the villages' natural and cultural characteristics. The Town needs to know the opportunities and limitations to commercial and residential growth that are the result of wastewater management practices. This knowledge will enable the town to develop an action plan that has both short-term and long-term solutions for wastewater management.

Property values and the ability to concentrate growth in village areas are potentially limited by onsite wastewater treatment systems.

The Town of East Montpelier is rightfully insisting that the alternatives to be considered are not limited to conventional or even currently approved "innovative/alternative" solutions. A wide range of options, including water conservation, source separation, and emerging technologies, need to be considered alongside prescriptive and performance-based onsite and cluster systems, as potential solutions.

3.3 Scope of Services

The scope of this study has three main parts: Preliminary Investigation, Analysis of Alternatives and Presentation of Process, Findings, and Recommendations. The purpose of this report is to present the findings of the study within the following scope of services:

- Define Village Study Areas
- Resident and Property Owner Survey
- Build Out Analyses
- Wastewater Needs Investigation
  - Background Data Collection and Review
  - Field Investigations.
  - Onsite Wastewater Inspections
  - Surface Water Reconnaissance
  - Estimates of Potentially Useable Area and Soil Absorption System Capacity
  - Definition of Problem Areas
- Screening Level Analysis of Indirect Discharge Alternatives
  - Wastewater Flow Reduction and Discharge Prevention
  - Decentralized Wastewater Pretreatment
  - Decentralized Wastewater Treatment
  - Septic Tank Effluent/Secondary Effluent Dispersal
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- Development of Community Wastewater Management Alternatives
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- Municipal Infrastructure Wastewater Management Alternatives
  - Description of Alternatives
  - Preliminary Cost Estimates
- Private Infrastructure Wastewater Management Alternatives
  - Description of Alternatives
  - Preliminary Cost Estimates

- Recommend Wastewater Management Options
- Presentation of Process, Findings, and Recommendations
  - Kickoff Meeting with Wastewater Advisory Committee (WAC)
  - Initial Community Informational Meeting
  - Joint meeting of WAC & Planning Commission Regarding Build Out Analysis Assumptions and Criteria
  - Presentations to WAC
    - Preliminary Investigation Results (30% draft)
    - Alternatives for Cost Estimates
    - Alternatives Analysis (60% draft)
    - Draft Final Report and Findings (90% draft)
  - Community Informational Meeting Regarding Final Report

4 PRELIMINARY INVESTIGATION

4.1 Village Study Areas

The East Montpelier Wastewater Advisory Committee (WAC) has worked with FA&A to delineate study areas in each village (Appendix A, Figures 1 and 2). Roads, surface waters, parcel boundaries, and soils have been obtained from The Central Vermont Regional Planning Commission for each study area.

The East Montpelier Village Study Area has 141 parcels, totaling over 415 acres, of which 126 parcels are developed with residential, commercial, industrial, and institutional uses. The Crystal Springs Water Company has approximately 650 service connections around the Village. Water use is primarily domestic; however, some commercial and industrial customers are served. There are a few individual onsite wells in the study area. The Winooski River runs through the East Montpelier Village Study Area.

The North Montpelier Village Study Area is centered around the bridge over North Montpelier Pond. The North Montpelier Village Study Area has 32 parcels, totaling over 69 acres, of which 31 parcels are developed with residential, commercial, industrial, and institutional uses. North Montpelier has a shared water system that provides spring water to approximately six users, the remaining existing residential and commercial uses are typically served by individual onsite wells. The Kingsbury Branch of the Winooski flows through North Montpelier Pond in East Montpelier.

4.2 Property Owner Survey Questionnaire

A draft survey was developed by the WAC and was revised with input from FA&A. Approximately 162 copies of the survey were mailed out to the owners of 226 parcels. The survey recipients included all property owners within the study areas, and also included a few property owners immediately adjacent to the study area. Thirty-five survey responses were received from residents of East Montpelier village and North Montpelier village. Responses to the survey questionnaire are summarized in three categories: one category for each village, and one for the respondents outside of the study areas (Appendix B).

Twenty-seven responses came from East Montpelier village, eight from North Montpelier and eight from out of the study areas. The percentage of the total number of surveys for each village area that gave the particular answer are reported for each question.

The specific answers for the survey questions have been and will be kept confidential as stated on the survey cover letter.

Owner's perception of the condition of their systems as "pretty good" to "excellent" were 45% in East Montpelier Village, and 100% in North Montpelier Village.

Based five responses, construction costs of system replacements over the past ten years were generally in the range of $9,000 to $12,000. One respondent reported a replacement cost of approximately $37,000.

In East Montpelier Village, interest in a shared or community system was relatively evenly split between yes (19%), no (22%), and need more information (22%). Thirty-seven percent of the East Montpelier surveys returned did not have a response to this question. In North Montpelier Village interest in a shared or community system was tentative, with yes (13%) no (38%) and need more information (50%). All North Montpelier surveys returned had a response to this question.

4.3 Build Out Analyses

The build out analysis evaluated 156 existing parcels in the study areas - 126 parcels in East Montpelier and 30 in North Montpelier. (Note: the build out analysis was completed prior to the expansion of the study area in each village). The build out analysis was conducted by CVRPC (Appendix C). The build out analysis was conducted using assumptions that were reviewed by the East Montpelier Planning Commission. The build out analysis assumed that the zoning for the village (residential and commercial) zoning districts had a 0.75 acre minimum lot size, less than the current 1.0 acre minimum lot size. Also the build out analysis assumed that only parcels with existing commercial would have additional commercial development in the future. This last assumption was made to simplify the analysis. As commercial land uses are so variable, it was not practical to estimate specific future commercial uses for this build out analysis

The key finding of the build out analysis of both village areas was that the parcels with existing development are essentially built out according to current zoning requirements The build out for currently undeveloped parcels in East Montpelier revealed significant growth potential. However, in North Montpelier undeveloped parcels were generally not included in the study area and therefore a lesser growth potential was estimated for North Montpelier.

Lot-by-lot wastewater flow estimates for existing and build out conditions have been prepared (Appendix C, Table C-5). Existing flows were estimated using bedroom counts and commercial square footage from the Town Assessor's files and town or state permit data. For commercial occupancies with no permit data, a design flow of 100 gallons per day for every 1,000 square feet of floor area was used. This would represent approximately 6 employees for the conversion of a 1000 square feet of residential space to retail or office use. For residential uses, the design flows from the 2002 Environmental Protection Rules, Chapter 1 were used to estimate wastewater design flows for individual onsite systems and large cluster systems.

4.4 Wastewater Needs Investigations

Wastewater and water supply permit data for individual parcels in each village study area have been collected for 26 lots (Appendix D, Table D-1). The approximate location of the Crystal Springs Water System distribution system was provided by Mr. Dean Hedges. Individual onsite water supply wells were located in the field. No public community drinking water supply source protection areas were located in the study area. The approximate locations of well shields for individual drinking water supply wells were determined using USGS topographic maps (Appendix A, Figures 6 and 7).

4.4.1 Background Data

East Montpelier was divided into four subareas for the purpose of understanding common conditions for wastewater needs (Appendix A, Figure 4). North Montpelier was evaluated as a single area, due to it's small size (Appendix A, Figure 5). The following subareas were defined, and the distribution of parcels summarized (Table No. 1, page 15), for the following subareas:

- Subarea 1 - East Montpelier Village - 70 to 425 Quaker Hill Road
- Subarea 2 - East Montpelier Village - 75 to 285 Kelton Road; and 75 to 335 Route 14 North (North of Route 2)
- Subarea 3 - East Montpelier Village - 2283 to 3070 Route 2
- Subarea 4 - 2415 to 2165 Route 14 S and adjacent side streets.
- Subarea 5 - North Montpelier Village - 2830 to 3320 Route 14N; 90 to 305 Factory Street; 2023 to 2051 Route 214; and 35 Butterfield Road

Table No. 1
Summary of Parcel Data by Subarea

Subarea	Developed Parcels	Undeveloped Parcels	Total Number of Parcels	Residential Occupancies	Commercial/ Institutional Occupancies
1	22	1	23	22	0
2	15	5	20	12	3
3	52	0	52	39	13
4	37	9	46	33	4
East Montpelier Village Subtotals	126	15	141	106	20
5 (North Montpelier)	31	1	32	29	2
TOTALS	157	16	173	135	22

4.4.2 Field and Permit Investigations

Town and State of Vermont onsite wastewater system permit records where reviewed for parcels in the study areas. Permit data was available for 22 parcels in East Montpelier and 4 parcels in North Montpelier (Appendix D, Table D-1). These permits typically had plans for onsite replacement areas. Some permits had soil test pit data to support the onsite wastewater system design.

Voluntary on-site system inspections were solicited in the survey questionnaire. Eleven respondents requested inspections - four in East Montpelier, four in North Montpelier, and three out of the study area. During the month of June, FA&A completed three inspections in East Montpelier, three in North Montpelier and two out of the study area. The number of inspections was limited to eight by the availability of owners within the time frame allocated for the inspections.

FA&A walked through each study area making a visual assessment. of suitability for onsite wastewater capacity. A canoe was used to look for potential points of pollution along North Montpelier Pond. High water in the Winooski River during August site visits prevented us from being able to walk or canoe the Winooski River in East Montpelier Village. Appendix D (Table D-1) summarizes types of wastewater systems, conditions of systems, including the documented failed system. Only one potential

point of pollution was identified in East Montpelier Village - a shared off-site system. At the time of the site visit, there appeared to be surfacing effluent that combined with runoff, and flowed to the Winooski River. No other systems appeared to have imminent potential for failure, although two site inspections revealed very small systems relative to the size of the residential dwelling served by the system. Although anecdotal information revealed a reported failed system in North Montpelier, follow-up communication with the Sewage Officer, revealed no apparent potential points of pollution in North Montpelier village.

4.4.3 Estimates of Potentially Usable Area and Soil Absorption Capacity

Potentially usable areas for onsite wastewater systems have been defined in each village study area (Appendix A, Figures 6 & 7). Estimated application rates, linear loading rates, soil absorption system types, and representative dimensions in each village study area have been estimated (Appendix D, Table D-2).This estimation of soil characteristics relates to sizing onsite systems and is based on Natural Resources Conservation Service (NRCS) soil suitability ratings, soil descriptions, experience working with Vermont soils, and the Simplified Desktop Hydrogeologic Analysis Guidelines (VTDEC, 2003).

Soil suitability for onsite wastewater was estimated using NRCS soil survey mapping units (Appendix A, Figures 8 and 9). These data are intended for planning purposes only and should not be used to determine the suitability of a specific parcel of land or location for onsite wastewater systems.

In East Montpelier village, the mapping units indicated soils suitable for inground leachfields along Route 2 between the Route 14 South intersection and the Route 14 North intersection. However, review of test pit logs in soil permit applications, and the presence of mound systems in this area, prompted the change in status of two soil mapping unit areas from well suited to potentially suited for onsite wastewater systems (Appendix A, Figure 8). At least one inground system has been permitted in this area. Overall, the soils in the study area are generally marginally suited for onsite wastewater system with the exception of an area south of the Winooski River and north of the Sandy Pines Mobile Home Park.

In North Montpelier, the soils mapping units in the vicinity of the dam are generally marginally suited for onsite wastewater systems (Appendix A, Figure 9). Well suited soils are present up the hill along Route 14 south of the dam, and along Route 214 east of the North Montpelier Store.

4.4.4 Definitions of Problem Areas

Parcels with potential limitations for onsite wastewater treatment and dispersal systems in each village study area were identified (Appendix A,

Figures 10 & 11). One point of pollution was identified.

The village of East Montpelier has approximately 28 developed parcels with apparent area limitations for onsite replacement systems and approximately 8 developed parcels with apparent limitations for soils (Appendix A, Figure 10). The area limitations also include parcels that have steep slopes that constrain the useable area. The total of 36 developed parcels with onsite limitations comprise approximately 32% of the developed parcels in the village. The areas with apparent limitations for onsite wastewater are generally located in 5 or 6 clusters in the village.

The village of North Montpelier has approximately 13 parcels with apparent limitations for onsite systems. This number is approximately 45% of the total number of developed parcels in this village. These parcels are generally clustered on either side of the lower pond. Two parcels are located between Route 14 and the upper pond.

4.4.5 Potential Areas for Off-Site or Cluster Systems

NRCS soil mapping units with potential suitability for conventional inground leachfields, and prescriptive mound systems within one mile of the approximate centroid of each study area were identified (Appendix A, Figures 12 & 13). The Town had done testing at the Wyman property on Route 2 approximately one-half mile east of East Montpelier Village (personal communication, R. Czaplinski, 2006). The soils on a good portion of the Wyman property reportedly consisted of deep well drained material.

The East Montpelier Volunteer Fire Department is looking for a site to build a new fire station, preferably in or near East Montpelier village (personal communication, T. Rolland, 2006). This may present an opportunity for the Town to collaborate with the Fire Department to find a site that may have capacity and proximity for an off-site wastewater system to serve a small or large cluster of users in East Montpelier village.

5 ALTERNATIVES ANALYSIS

5.1 Screening Level Analysis of Indirect Discharge Alternatives

This section provides a summary screening level analysis of indirect discharge alternatives. The bibliography in Appendix E provides the sources of references cited in this section.

For this report, indirect discharge alternatives include all subsurface wastewater dispersal systems, including small scale systems and indirect discharges that do not directly discharge wastewater to surface waters. In Vermont, small-scale systems (<6,500 gpd) are regulated by the Environmental Protection Rules, Chapter 1 Wastewater System and Potable Water Supply Rules (commonly referred to as the EPR). Large-scale systems (> 6,500 gpd) are regulated under the Environmental Protection Rules, Chapter 14, Indirect Discharge Rules (IDR).

Currently, the Town of East Montpelier has jurisdiction over all wastewater systems in town serving single family homes that do not have, nor do not require, a state subdivision permit. As of July 1, 2007, the State of Vermont will have regulatory jurisdiction over all small scale potable water and wastewater systems. At that time the Town of East Montpelier will not be able to have any technical criteria for decentralized or onsite wastewater treatment systems that are different from the EPR (Thompson, 2006).

A summary along with an evaluation of wastewater management options is provided in section 5.1.5. Table No. 2 (pages 32 - 35) provides a summary of the advantages and disadvantages of each wastewater management option, followed by a discussion of specific alternatives for East Montpelier and North Montpelier villages.

5.1.1 Wastewater Flow Reduction and Discharge Prevention

Water conservation can both improve the longevity of a properly operating system and decrease the degree of failure if a system is clogged or surfacing. This section provides a description along with an evaluation of the advantages and disadvantages of the following types of flow reduction and discharge prevention systems. These approaches decrease or divert the amount of waterborne wastes away from soil absorption systems.

5.1.1.1 Low Flow Plumbing

Low flow faucets, low flow showerheads , and ultra low flow toilets have been required for all new plumbing fixtures sold in the United States since 1992. According to the American Water Works Association, the following definitions are generally used for low flow fixtures:

Low Flow Faucet:	2.2 gallon per minute (gpm) or less at 80 pounds per square inch (psi)
Low Flow Showerhead:	2.5 gpm or less at 80 psi
Ultra Low Flow Toilet:	1.6 gallons per flush (gpf)

Fixtures with these flow ratings are approved by the Vermont Plumbing Code. Many existing houses have older plumbing fixtures. Generally before 1980, toilets required 5 gpf. Between 1980, when California required low flow toilets (3.5 gpf) and 1992, new toilets could be either 3.5 gpf or 5 gpf.

Low flow and ultra low flow fixtures reduce the hydraulic loading on a leachfield and also reduce the amount of water required to be supplied to the building. They are readily available at hardware and home supply stores.

There are a number of management strategies to increase the use of low flow fixtures. These can be implemented at the municipal level.

Sewage code that requires all wastewater system repairs and upgrades include retrofitting the household plumbing, that may include:

- Local building code that require all plumbing upgrades comply with the Vermont Plumbing Code (there currently is not local plumbing code enforcement in East Montpelier)
- Incentive programs that provide discounted or rebates on low-flow plumbing fixtures
- Toilet exchange programs that offer ultra low flow toilets in exchange for 3.5 gpf or 5 gpf toilets.
- Public education program promoting the benefits of low flow and ultra low flow fixtures
- Mandatory low flow and ultra-low flow plumbing includes mandating that users upgrade toilets, sinks and showerhead to low flow fixtures.

It is important to realize that low flow and ultra-low flow fixtures result in an increased strength of waste needed for disposal. Therefore, the soil application rates and/or treatment system design need to be adjusted to accommodate the higher strength wastewater at lower flow rates.

5.1.1.2 Low Water Use Appliances

Clothes washing machines and dishwashers are now manufactured in low consumption models.

- Horizontal axis washing machines can provide water savings from 30 to 50% over conventional models (Leverenz, et al, 2002).
- Water conserving dishwasher machines can use as little as 5 to 8 gallons per load. (Leverenz, et al, 2002).

5.1.1.3 Extremely Low Flow Toilets & Waterless Urinals

There are a number of types of toilets that are relatively conventional in appearance but use very little or no water. These are foam flush toilets, vacuum flush toilets, and compressed air toilets

- Foam Flush Toilets. These toilets use a mixture of water and a biodegradable alcohol-based soap. They use approximately one cup water per flush (0.0625 gpf). They can be used with either composting toilets and water carriage systems (with a transfer unit) In Vermont, they are in use in a new building at Vermont Law School and a new dormitory at the University of Vermont. They are manufactured in Japan by Nepon, are distributed by Clivus New England, and are readily available in the United States.
- Vacuum Flush Toilets. These units use a vacuum system and use as little as one pint of water per flush (0.125gpf).
- Compressed Air Toilets. These units add compressed air to water to use from 0.125 gpf to 0.5 gpf.
- Waterless Urinals. Waterless urinals are widely available. They generally use a oil-filled trap to prevent odors from emanating into the room. The urine is typically mixed with the blackwater prior to dispersal.

5.1.1.4 Urine Diverting Toilets

These toilets were developed in Scandinavia to reduce water use and to collect nutrients (nitrogen and phosphorus) for reuse prior to mixing with wastewater. A separating rim in the front of the bowl of the toilet collects the urine for reuse. The fecal matter is removed either by gravity in composting toilets or flushing in conventional toilets. Although not widely used, urine separating toilets are available in the US.

5.1.1.5 Greywater Separation and Composting Toilets

Greywater separation and composting toilets can be used to decrease hydraulic loading to leachfields or mound systems. Greywater is generally considered to be water from bathroom and lavatory sinks, showers, tubs, washing machines. Blackwater is generally considered to be toilet water, dishwashers, kitchen sink

water, and wash water soiled with diapers (State of California, 1995). Dual plumbing systems can be used to divert the greywater from the black water, although this does not result in any decrease in overall wastewater flow. To achieve a water flow reduction, the greywater needs to be associated with other flow reduction approaches such as a composting toilet.

Greywater must be treated as a pathogenic material since if someone is infected with or is a carrier of pathogens and washes their hands, takes a shower, or if pathogens are washed off clothing (other than diapers) or objects in a sink they will be in the greywater. The State of Vermont does not have specific rules pertaining to greywater, therefore the greywater should be treated and dispersed in a manner similar to blackwater.

Composting toilets are designed to store and compost, by aerobic bacterial digestion, human urine and feces, which are non-water carried. Toilets may include necessary venting, piping, electrical, and/or mechanical components. Separating, treating and disposing of grey-water and blackwater separately can have its advantages. Composting toilets can reduce total wastewater volume by about 40% to 50%, and grey water may be treated and disposed of through conventional or alternative means, depending upon site conditions and soil conditions.

Composting toilets are a proven wastewater management technology. They can be a viable component of a wastewater management program, providing a significant reduction (40-60%) of water use and subsequent need for wastewater treatment and disposal, if the conditions for installation, operation and management are appropriate.

The current regulatory practice in Vermont requires that composted material be buried onsite at least 12" below ground surface.

There are many types of composting toilets that are readily available. Leverenz, et al (2002) breaks down types of composting toilets based the following characteristics:

- Location
  - self-contained (above floor)
  - centralized (below floor)
- Composting method
  - continuous
  - batch
- Level of sophistication
  - passive

- intensive

Detailed information on, and discussion of, these types of composting systems is available in reference materials (Leverenz, 2002; Del Porto & Steinfeld,1998). It is worth noting two points:

- In the 1980s, a Vermont DEC study of self-contained composting toilets in use in Vermont revealed a very low level of user satisfaction with these units (Van Houten, ~1987).

- The two institutional applications in Vermont, mentioned above, utilize centralized composting toilets in conjunction with foam flush toilets.

It is apparent from the literature that a centralized composting unit would be the most appropriate for continuous use in a single family dwelling, business, or institution. The application of composting toilets in existing buildings is an option that would require retrofitting of bathrooms. The feasibility of retrofits for an individual building depends on the location of existing bathrooms and ability to provide plumbing or chutes that can lead to a centralized composting unit in the basement. If the composting system is not in the basement, then the floor of the area where the centralized composter is located must be reinforced to handle the weight of a full composting unit. Centralized composting units should be readily accessed from outside for maintenance. Greywater treatment and dispersal capacity would be required.

5.1.1.6 Holding Tank Systems

A holding tank system is a water tight tank designed to hold a specific amount of wastewater along with controls, alarms, and pump-out features to facilitate easy and reliable pumping of the sewage from the tank. The system must be pumped out when full. Due to frequent emptying of holding tanks, if they are installed in an area of high groundwater, the bouyancy of the empty tank (the tendency of an empty tank to float and possibly rise out of the ground) must be taken into account, A high water alarm is used to indicate when pumping is needed. The wastewater is then trucked to and disposed of at an approved facility.

Holding tanks are allowed under the EPR (§1-522) for limited applications. They can be use for publicly owned buildings that have less than 600 gpd design flows and no feasible alternatives for wastewater treatment and dispersal. The EPR requires 14 day flow capacity for these holding tanks. For reference, assuming that a holding tank is sized to be pumped out once every two

weeks, then a 6,000 gallon tank would be required for a three bedroom home (420 gpd).. Over the course of a year, up to 156,000 gallons may need to be pumped out.

Holding tank systems have a potentially low design and construction cost; but have the highest operational costs associated with trucking and disposal of raw wastewater.

5.1.2 Decentralized Wastewater Pretreatment

This section provides a description along with an evaluation of the advantages and disadvantages of the following types of system components for pretreatment of wastewater:

5.1.2.1 Septic Tank Volume and Compartmentalization

A septic tank is a buried, watertight container used to clarify and partially treat wastewater. The recommended volume of a septic tank is a function of the household water usage and the detention time needed to perform clarification and treatment. Efficient clarification takes time to complete because fats, oils, greases, and suspended solids travel slowly in water and may require hours to either float to the top or settle to the bottom. The recommended detention time ranges from 36 to 48 hours, but the absolute minimum is 24 hours.

The septic tank will serve as a receptacle for all the settleable and floatable materials until the tank is pumped. For this reason, the tank design must include provisions for adequate storage. The storage capacity is based on the intended use of the tank and the anticipated pumping interval. A tank that is too full of solids will have a shortened detention time and will not function properly and will allow unwanted substances to pass through to the soil absorption system.

For single family residences with a design flow of less than 667 gallons per day, a standard septic tank volume of 1,000 gallons is adequate. For systems larger than 667 gallons per day, the tank should be designed to provide adequate volume for the septic tank's reserve volume, operating range for modulation, clear zone, scum volume, and sludge volume, as well as a detention time from 36 to 48 hours, with an absolute minimum of 24 hours.

Compartmentalization can enhance the operation of the septic tank. A two-compartment tank helps to eliminate the possibility of short-circuiting wastewater through the system.

5.1.2.2 Septic Tank Effluent Filters

Effluent filters have been developed for use in septic tanks to filter the effluent prior to discharging it either to the leach field or to further treatment processes. One type of filter uses a series of plastic trays, and another filters the effluent through a series of long tubes and screens as the effluent flows upward through the outlet pipe of the septic tank. These filters can provide for enhanced solids removal, with associated Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) reduction. These filters are required to be cleaned at certain intervals. The cleaning intervals are dependent on the type of filter being used along with the flow volume and waste strength. Typically the filters should be cleaned a minimum of once per year. Filters are typically cleaned by simply pulling up on the cartridge handle, placing the cartridge over the inlet access of the septic tank, spraying the cartridge off using a garden hose, and returning the cleaned cartridge in place.

5.1.3 Decentralized Wastewater Treatment

5.1.3.1 Passive Attached GrowthTreatment Systems

Passive attached growth treatment system are systems that rely on gravity flow for distribution. Types of passive treatment systems currently allowed in the EPR include:

- Conventional soil absorption systems
- Intermittent peat filters
- In-field pipe/geotextile treatment/dispersal systems (*Presby Systems*)

These types of systems are typically less costly to construct and maintain. They require no expensive pumps or blowers. There are no electrical and fewer, mechanical, and maintenance costs associated with them.

A conventional soil absorption system is the ideal system in the proper soil conditions. Conventional soil absorption systems are the least expensive to construct and maintain. Conventional soil absorption system require a minimum of 36" depth to seasonal high groundwater table below the bottom of the infiltrative system. Assuming a 6" depth to bottom of the infiltrative system (e.g., a trench or bed), the minimum depth to seasonal high groundwater for a conventional soil absorption system is approximately 42" below ground surface. Conventional soil absorption systems also require a minimum of 48" depth to bedrock below the bottom of the infiltrative system. Again, assuming a 6" infiltrative system depth, the minimum depth to bedrock for a conventional soil

absorption system is approximately 54" below ground surface. The required depths to seasonal high groundwater and bedrock increases for greater ground surface slopes.

Intermittent peat are single pass attached growth systems along with filtration that provide significant treatment (< 30 milligram per liter (mg/L) for both: five-day Biochemical Oxygen Demand (BOD_5); and Total Suspended Solids (TSS)) of low strength wastewater effluent prior to disposal. These systems meet the EPR for Filtrate Effluent Disposal Systems. Therefore, the loading rates may be increased, thus reducing the size of the disposal system. The isolation distance to seasonal high water table and bedrock may also be reduced. These passive treatment systems typically cost less than active treatment systems and have lower operation and maintenance costs. These systems work best when there is an elevation difference between the treatment system and the disposal system, as they rely on gravity. Passive systems may not be suitable for sites with low permeability soil or sites with shallow depths to seasonal high groundwater and/or bedrock.

In-field pipe and geotextile treatment/dispersal systems are currently only approved as a single proprietary system in Vermont. They can provide up to a 50% decrease in loading area and vertical separation to groundwater.

5.1.3.2 Active Attached Growth Treatment Processes

Attached growth treatment processes provide biological treatment in which microorganisms responsible for the conversion of organic matter or other constituents to gases and cell tissue. These microorganisms are attached to media such as rocks, plastic, or textile materials. Attached growth processes are also known as fixed film processes.

Types of attached growth treatment processes approved for general use in Vermont include:

- SeptiTech, Recirculating Fixed Film Treatment System
- *Advantex*, Textile Recirculating Fixed Film Treatment System
- *Bioclere*, Recirculating Fixed Film Treatment System
- *Puraflow* and *Ecoflow Biofilter*, Peat Recirculating Fixed Film Treatment Systems
- *EcoFlow,* Aerated Constructed Wetland System

Attached growth treatment processes provide significant treatment of low and medium strength wastewater (< 30 mg/l BOD_5 and TSS) prior to disposal. These systems meet the State of Vermont, Environmental Protections rules for Filtrate Effluent

Disposal Systems. Therefore, the loading rates may be increased thus reducing the size of the disposal system. The isolation distance to seasonal high water table and bedrock may also be reduced.

Attached growth treatment process typically have a higher construction cost than suspended growth treatment processes. Attached growth processes can handle surges in flow better than suspended growth systems and provide better quality effluent under surge conditions. Attached growth systems typically have lower operation and maintenance costs than suspended growth systems.

5.1.3.3 Active Suspended Growth Treatment Processes

Suspended growth treatment processes provide biological treatment in which microorganisms responsible for the conversion of organic matter or other constituents to gases and cell tissue are maintained in suspension within the liquid.

Types of attached growth treatment processes approved for general use in Vermont include:

- *Norweco Singular*, Suspended Growth Extended Aeration System
- *MicroFAST*, Fixed Activated Sludge Treatment Systyem
- *Aqua Aire* and *Aqua Safe*, aerobic Wastewater Treatment Systems

Attached growth treatment processes provide significant treatment of low and medium strength wastewater (< 30 mg/l BOD_5 and TSS) prior to disposal. These systems meet the State of Vermont, Environmental Protections rules for Filtrate Effluent Disposal Systems. Therefore, the loading rates may be increased, thus reducing the size of the disposal system. The isolation distance to seasonal high water table and bedrock may also be reduced.

Suspended growth treatment processes typically have less expensive construction costs than attached growth treatment processes. Suspended growth processes cannot handle surges in flow as well as attached growth systems and do not provide as good quality effluent under surge conditions. Suspended growth systems typically have higher operation and maintenance costs than attached growth systems.

5.1.3.4 Emerging Treatment Technologies

The widespread use of innovative and alternative systems in Vermont and nationally has led to a significant amount of innovation. However, all technologies will need to be approved by the State of Vermont DEC, as of July 1, 2007 prior to use. Emerging technologies include energy-intensive approaches such as in-house microwave wastewater treatment units and the use of specific bacteria species and aeration to enhance septic tank performance. These are not in widespread use in Vermont.

Tertiary advanced treatment followed by ultraviolet disinfection and reuse is allowed for institutional use as can be observed in Vermont at the I-89 Sharon Rest Area, where the treated wastewater is reused for toilet flushing. This approach has been incorporated into a few single family residences such as the Toronto Healthy House (Paloheimo and LeCraw, 1996). The Toronto Healthy House is an urban residence that utilizes secondary treatment, tertiary treatment, and ultraviolet disinfection and reuse for toilet flushing.

5.1.4 Septic Tank Effluent/Secondary Effluent Dispersal

Wastewater that has either been settled in a septic tank or treated in a filtrate system needs to be safely dispersed into the environment. Soil dispersal systems are required to apply effluent to the soil at a loading rate appropriate for treatment in the unsaturated soil beneath the dispersal system, and to provide even hydraulic distribution to keep the wastewater below the ground surface until it can safely mix with surface water.

5.1.4.1 Soil Dispersal Systems

Soil dispersal systems require sufficient area to allow for percolation of wastewater into the soil. This area is determined by the type of the system and is based on percolation rate of the soil. The following soil dispersal system requirements are based on the EPR:

Conventional gravity dispersal systems typically consist of a distribution box and a subsurface stone seepage bed or absorption trench filled with stone and 4" perforated pipe, which are covered with filter fabric, backfill material and topsoil. The depth to seasonal high groundwater needs to be a minimum of 42" and bedrock 54" below ground to construct a conventional septic tank/gravity dispersal systems. With adequate depths to bedrock and seasonal high groundwater across the width of the system, beds and trenches can be used on ground surface slopes

of up to 10% and 30%, respectively.

A pump station is required to dose a dispersal system when the dispersal system is upgradient of the treatment system(s). When at-grade or mound dispersal systems are used, the distribution system is required to be pressurized. Dosing and pressure distribution is recommended on all systems by the EPR rules and is required when the design flow requires more than 500 linear feet of distribution piping. If the disposal system is located down gradient of the treatment system(s), a dosing siphon could be used in lieu of a pump station. A dosing siphon provides pressure but works on elevation (head) pressure and does not require electricity.

A pressurized in-ground disposal system is similar to a gravity disposal system in construction except the piping is pressurized consisting of smaller sized pressure piping with holes sized and spaced properly. The depth to seasonal high groundwater needs to be a minimum of 42" and bedrock 54" below ground to construct a pressurized in-ground disposal system. The slope requirements are the same as trenchs and beds, noted in Section 5.1.4.1.

At-grade systems may be used on sites that are not suitable for in-ground systems because of inadequate depth to water table, bedrock, or impermeable soil. At-grade systems offer an alternative to mound systems in some situations. At-grade systems are constructed by tilling the ground surface and placing the stone directly on the tilled surface. Stone aggregate is not placed in the subsurface as an in-ground disposal system and no sand is placed under the stone as in a mound system. Pressure pipe with holes sized and spaced appropriately is placed in the stone. The stone is covered with with filter fabric, backfill material and topsoil. The depth to seasonal high groundwater needs to be a minimum of 36" and bedrock 48" below ground to construct an at-grade disposal system. At-grade systems can be used on ground surface slopes up to 20%.

A mound system can be utilized when an area has a seasonal high water table to within 24" of the ground surface and/or the native soil has poor percolation capacity. Mounds are constructed above grade to artificially provide a minimum of 36" of unsaturated soil between the bottom of the mound infiltrative surface and the seasonal high water table. Mound systems are constructed by tilling the ground surface and placing a minimum of 12" of sand directly on the tilled surface. The sand must meet the sieve requirements of the EPRs. Additional sand and stone for infiltration is placed over the minimum 12" of sand. Pressure pipe

with holes sized and spaced appropriately is placed in the stone. The sand and stone is covered with filter fabric, backfill material, and topsoil. The depth to seasonal high groundwater needs to be a minimum of 24" and bedrock 36" below ground to construct a mound disposal system. Mound systems can be used on ground surface slopes up to 30%.

A filtrate treatment system consists of a treatment system after a septic tank in which the treated effluent has less than 30 mg/l BOD_5 and 30 mg/l TSS. A filtrate disposal system can allow the loading rate to the disposal system to be increased to up to twice the loading rate allowed for septic tank effluent.This can allow up to a 50% reduction in the size of the disposal system. Filtrate treatment systems also allow a reduction in the isolation distances required from the bottom of the leachfield to bedrock and the seasonal high water table. The EPR includes intermittent sand filters and recirculating sand filters among several non-proprietary filtrate treatment systems, The State of Vermont maintains a list of several proprietary filtrate treatment systems; these approved Innovative/Alternative systems need to meet the filtrate treatment requirements.

Performance based soil dispersal systems can be installed on sites with deeper than 18" depth to bedrock and with the induced groundwater mounding deeper than 6" below grade. When using a performance based approach to evaluate a site and design a system in an area with a seasonal high water table less than 24" below ground surface, a higher level of soil and site investigations, including hydrogeologic capacity evaluation, are required.

5.1.4.2 Two-year Time of Travel Management Zone

The EPR allows the reduction or elimination of the required vertical separation to groundwater for less than 700 gpd design flows, if potable water supplies can be protected. The designation of a two-year time of travel zone requires a hydrogeologic study and ownership of the entire two-year time of travel management zone (EPR §1-523).

5.1.4.3 Store and Dose Systems

The EPR allows for storage of wastewater for up to one month to avoid applying wastewater when the water table is within the required separation distance to seasonal high groundwater. Sufficient storage to hold the volume of wastewater generated over a thirty day period is required, along with the designation of a two year time of travel zone (EPR §1-524).

5.1.4.4 Emerging Dispersal Technologies

Alternative soil dispersal systems include the following:

- Drip Irrigation
- Shallow Gravel-less Systems

A subsurface drip system is a pressurized wastewater distribution system that can deliver small, precise doses of effluent directly into the upper levels of the soil. Drip distribution piping is small diameter, flexible polyethylene tubing with small in-line emitters. Drip systems require advanced treatment of the effluent prior to entering the drip-line.

Shallow gravel-less systems consist of using preformed structures or gravel substitutes to provide void space for passage and storage of effluent, and to provide an interface with the exposed infiltrative surface. Shallow systems discharge effluent through the upper soils where the majority of the soil biota live. Nitrates, phosphorus, and other contaminants are more easily removed by the bacteria and plant uptake. These trenches are approximately 12 to 16 inches wide and therefore can be approved under the EPR with a minimum of 4 foot spacing between trenches. The alternative approach would be to allow these with as little as 1 foot spacing between trenches.

The type of dosing should also be considered in effluent dispersal. The majority of systems are volume dosed. This means that a slug of flow is sent to the disposal system when called for. Volume dosing can lead to saturated conditions that does not provide oxygen for the microbes. Timed dosing is alternative to volume dosing. In timed dosing, the surges of wastewater generation are stored in the dosing chamber. The system pumps more frequent; but less volume of effluent to the dispersal system throughout the entire day. This leads to maintaining unsaturated conditions for better treatment.

5.1.4.5 Best-Fix Approach to Onsite Wastewater Systems

The Town of East Montpelier and the State of Vermont DEC have had a general practice of requiring full compliance with the rules for changes in use that require permits. Significant repair and replacement of existing systems also require permits and therefore the repair or replacement of any system needs to be designed by a Licensed Designer. However, when repairs or replacements are for existing uses and existing flows that comply with local and state rules, and full compliance with the EPR cannot be obtained, then a best-fix approach is generally used.

Best-fix approaches to system design enable the design and installation of a system that comes as close to the requirements of the Environmental Protection Rules as possible. Best-fix designs are first and foremost intended to protect public health and water quality. The appropriate best-fix design needs to be based on a site-specific evaluation of soils and site conditions, as well as consideration of potential off-site solutions, such as easements on adjacent land. The Licensed Designer can then develop the most appropriate wastewater system design to meet the needs of the property owner. Due to the subjective nature of best-fix solutions, the Licensed Designer should work closely with the Town Sewage Officer, and/or DEC Barre Regional Office engineering staff to develop a practical design that the reviewer can approve. As of July 1, 2007, all wastewater and water supply systems will be under the jurisdiction of the DEC, and therefore best fix solutions will all be reviewed by Barre Regional Office staff.

Table No. 2
Evaluation of System Components

FLOW REDUCTION AND DISCHARGE PREVENTION		
System Component	**Advantages**	**Disadvantages**
Low Flow and Ultra-Flow Plumbing	• Lower hydraulic load on leachfield • Easy to retrofit faucet and showerheads • Decreased water consumption • Compliant with Plumbing code	• Interior renovations may be needed for toilet replacement
Low Water Use Appliances	• Decreased hydraulic load on leachfield • Decreased water consumption • Typically more energy efficient that conventional appliances	• Increased cost relative to conventional appliances
Extremely Low Flow Plumbing & Waterless Urinals	• Very low hydraulic load on leachfield • Decreased Water Consumption	• Requires plumbing changes. • Need to confirm compliance with Plumbing Code for individual models
Urine Diverting Toilets	• Decreased hydraulic load on leachfield • Nutrient Recycling & Reuse	• Need for storage tank • Need to empty storage tank • Need to confirm compliance with Plumbing Code for individual models • Not in current EPR
Greywater Separation and Composting Toilets	• Decreased hydraulic load on leachfield (35% reduction is size on case-by-case basis) • Decreased organic strength (BOD_5 & TSS) going to leachfield • Decreased nutrients to leachfield	• Requires space in basement or structurally sound space in house • Self-contained systems not recommended for continuous use • Requires a leachfield • Greater cost than conventional toilet
Holding Tank Systems (EPR §1-522)	• No discharge	• Limited under EPR for publicly owned buildings; with no feasible alternative and less than 600 gpd design flow • Need to install tank for 14 day flow capacity • Extremely high pump-out costs

Table No. 2
Evaluation of System Components
(Continued)

PRETREATMENT COMPONENTS		
System Component	**Advantages**	**Disadvantages**
Septic Tank Volume and Compartmentalization	• Adequate volume provides for better treatment and clarification. • Compartmentalization reduces short-circuiting.	• Larger septic tanks are more expensive than smaller tanks.
Septic Tank Effluent Filters	• Retains more solids in septic tank. • Provides enhanced effluent with reduced solids, and BOD_5 to the disposal Field • Requires less frequent pumping • Prolongs the life of disposal systems • Lower cost for new systems	• Potential for increased maintenance costs associated with cleaning filters.

Table No. 2
Evaluation of System Components
(Continued)

TREATMENT COMPONENTS		
System Component	**Advantages**	**Disadvantages**
Passive Attached Growth Treatment Systems	• Typically lowest construction, operation and maintenance costs. • No energy costs for pumps or blowers	• Conventional soil absorption system need adequate depth to seasonal high groundwater and bedrock • Requires adequate ground surface relief to have gravity drainage • Approved advanced treatment systems can have up to 50% reduction of application area and 50% reduction of vertical separation to seasonal high groundwater
Active Attached Growth Treatment	• Provides for secondary treatment. • Increases application rate and decreases size of disposal system. • Can handle flow surges.	• Typically higher initial construction cost compared to suspended growth system • Energy costs for pumping • Approved advanced treatment systems can have up to 50% reduction of application area and 50% reduction of vertical separation to seasonal high groundwater
Active Suspended Growth Treatment	• Provides for secondary treatment. • Increases application rate and decreases size of disposal system.	• Cannot handle flow surges very well. • Typicaly higher operation and maintenance costs compared to attached growth systems • Energy costs for pumping and/or blowers • Approved advanced treatment systems can have up to 50% reduction of application area and 50% reduction of vertical separation to seasonal high groundwater
Emerging Treatment Technologies	• Opportunities for reuse may decrease wastewater flows	• Will require DEC approval

Table No. 2
Evaluation of System Components
(Continued)

SOIL DISPERSAL COMPONENTS		
System Component	**Advantages**	**Disadvantages**
Gravity Pipe Dispersal Systems	• Minimal maintenance require • No energy input required	• Typically less uniform distribution compared to pressurized distribution
Pressurized Pipe Dispersal Systems	• More uniform distribution • Uniform distribution allows for at-grade and mound system to be effective	• Energy consumption • Does not work when power is out • Increased Cost of pump and chamber; or larger septic tank and pump in biofilter basket, compared to gravity system • Operation and maintenance of pump • Replacement of pump
Emerging Dispersal Systems	• Shallow gravel-less trenches provide better soil volume utilization compared to trenches or beds • Drip dispersal systems provide best soil volume utilization for treatment • Drip Dispersal allows for irregular system shape • Drip systems are currently allowable by DEC for fixing failed systems on a case-by-case basis	• Need DEC approval for new construction • Energy consumption • Does not work when power is out • Increased Cost of pump and chamber; or larger septic tank and pump in biofilter basket, compared to gravity system • Operation and maintenance of pump • Replacement of pump
Two-year Time of Travel Management Zone (EPR §1-523)	• Reduce or eliminate required vertical separation to seasonal high groundwater	• Need to determine two-year time of travel zone and confirm no potable water sources in it • Need to own two-year time of travel zone • Less than 700 gpd design flow
Store and Dose Systems (EPR §1-524)	• Reduces or eliminates required vertical separation to seasonal high groundwater	• Need Storage for a minimum of 30 days average use • Need to designate two-year time of travel management zone

5.1.5 Decentralized Wastewater Management Programs

5.1.5.1 Management Models

Management of decentralized wastewater systems is essential to the long-term sustainability of programs. Recognizing this fact, the United States Environmental Protection Agency (USEPA) has developed voluntary guidelines for decentralized wastewater management (USEPA, 2003). The following levels of management models are presented in the EPA guidelines, entitled: Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems (Guidelines):

- Homeowner Awareness Model
- Maintenance Contract Model
- Operating Permit Model
- Responsible Management Entity Operation and Maintenance Model
- Responsible Management Entity Ownership Model

These Guidelines (excerpted in Appendix E) present advantages and disadvantages (benefits and limitations) of these models in a one page summary (Appendix E, Table 1, page 15). A detailed description of the activities that can be associated with each management model are also are presented in Appendix E (Guidelines' Appendix A). Customization of these management models for local conditions is necessary. The ultimate management model for East Montpelier can be based on a single model or a blend of elements from multiple management models.

The appropriate level of management for East Montpelier Villages should be based on risk of water quality and human health impacts. There are low risk and high risk lots in each village as signified by the potential suitability for onsite systems. Overall, due to limited lot sizes and depths to seasonal high groundwater, the general risk for developed lots appears to be moderate in East Montpelier and North Montpelier.

The Town is already implementing a Homeowner Awareness model (Appendix E, Management Model 1) through the existing town permit system and the activities of the Wastewater Advisory Committee.

A Maintenance Contract model (Appendix E, Management Model 2) requires an operating entity be engaged who professionally provides a specific level of service for each system. Maintenance contracts are currently required for alternative and innovative systems approved by the State of Vermont. The level of service

can be tailored to the type of system or the location of the system relative to sensitive receptors, such as groundwater, surface water, and/or drinking water sources. It is the responsibility of the homeowner to renew the maintenance contract and notify the Town that the maintenance contract is in effect. The Town and State should already be implementing this level of management for all advanced treatment systems (approved innovative/alternative systems) in East Montpelier.

The Operating Permit model (Appendix E, Management Model 3) is the one that provides for a renewal of the permit to operate a system. In the study area, the Sandy Pines Mobile Home Park has an operating permit under the State of Vermont IDR program, because it has a design flow of greater than 6500 gpd. For individual onsite systems, a dog license is an analogy for this model. At a specified interval, a homeowner would be required to renew their operating permit and, if necessary, provide documentation that the appropriate level of operation and maintenance has been completed. For a conventional gravity system that complies with the current regulations, that appropriate level of O&M may be a system inspection or a septic tank pumpout. For a system that has a pump, documentation that the pump and float switches were inspected might be required. For an advanced treatment system, documentation that the manufacturer's required maintenance has been completed might be required. An example of an operating permit model in Vermont is the Town of Grafton's ordinance that requires all septic tanks in the three villages be pumped every three years.

The Responsible Management Entity (RME) models (Appendix E, Management Models 4 and 5) turn over either operation and maintenance (Model 4); or ownership, including operation and maintenance (Model 5) to an entity that would serve as a onsite wastewater management utility. The RME could be a municipality or a private entity. There are no current examples of an onsite wastewater RME in Vermont at this time. The closest analogy in Vermont for a water resource-related distributed infrastructure is the South Burlington Stormwater Utility, where the City of South Burlington is collecting fees and is assuming responsibility for stormwater management on a city-wide basis.

5.1.5.2 Onsite Wastewater Management Entities

Onsite wastewater systems can be managed by the Town, a fire district, or a private management entity. The Town of Warren manages onsite wastewater systems along with two cluster systems in Warren village.

Fire districts are single purpose management entities that need to be established by a specific legal process. The Vermont Rural Water Association's Summer 2005 Newsletter included the following succinct description of fire districts: *"Fire districts are municipal corporations. Their purpose is to manage certain functions of town governments that either are not available throughout the entire town, or are better administered by a distinct, special-purpose entity. Fire districts have been formed to manage community sewage systems, fire departments, and water systems."* The authority to establish a fire district is described in Title 20, Vermont Statutes Annotated, Chapter 171.

5.1.6 Collection System Alternatives

5.1.6.1 Description of Collection System Alternatives

Three types of wastewater collection alternatives were evaluated for this project. These collection alternatives include:

- Gravity Sewer/Pump Stations/Forcemains
- Grinder Pump/Low Pressure Sewer
- STEP System/Low Pressure Sewer

5.1.6.2 Wastewater Collection System Technical Evaluation

5.1.6.2.1 Individual On-Site Systems

Individual on-site systems do not require a collection system.

5.1.6.2.2 Gravity Sewer/Pump Stations/Forcemains

Gravity sewers rely on gravity to flow wastewater from the point of generation to the treatment facility/disposal system. Gravity sewers are typically laid at uniform line and grade and are designed with sufficient velocities to maintain solids in suspension. For this reason, gravity sewers must be laid at a continuous downhill gradient. Depending on terrain, site topography, total system length and overall configuration, gravity sewers often become greater than twelve (12) feet deep. Manholes are required at a maximum spacing of 300 feet and at all changes in horizontal or vertical direction and pipe size. Pumping stations are required at low areas or when the sewers become excessively deep to pump the wastewater to a location where it can flow by gravity again or to the treatment facility. Forcemain for gravity sewer pump station consists of minimum 4 inch diameter pipe.

Advantages

- Annual O&M costs can be less than mechanical alternatives.
- Gravity sewers are less expensive to connect to in the future than low pressure sewer systems.
- Frequent manholes provide ready access for regular inspection and maintenance of sewers.
- Additional service or lateral connections can be made easily at any time in the future, as the need arises.
- Standard technology.

Disadvantages

- Gravity sewer installations are more expensive to construct than a low pressure sewer system.
- Gravity sewers must be laid at a constant slope or grade and can become excessively deep thereby requiring pump stations.
- Gravity sewer and forcemain pipe sizes are larger than low pressure sewer systems.
- Laying pipe to accurate line and grade requires more skilled labor than a low pressure sewer system.
- Gravity sewer systems require accounting for more infiltration in the design flows than a low pressure sewer system.
- Pump stations for gravity sewer systems are typically more expensive than low pressure sewer systems

5.1.6.3 Grinder Pump/Low Pressure Sewer

Grinder pumps are submersible and are installed in a wet well. For individual systems, there is typically one single grinder pump per system. The wet well is typically a precast concrete structure. A grinder pump has stainless steel cutting bars and teeth that shred influent particles into a fine slurry. This slurry is then pumped through the small diameter low pressure sewers. The grinder pump system operates on a "pump on"/"pump off" scenario based on float positions. The typical single family grinder pump is a 2 horsepower (HP) pump. The use of small diameter forcemains reduces construction cost and flow rates can be reduced. Pumping heads for operation of the system are developed using the combined energy of multiple grinder pumps working together to convey flow through the collection system.

Advantages

- Small diameter pressure sewer systems typically reduce initial capital costs compared to conventional gravity sewers.
- Low pressure sewers do not need to be laid to line and grade. They are typically buried six foot deep and follow the lay of the land.
- Shallower installations are less costly and easier to install than gravity systems.
- Solids are conveyed to one single large septic tank located at the disposal site. This makes it easier to manage the solids at one larger tank rather than a large number of individual tanks at each property for STEP systems.
- Electric costs for pump operation are paid directly by the individual users.

Disadvantages

- Grinder pumps are larger horsepower (2 HP) than STEP pumps (1/2 HP) and cost more to operate.
- Individual wastewater pumps are required at each property.
- The effluent slurry pumped to the single large septic tank does not settle as well as in individual STEP tanks.
- Maintenance is more difficult when main lines require periodic flushing.
- Grinder pumps typically require more maintenance than STEP pumps.
- Grinder pump systems are significantly more expensive for future connections than gravity systems.

5.1.6.4 STEP System/Low Pressure Sewer

A Septic Tank Effluent Pumping (STEP) System is a system in which both septic tank and effluent pumping processes occur in a single tank or combination of tanks in series. A portion of the tank(s) is dedicated to septic tank capacity, another portion is dedicated to effluent pumping, with a final portion dedicated to emergency storage.

Located inside the STEP tank is a pump vault which houses a filter and pumping system. Effluent from the clear zone of the septic tank enters the pump vault and is filtered by the effluent filter. Because only effluent is being pumped, a small ½ HP submersible turbine type pump is used to pump the effluent. The ½ HP effluent pump saves energy over larger horsepower solids handling pumps.

The STEP system utilizes a small diameter pressure sewer and low pumping rates. The removal of solids eliminates the need to

pump at higher velocities for the purpose of maintaining solids in suspension. Pumping heads for operation of the system are developed using the combined energy of multiple effluent pumps working together to convey flow through the collection system.

STEP System Advantages

- Small diameter low pressure sewer systems are typically less expensive to construct compared to conventional gravity sewers. STEP system low pressure sewer diameter (2" to 3") is less than conventional gravity sewers (8") and grinder pump system low pressure sewers (3" to 4").
- Low pressure sewers do not need to be laid to line and grade.
- Shallower installations are less costly and easier to install.
- Septic sludge is better settled in individual STEP tanks than pumping into a single larger septic tank.
- Studies have shown that sludge pump out frequencies are fewer with STEP systems.
- Electric costs for pump operation are paid directly by the individual users.

STEP System Disadvantages

- Maximum wastewater flow is limited by the small diameter of the various low pressure sewers.
- Individual wastewater pumps are required at each property.
- The large number of individual STEP tanks requiring periodic solids removal is more difficult to manage than one single large septic tank with gravity or grinder pump systems.
- STEP pump systems are significantly more expensive for future connections than gravity systems.

5.2 Community Alternatives for Villages

Community Wastewater Management Alternatives were developed based on specific needs and conditions for East Montpelier and North Montpelier villages.

5.2.1 Infrastructure Alternatives

This section develops alternatives that include the potential mixes of individual, cluster, and community wastewater management systems, as well as by-product and biosolids management. The following alternatives have been developed for evaluation in this report:

- Alternative No. 1 - Manage Existing Systems with Individual Solutions for Failed Systems

- Alternative No. 2 - Manage Existing Systems with Individual Solutions for Marginal Sites
- Alternative No. 3 - On-Site Management Plus Off-Site Solutions for Marginal Sites
- Alternative No. 4 - On-Site Management Plus Small Clusters for Marginal Sites
- Alternative No. 5 - On-Site management Plus Large Clusters for Marginal Sites
- Alternative No. 6 - Off-Site Management with Indirect Discharge Systems
- Alternative No. 7 - Off-Site Management with Direct Discharge Systems

Alternatives 1, 2, 3, 4, and 5 each have an onsite management component that is described in Section 5.2.2. Alternative 6 and 7 address all wastewater in the villages' study areas.

The advantages and disadvantages for each of the above options are described in Table No. 3 (page 43), Summary of Wastewater Management Alternatives.

Table No. 3
Summary of Wastewater Management Alternatives

No.	Description	Initial Year (2008) Flow (gpd)		Design Year (2028) Flow (gpd)		App. Land Area Needed (Acres)	Overall Advantages	Overall Disadvantages	Comments
1	Manage Existing Systems with Individual Solutions for Failed Systems[A]	Individual Systems See Table C-5		Individual Systems See Table C-5		N/A	- Addresses public health concerns - Onsite management can maximize individual system longevity and decrease or eliminate replacement costs - Costs are incurred as needed	- Solutions are dependant on site & soil limitations of individual property - Does not enable high density growth - Wide range of potential costs	- Requires onsite management program
1A	Cluster System for Failed System in East Montpelier	755		755		0.5	- Addresses public health concerns Onsite management can maximize individual system longevity - Costs are incurred as needed - Failed system is upgraded immediately	- Solutions are dependant on site & soil limitations of individual property - Does not enable high density growth - Wide range of potential costs	- Requires onsite management program
2	Manage Existing Systems with Individual Solutions for Failed & Marginal Sites[A]	Individual Systems See Table C-5		Individual Systems See Table C-5		N/A	- Addresses Public Health Concerns - Onsite management can maximize individual system longevity - Failed and Marginal Systems upgraded by owners	- Solutions are dependant on site & soil limitations of individual property - Does not enable high density growth - Wide range of potential costs for onsite system users	- Requires onsite management program - Costs are incurred immediately for owners of failed and marginal systems
3	On-Site Management Plus Off-Site Solutions for Individual Failed & Marginal Sites[A]	Individual Systems See Table C-5		Individual Systems See Table C-5		N/A	- Addresses Public Health Concerns - Onsite management can maximize individual system longevity - Failed and Marginal Systems upgraded immediately	- Does not enable high density growth - Wide range of potential costs for onsite and off-site system users - Solutions are dependant on site & soil limitations of onsite or offsite property	- Requires onsite management program - Costs are incurred immediately for owners of failed and marginal systems
4	On-Site Management Plus Small Clusters for Failed & Marginal Sites[A]	North Montpelier Cluster	5,200	North Montpelier Cluster	6,000	1.2	- Addresses Public Health Concerns - Failed and Marginal Systems upgraded immediately - Onsite management canincrease longevity of remaining systems	- Does not enable high density growth beyond marginal properties - Wide range of potential costs for onsite and cluster system users	- Requires onsite and cluster system management programs - Costs are incurred immediately for owners of failed and marginal systems
		Montpelier Village		Montpelier Village					
		Kelton Road Cluster	1,600	Kelton Road Cluster	1,900	0.4			
		Quaker Hill Cluster	2,100	Quaker Hill Cluster	2,300	1.9			
		Route 2 Center Cluster	2,400	Route 2 Center Cluster	2,800	0.6			
		Route 2 South Cluster	3,200	Route 2 South Cluster	3,800	0.8			
		Route 14 Cluster	3,300	Route 14 Cluster	3,900	0.8			
5	On-Site Management Plus Large Clusters for Failed & Marginal Sites[A]	North Montpelier Cluster	5,200	North Montpelier Cluster	6,000	1.2	- Addresses Public Health Concerns - Decentralized management model - Failed and Marginal Systems replaced with off-site/cluster solution immediately -Onsite management can increase longevity of remaining systems	- Does not enable high density growth beyond marginal properties - Wide range of potential costs for onsite and cluster system users	- Requires onsite and cluster system management programs - Costs are incurred immediately for owners of failed and marginal systems - Indirect discharge (ID) system (8,400 gpd) requires certified operator
		Montpelier Village		Montpelier Village					
		Route 2 Cluster	7,000	Route 2 Cluster	8,400	1.7			
		Route 14 Cluster	3,300	Route 14 Cluster	3,900	0.8			
6	Off-Site Management with Large Clusters for All Systems	North Montpelier Cluster	12,200	North Montpelier Cluster	14,600	3.0	- Addresses Public Health Concerns - Costs are shared among all users - Enables high density growth - Immediate solution for all village needs	- May require higher density growth to be cost-effective - Relatively High costs - May require mandatory connections to minimize user costs	- Requires municipal management - ID systems require certified operator
		Montpelier Village		Montpelier Village					
		Route 2 Cluster	22,900	Route 2 Cluster	27,400	5.7			
		Route 14 Cluster	10,000	Route 14 Cluster	12,100	2.5			
7	Off-Site Management with Direct Discharging Systems	North Montpelier	12,200	North Montpelier	14,600	2.0	- Addresses Public Health Concerns - Costs are shared among all users - Enables high density growth - Immediate solution for all village needs	- May require higher density growth to be cost-effective - Relatively high costs - May require mandatory connections to minimize user costs	- Requires municipal management - Wastewater treatment facilities require certified operator
		Montpelier Village	33,000	Montpelier Village	39,500	2.0			

Notes:
A. Onsite management action plan for individual systems are discussed in Section 5.2.2 with reference materials such as EPA management models (Appendix E).

5.2.2 Onsite Wastewater Management Action Plan Framework

Preparation of an onsite wastewater management action plan for the East Montpelier villages was requested by the East Montpelier Wastewater Advisory Committee. A framework for a Wastewater Management Action Plan, to meet the specific needs of East Montpelier and North Montpelier villages follows:

5.2.2.1 Provide public outreach, information and education of onsite wastewater system owners and users.

5.2.2.2 Inventory of onsite wastewater treatment systems

- Field inspection of onsite wastewater treatment systems
- Evaluation of soils in vicinity of existing onsite wastewater systems
- locate failed systems and potential points of pollution

5.2.2.3 Continue to pursue best-fix approaches for marginal or failed Systems as they become known

5.2.2.4 Develop and maintain a record-keeping program to track Installed systems.

5.2.2.5 Provide and expand on information regarding potential sources Of funding for individual onsite wastewater treatment system repairs and upgrades.

5.2.2.6 Promote public health protection, land use planning, and water Quality protection coordination among the following: selectboard, wastewater advisory committee, sewage officer, health officer, planning commission, and other appropriate local entities, regarding wastewater treatment capacity and compatibility with soil types.

5.2.2.7 Continue local discussion of establishing onsite wastewater management entitites in the villages as a potential model for implementing the action plan (see 5.1.5.2).

5.2.2.8 Participate in the ongoing revision of the Vermont Wastewater System and Potable Water Supply Rule (Environmental Protection Rules, Chapter 1) in advance of the July 1, 2007 jurisdictional changes, with specific emphasis on management and best fix systems.

5.2.2.9 Outreach is critical to ensure systems are properly operated and maintained. The inventory can build on the data collected in the feasibility study. The record keeping process will facilitate management, so system problems, maintenance and improvements can be recorded to provide a feedback loop on the effectiveness of the management program. The State of Vermont ANR can loan money to municipalities at 2% interest rate. These municipalities can, in turn, loan the money out to landowners, The loan would be completely repaid upon sale of the building, as the municipality can establish a lien on the building. The coordination of land use planning is essential so that local government can establish and carry out programs toward common objectives.

5.2.2.10 The approach outlined in this action plan could enable the community to move forward in: (1) building local understanding of wastewater needs; (2) developing a comprehensive documentation of the wastewater needs on all properties in the Villages; and (3) increasing the role of property owners, residents, and business owners in addressing the management of wastewater at the local level. The development of an Action Plan does not preclude the potential need for, and pursuit of, small or large cluster system solution(s) now or in the future.

5.2.3 Wastewater Flow Projections

Wastewater flow projections were developed for each of the alternatives identified above. Flow values were developed using the State of Vermont, Environmental Protection Rules, Chapter 1, dated August 16, 2002. Orthophotos, Town records and on-site visual reconnaissance were used to supplement the GIS information related to user type and number of units in each area. Initial Year flow estimates and equivalent users were developed using the flow values and quantities.

Population projections were used to estimate the growth rate and thus future flows over a twenty year planning period (2008 to 2028). Population projections were developed utilizing the following sources:

- *Vermont 2000 Census*, Issued June 2003 by the U.S. Department of Commerce
- *2004 Vermont Population Estimates*, by the Vermont Health Department

Table No. 4 (page 46) provides a summary of the 1980, 1990 and 2000 census and 2004 population estimates for the Town of East Montpelier. The 1980, 1990 and 2000 census and 2004 population estimates were plotted on the graph in Appendix F (Figure F-1). High, recent, and low population projections were developed using past data. It was decided that the recent population projection of approximately 1% per year or 20% for the planning period would be used. Table No. 4 (page 46) summarizes the flow projections for each alternative. Wastewater flow projections are detailed for alternative in Appendix F (Tables F-1 through F-4).

Table No. 4
Population Projections

Year	Population	Population Estimate		
		High	Recent	Low
1980	2,205			
1990	2,239			
2000	2,578			
2004	2,657			
2008		2,800	2,750	2,675
2028		3,460	3,180	2,730
	Percent Increase	24%	16%	2%

5.2.4 Municipal Infrastructure Wastewater Management Alternatives Costs

The cost estimates presented in this section are based on information contained in this report and are intended to provide preliminary estimates for comparison of alternatives and local decision-making as to which options may be carried forward to more detailed cost estimates based on more detailed analyses.

Prior to the development of the construction cost estimates for the Municipal Infrastructure Wastewater Management Alternatives (Alternatives 1A, 4, 5, and 6), quantity take-offs were completed from each of the conceptual design plans (Appendix A, Figures 14-18) to establish quantities of equipment, materials, and labor necessary to construct a fully operational system. Construction costs were generated using *2006 Means Building Construction Data*, and bid results from recent construction projects in Vermont. An Engineering News Record (ENR) cost index was used to project the construction cost to February 2009. The estimated construction costs for all of the alternatives are summarized in Table No. 5 (page 46). Detailed construction cost estimates for each alternative are provided in Appendix G (Table G-1 through G-4).

Table No. 5
Summary of Construction Cost Estimates

Alternative	Description	Construction Cost Estimate [1]
1A	Replace Existing Failed Cluster System	$230,000
4	On-Site Management Plus Small Clusters for Marginal Sites	$2,900,000
5	On-Site Management Plus Large Clusters for Marginal Sites	$3,000,000
6	Off-Site Management with Indirect Discharge Systems	$6,600,000

Notes:
1. Engineering News Record (ENR) 8950= January 2009

5.2.4.1. Total Project Cost Estimates

An estimate of the total project cost for the each of the Municipal Infrastructure Wastewater Management Alternatives (Alternatives 1A, 4, 5, and 6), which includes construction cost, engineering, hydrogeological, archeological, permitting, legal, fiscal, administrative, and land costs was prepared. Total project costs also include a 10% construction contingency. These estimated total project costs (TPC) at this feasibility level are very preliminary. However, the TPC of the selected alternative does provide an "order of magnitude" that is useful at this feasibility level to estimate the feasibility of a conventional subsurface disposal system. The estimated construction costs for all of the alternatives are summarized in Table No. 6 (page 47). Detailed total project cost estimates for each alternative are provided in Appendix G (Table G-5 through G-8).

Table No. 6
Summary of Total Project Cost Estimates

Alternative	Description	Total Project Cost Estimate [1]
1A	Replace Existing Failed Cluster System	$330,000
4	On-Site Management Plus Small Clusters for Marginal Sites	$4,000,000
5	On-Site Management Plus Large Clusters for Marginal Sites	$4,400,000
6	Off-Site Management with Indirect Discharge Systems	$9,500,000

5.2.4.2. First Year User Cost

User costs are difficult to estimate at this time because of the lack of identified funding (grants, loans, local share). Appendix G (Table G-9) provides a summary of the preliminary "Best Case" First Year User Cost Estimate. The following are assumed for the "Best Case".

- A fully eligible 35% Vermont Pollution Abatement Grant
- Some amount of United States Department of Agriculture - Rural Development Grant
- Mandatory connections (100% of the possible users are connected)
- A State Revolving Fund (SRF) loan of 2% for 20 years.
- Construction starts in 2009
- Operation and maintenance (O&M) cost of $300/equivalent user (EU)

5.2.5 Private Infrastructure Wastewater Management Alternatives Costs

The cost estimates presented in this section are based on information contained in this report and are intended to provide preliminary estimates for comparison of alternatives and local decision-making as to which options may be carried forward to more detailed cost estimates based on more detailed analyses.

5.2.5.1 Construction Cost Estimates

Alternatives No. 1, 2 and 3 are private wastewater management alternatives. Because there is not enough information to recommend an identified number of properties for these alternatives, cost estimates for the range of types of individual on-site systems are provided.

On-site replacement systems can be complying or best fix. On-site replacement means to replace the existing on-site wastewater treatment and disposal system with a new on-site treatment and disposal system. The new system would be on-site or as near the property as possible. Adjacent properties could also share replacement systems. A replacement system that meets the requirements of the State of Vermont, Environmental Protection Rules (EPRs) would be complying. If not possible, a best fix system would be proposed. A best fix system is an on-site replacement system that does not meet the requirements of the EPRs due to site restraints but is designed to come close as

possible to meeting the requirements. Best fix systems can only be used to replace a system for existing flows, in a situation where site and soil conditions prevent the installation of a complying system. Best fix systems cannot be used for an increase in wastewater flows.

Typical construction costs for different types of replacement/best fix on-site systems are provided in Appendix H (Table No. H-1). The types of systems are categorized by increased levels and cost of treatment and disposal. Replacement of individual onsite systems may require the property owner to borrow the cost of construction or the total project cost. Interest and principal for private financing may range from approximately $540 to $3600 per year (Appendix H, Table H-2).

5.2.5.2 Management Cost Estimates

The cost of implementing the action plan for East Montpelier village and North Montpelier village was estimated for individual onsite system management (Appendix H, Tables H-3 through H-5). These costs were calculated assuming that start-up costs would be incurred during the first year to acquire equipment (computers, desk, filing cabinet, and field inspection tools) and set up the management program. Individual onsite system inspections during the second, third, and fourth years of implementation would result in higher annual costs for these years. It was estimated that during the fifth to the twentieth year period, that routine inspections, pumpouts and recordkeeping would be the bulk of the work. It was assumed that individual homeowners would be responsible for all costs associated with repairs, replacement or upgrades of onsite wastewater systems as needed.

Implementation of the Wastewater Management Action Plan without grant or loans would have an annual cost ranging from a maximum of $368 to $371 in the first four years while the program is set up and the systems are inspected. For the 5th through the 20th year, the annual cost per user would range from approximately $148 to $154 dollars per year. These costs may be reduced by grants and loans, as available.

These costs apply to users that will not be connected to infrastructure solutions for Alternatives 1, 2, 3,4 and 5.

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TOWN OF EAST MONTPELIER

NEEDS ASSESSMENT AND FEASIBILITY STUDY -

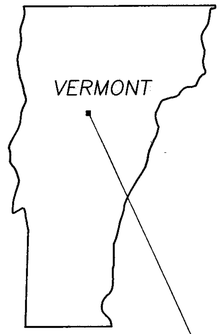
WASTEWATER TREATMENT FOR THE VILLAGES

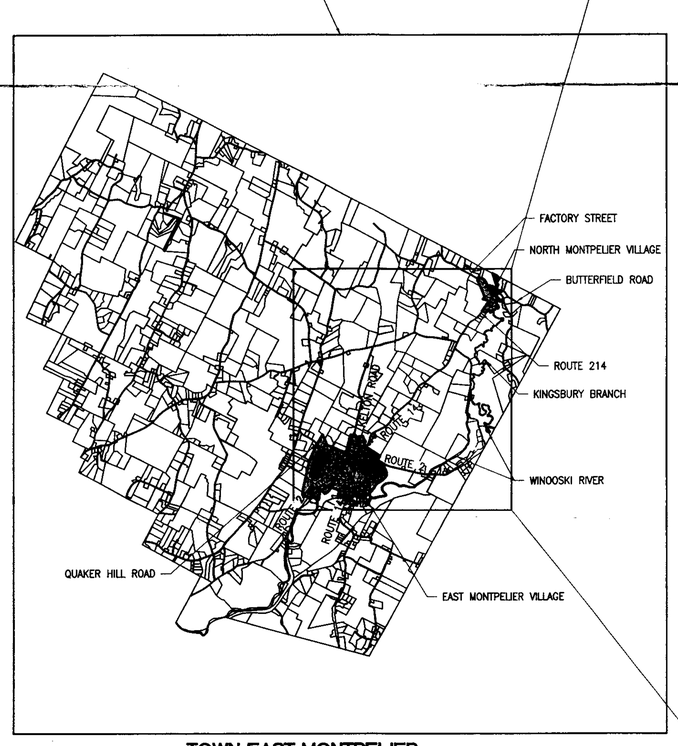
FINAL REPORT

MAY 2007

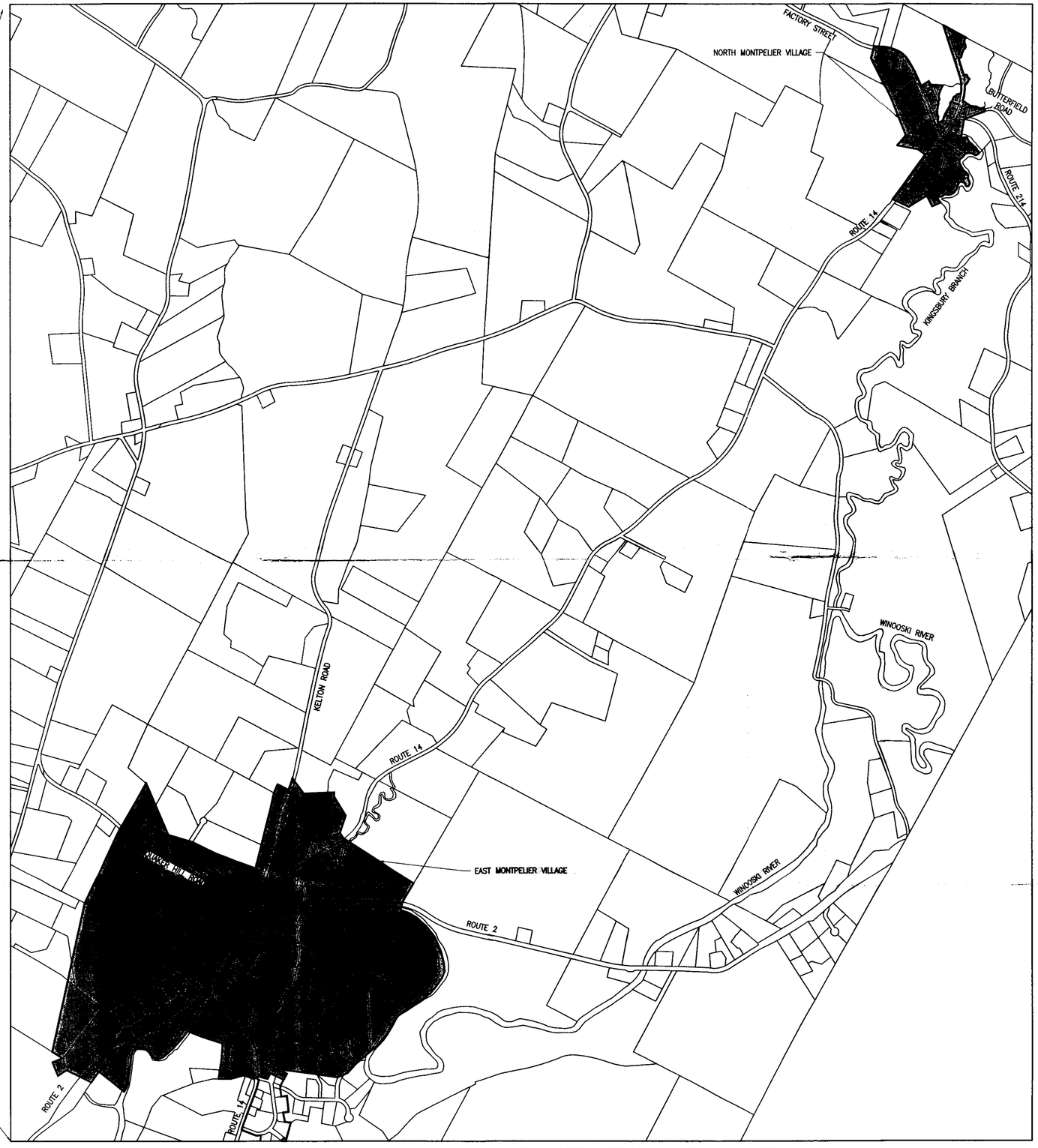
VOLUME 2 OF 2A

also See Volumes 1 & 2 and 2B





TOWN EAST MONTPELIER
SCALE: 1"=5000'



TOWN EAST MONTPELIER-NORTHWEST CORNER
SCALE: 1"=800'

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WASTEWATER TREATMENT
FOR THE VILLAGES

NO.	DATE	REVISION DESCRIPTION	CHECKED

LOCATION OF STUDY AREAS

DESIGNED	KJC
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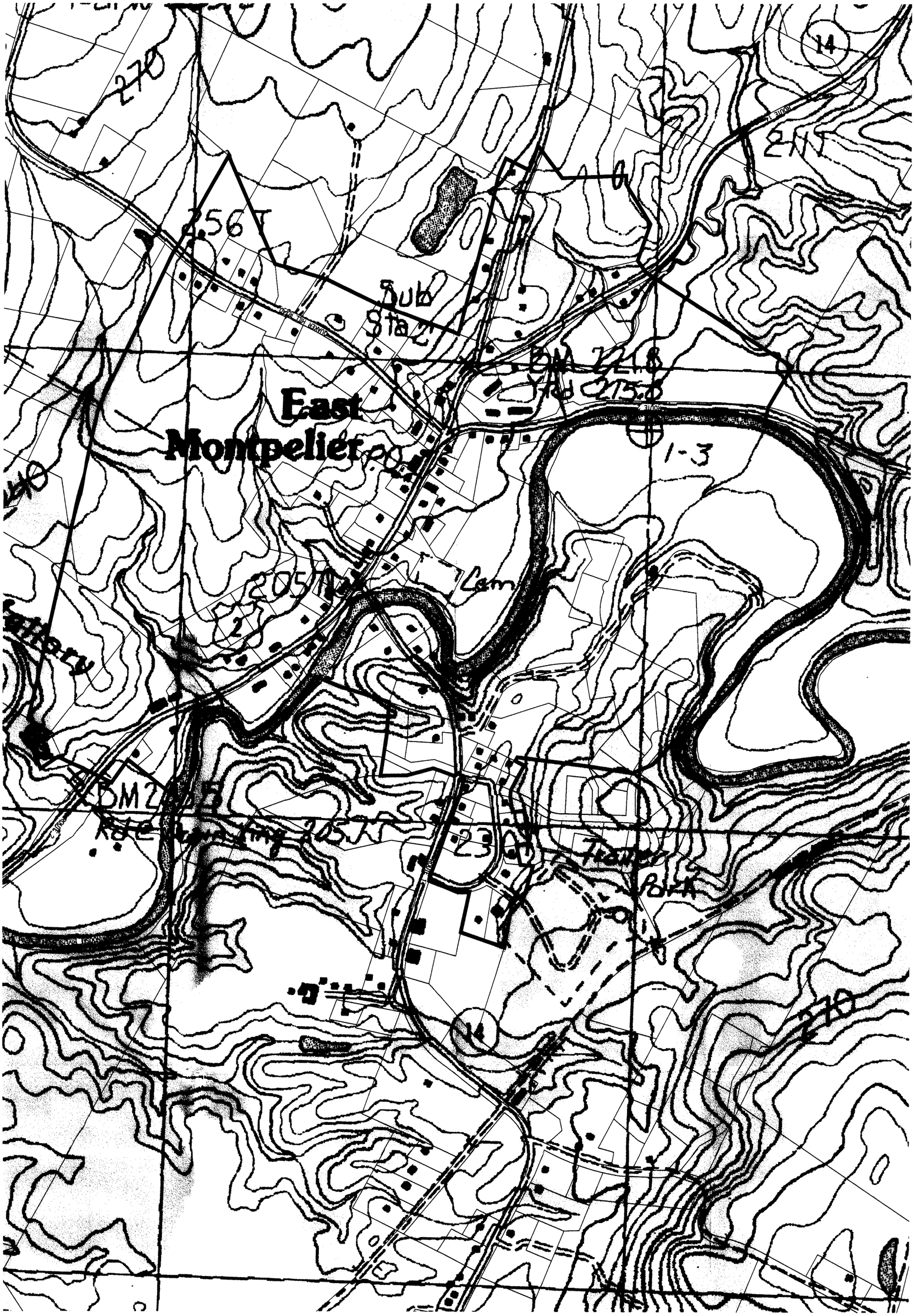
CHECKED	BFD
DATE	OCT. 2003
PROJECT NO.	06008
FIGURE NO.	1
SHEET	



NOTE:
SOURCE: USGS QUADRANGLE (1988) 7.5 MIN. BARRE WEST, BARRE EAST, PLAINFIELD, AND MONTPELIER

LOCATION PLAN-EAST MONTPELIER
SCALE: 1"=300'

DESIGNED	KJC	TOWN OF EAST MONTPELIER EAST MONTPELIER, VERMONT	
DRAWN	JEN		
CHECKED	BFD		
DATE	OCT. 2003		
NO.	DATE	REVISION DESCRIPTION	CHECKED
PROJECT NO.	06008	NEEDS AND FEASIBILITY WASTEWATER TREATMENT FOR THE VILLAGES	
FIGURE NO.	2	TOPOGRAPHIC MAP OF EAST MONTPELIER STUDY AREA	
SHEET			

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NOTE:
SOURCE: USGS QUADRANGLE (1988) 7.5 MIN BARRE WEST, BARRE EAST, PLAINFIELD, AND MONTPELIER

LOCATION PLAN-NORTH MONTPELIER
SCALE: 1"=100'

DESIGNED	KJC		
DRAWN	JEN		
CHECKED	BTD		
DATE	OCT. 2003		

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TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

SHEET 3 | FIGURE NO. | PROJECT NO. 06008

TOPOGRAPHIC MAP OF NORTH MONTPELIER STUDY AREA

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NOTES:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. ORTHO PHOTO FROM STATE OF VERMONT MAPPING PROGRAM
3. WATERLINE LOCATION FROM CRYSTAL SPRINGS WATER COMPANY (1969)

LOCATION PLAN-EAST MONTPELIER
SCALE: 1"=300'

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DATE	OCT. 2003		
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PROJECT NO.	06008	NEEDS AND FEASIBILITY WASTEWATER TREATMENT FOR THE VILLAGES	
FIGURE NO.	4	EAST MONTPELIER VILLAGE STUDY AREA LIMITS	
SHEET			

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NOTES:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. ORTHO PHOTO FROM STATE OF VERMONT MAPPING PROGRAM

LOCATION PLAN-NORTH MONTPELIER
SCALE: 1"=100'

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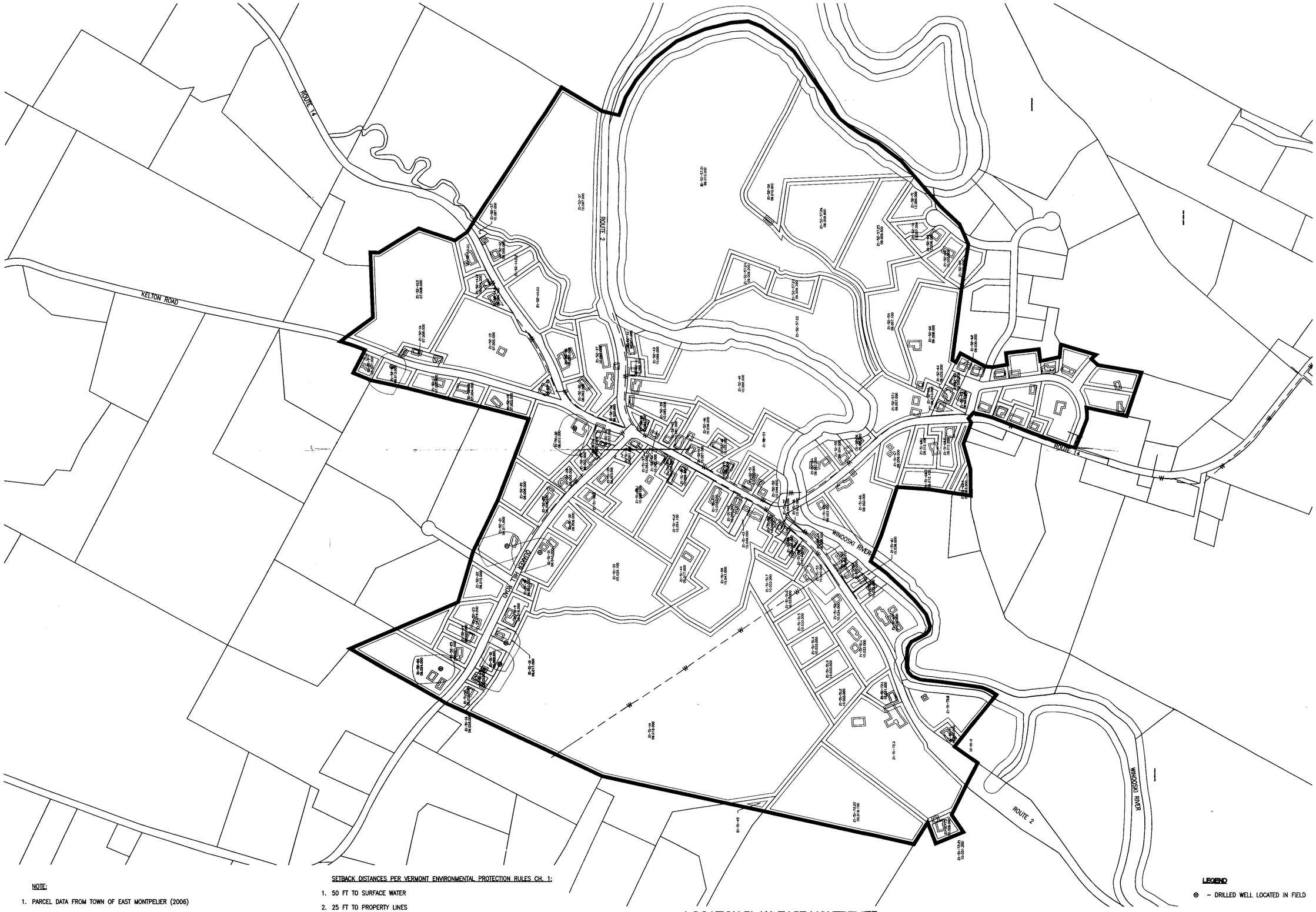
DRAWN	JEN		
CHECKED	BFD		
DATE	OCT. 2003		
NO.	DATE	REVISION DESCRIPTION	CHECKED
PROJECT NO.	06008	NORTH MONTPELIER VILLAGE STUDY AREA LIMITS	NEEDS AND FEASIBILITY WASTEWATER TREATMENT FOR THE VILLAGES
FIGURE NO.			
SHEET	5		



NOTE:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. SOURCE USGS QUADRANGLES 7.5 MIN BARRE WEST, BARRE EAST, PLAINFIELD, AND MONTPELIER

SETBACK DISTANCES PER VERMONT ENVIRONMENTAL PROTECTION RULES CH. 1:

1. 50 FT TO SURFACE WATER
2. 25 FT TO PROPERTY LINES
3. 10 FT TO BUILDINGS
4. 100 FT/200 FT FOR DRILLED WELLS PER VERMONT WATER SUPPLY RULE

LEGEND

⊗ – DRILLED WELL LOCATED IN FIELD

LOCATION PLAN-EAST MONTPELIER

SCALE: 1"=300'

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TOWN OF EAST MONTPELIER
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NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

EAST MONTPELIER VILLAGE ON-SITE CONSTRAINTS

NO.	DATE	REVISION DESCRIPTION	CHECKED

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DATE	OCT. 2003
PROJECT NO.	06008
FIGURE NO.	6
SHEET	

NOTE:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. PARCELS CONNECTED TO SHARED WATER SYSTEM REPORTED BY L. BROWN (2006)
3. SOURCE USGS QUADRANGLE (1988) 7.5 MIN BARRE WEST, BARRE EAST, PLAINFIELD, AND MONTPELIER

SETBACK DISTANCES PER VERMONT ENVIRONMENTAL PROTECTION RULES CH. 1:

1. 50 FT TO SURFACE WATER
2. 25 FT TO PROPERTY LINES
3. 10 FT TO BUILDINGS
4. 100 FT/200 FT FOR DRILLED WELLS PER VERMONT WATER SUPPLY RULE

LEGEND

⊙ – DRILLED WELL LOCATED IN FIELD

■ – PARCEL CONNECTED TO NORTH MONTPELIER SHARED WATER SYSTEM

LOCATION PLAN-NORTH MONTPELIER

SCALE: 1"=100'

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TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

NORTH MONTPELIER VILLAGE ON-SITE CONSTRAINTS

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DESIGNED	KJC
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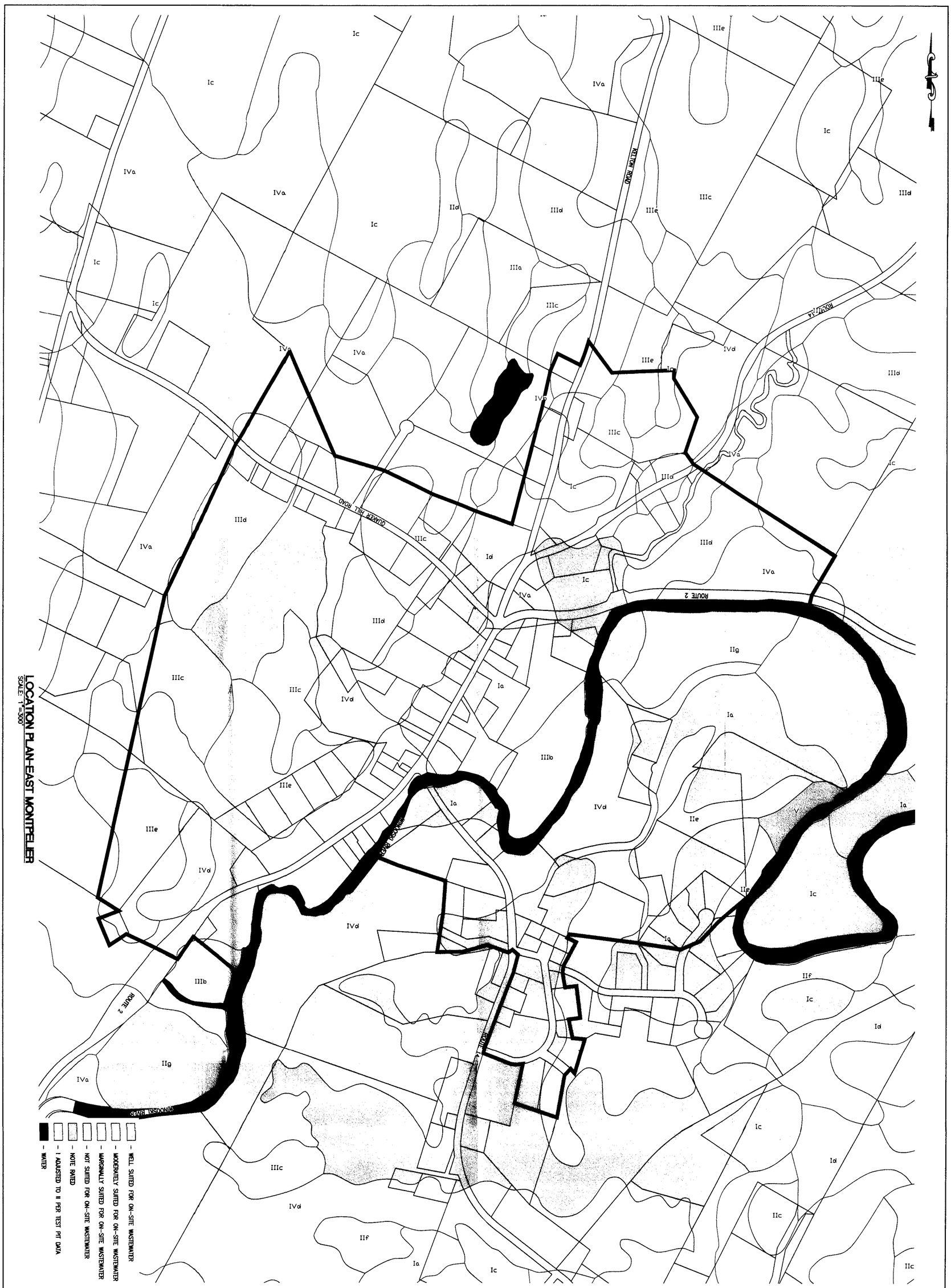
DATE	OCT. 2003
PROJECT NO.	06008
FIGURE NO.	7
SHEET	



NO.	DATE	REVISION DESCRIPTION	CHECKED

DESIGNED KJC
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DATE OCT. 2003
SHEET 8
FIGURE NO.
PROJECT NO. 06008

EAST MONTPELIER VILLAGE
SOIL SUITABILITY FOR ON-SITE SYSTEM

TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
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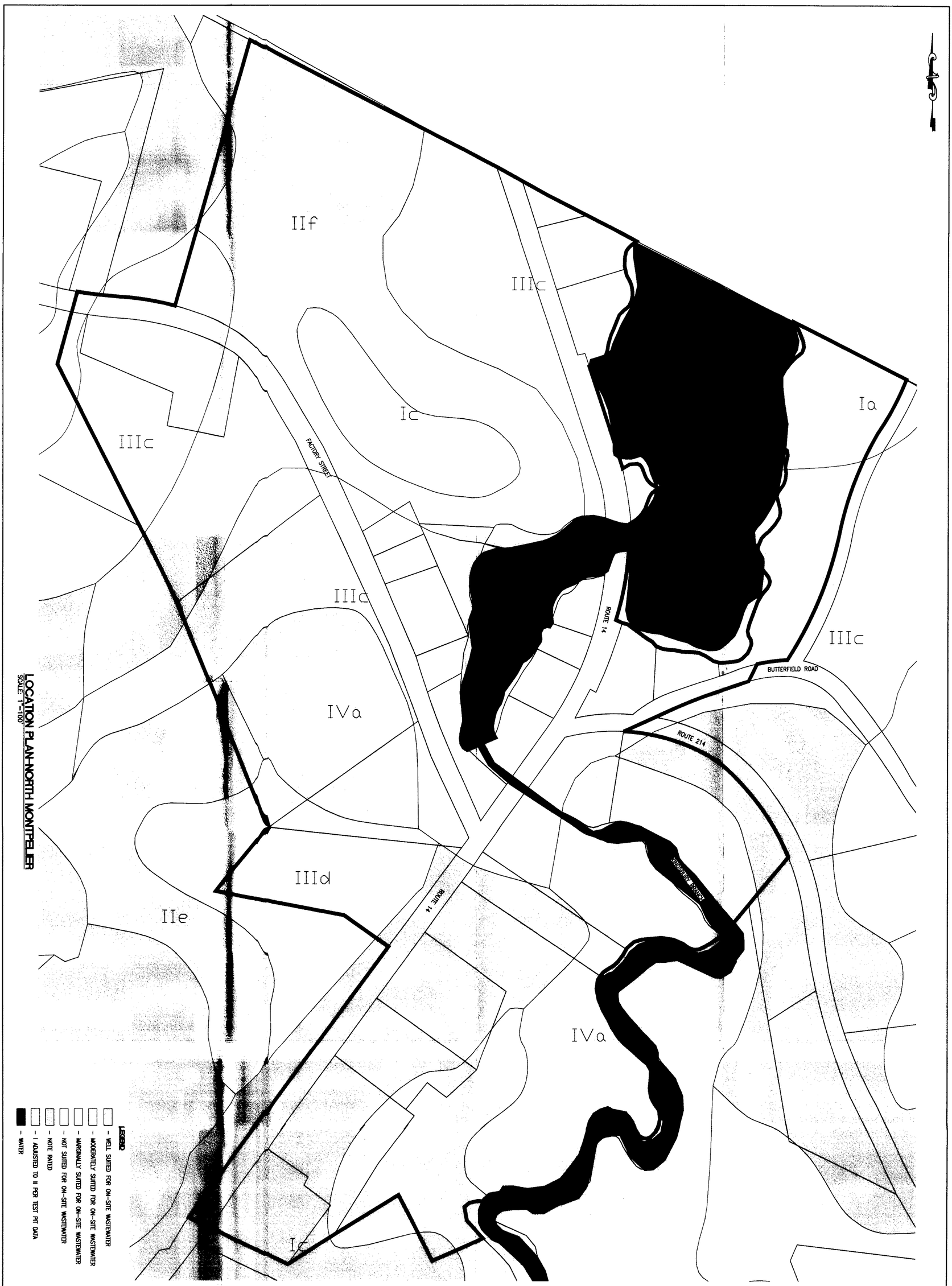

LOCATION PLAN-NORTH MONTPELIER
SCALE: 1"=100'

LEGEND
- WATER
- I ADJUSTED TO II PER TEST PIT DATA
- NOTE RATED
- NOT SUITED FOR ON-SITE WASTEWATER
- MARGINALLY SUITED FOR ON-SITE WASTEWATER
- MODERATELY SUITED FOR ON-SITE WASTEWATER
- WELL SUITED FOR ON-SITE WASTEWATER

NO.	DATE	REVISION DESCRIPTION	CHECKED

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DATE OCT. 2003
SHEET 9
FIGURE NO.
PROJECT NO. 06008

NORTH MONTPELIER VILLAGE
SOIL SUITABILITY FOR ON-SITE SYSTEM

TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
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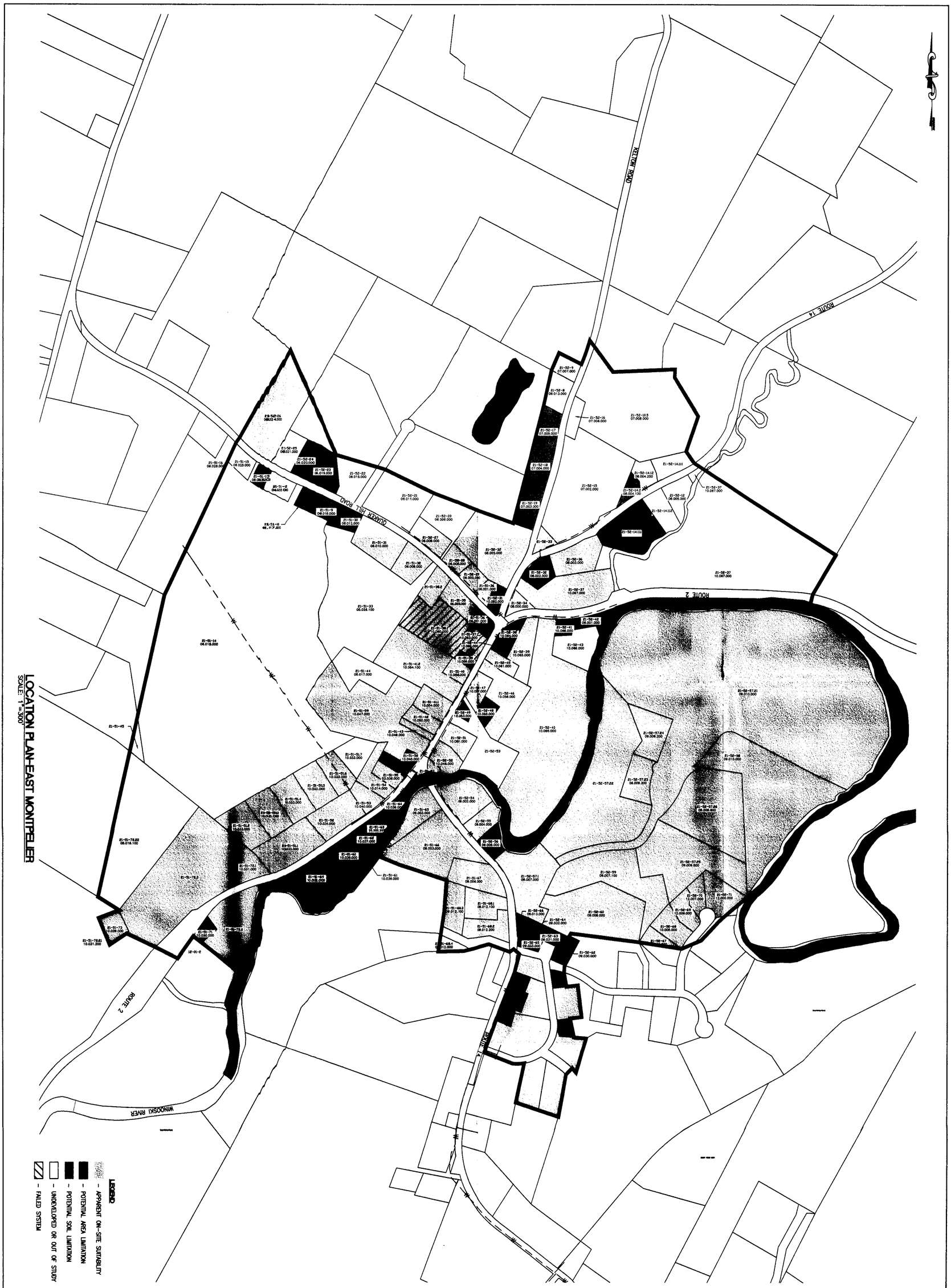

LOCATION PLAN-EAST MONTPELIER
SCALE: 1"=300'

LEGEND
- APPARENT ON-SITE SUITABILITY
- POTENTIAL AREA LIMITATION
- POTENTIAL SOIL LIMITATION
- UNDEVELOPED OR OUT OF STUDY
- FAILED SYSTEM

NO.	DATE	REVISION DESCRIPTION	CHECKED

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SHEET
FIGURE NO. 10
PROJECT NO. 06008

EAST MONTPELIER VILLAGE WASTEWATER NEEDS SUMMARY

TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

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LOCATION PLAN-NORTH MONTPELIER
SCALE: 1"=100'

LEGEND
- APPARENT ON-SITE SUITABILITY
- POTENTIAL AREA LIMITATION
- UNDEVELOPED OR OUT OF STUDY AREA

NO.	DATE	REVISION DESCRIPTION	CHECKED

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DRAWN: JEN
CHECKED: BFD
DATE: OCT. 2003

PROJECT NO. 06008
FIGURE NO. 11
SHEET

NORTH MONTPELIER VILLAGE WASTEWATER NEEDS SUMMARY

TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

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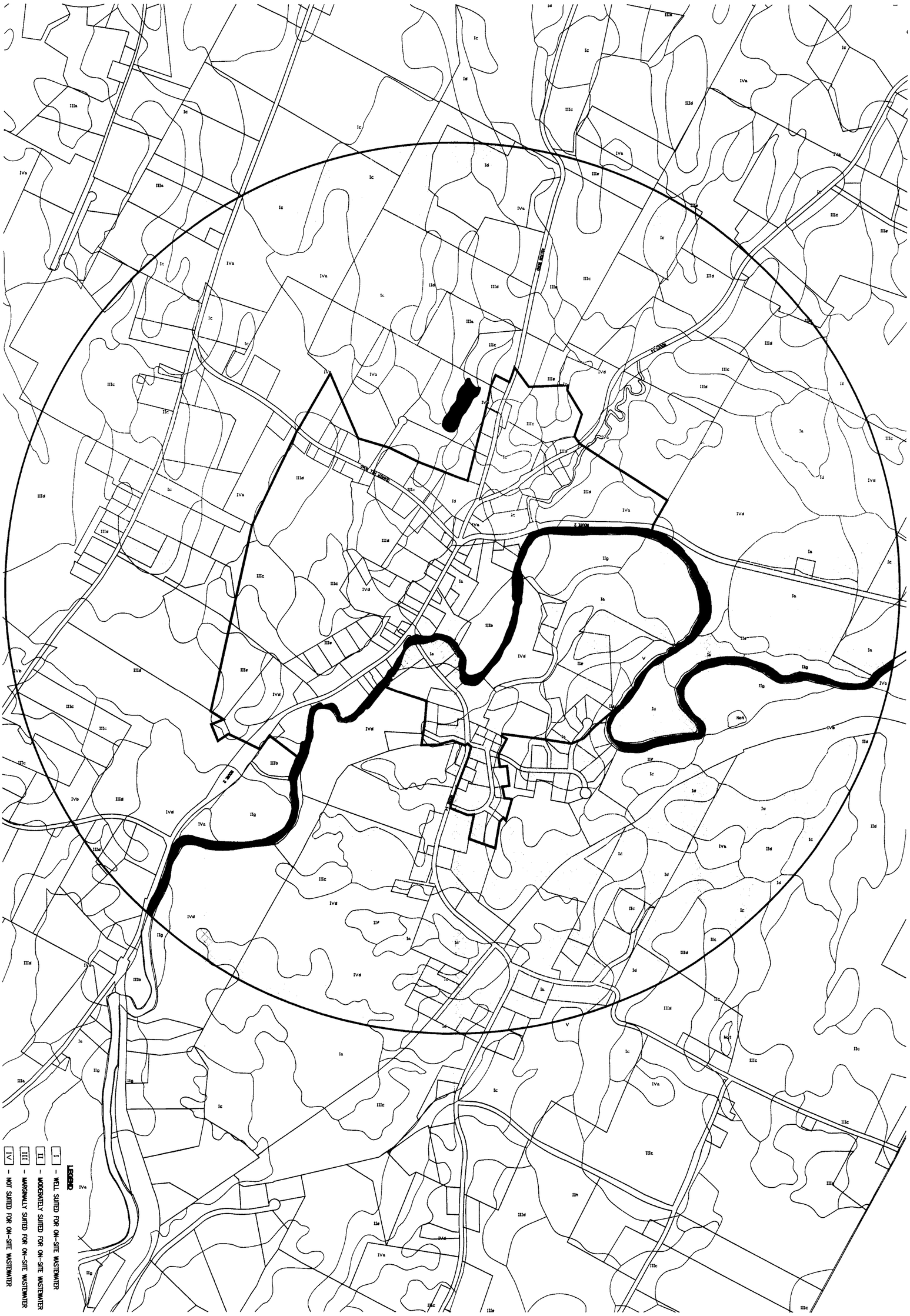

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SHEET 12
FIGURE NO.
PROJECT NO. 06008

EAST MONTPELIER VILLAGE SOILS WITHIN A MILE RADIUS

TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

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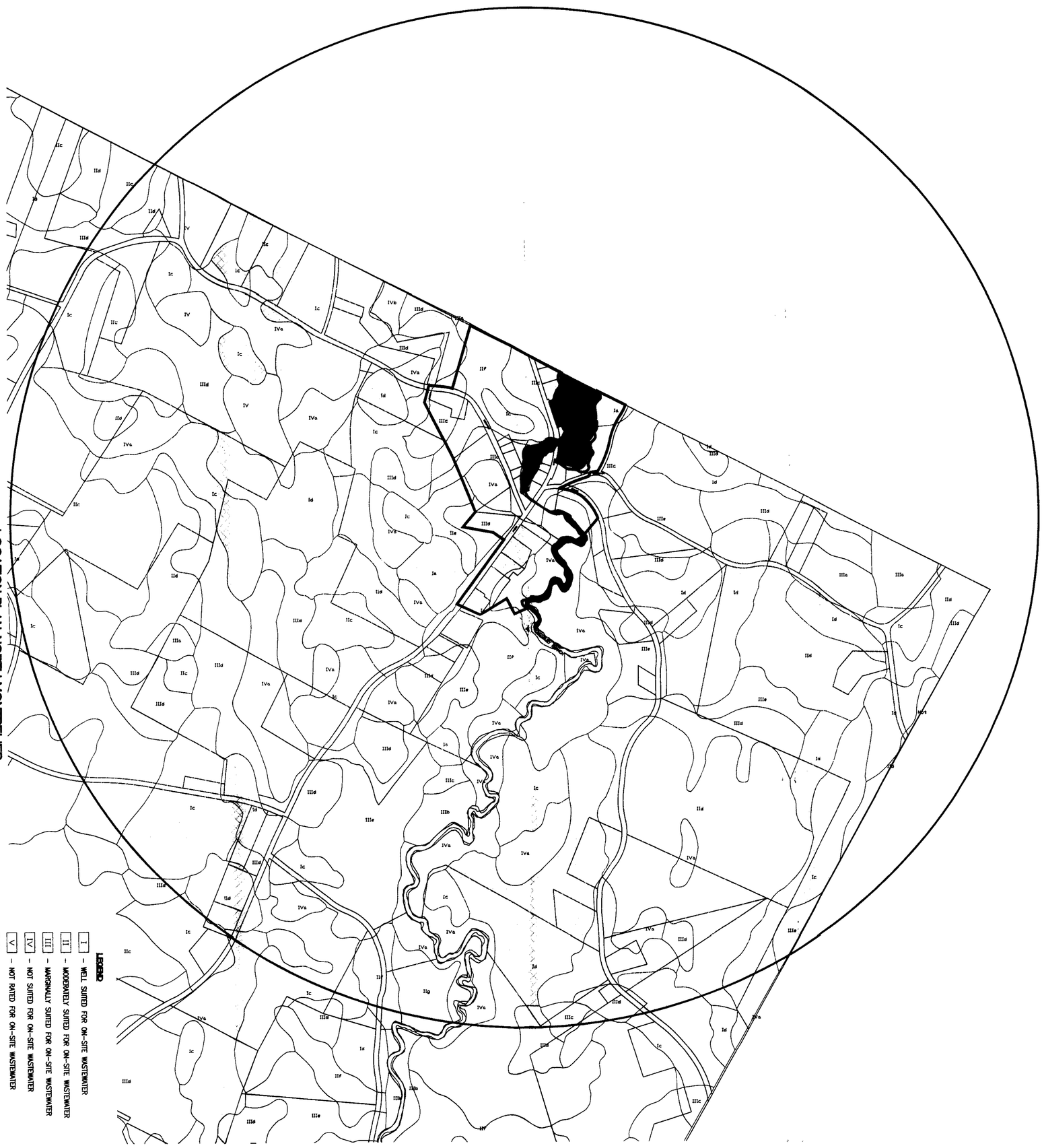

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DRAWN JEN					NEEDS AND FEASIBILITY WASTEWATER TREATMENT FOR THE VILLAGES
CHECKED BFD					
DATE OCT. 2003					
PROJECT NO. 06008					NORTH MONTPELIER VILLAGE SOILS WITHIN A MILE RADIUS
FIGURE NO. 13					
SHEET					

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TOWN OF EAST MONTPELIER

NEEDS ASSESSMENT AND FEASIBILITY STUDY -

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FINAL REPORT

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VOLUME 2 OF 2B

Also See Volumes 1 & 2 and 2 & 2A

NOTES:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. ORTHO PHOTO FROM STATE OF VERMONT MAPPING PROGRAM
3. WATERLINE LOCATION FROM CRYSTAL SPRINGS WATER COMPANY (1969)

LOCATION PLAN-EAST MONTPELIER

SCALE: 1"=300'

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TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

NO.	DATE	REVISION DESCRIPTION	CHECKED

ALTERNATIVE No. 4 - ON-SITE MNAGEMENT PLUS SMALL CLUSTERS FOR MARGINAL SITES EAST MONPELIER VILLAGE

DESIGNED KJC	PROJECT NO. 06008
DRAWN JEN	FIGURE NO. 14
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DATE OCT. 2003	SHEET

LEGEND

NORTH MONTPELIER SMALL CLUSTER PROPERTIES

NOTES:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. ORTHO PHOTO FROM STATE OF VERMONT MAPPING PROGRAM

LOCATION PLAN-NORTH MONTPELIER

SCALE: 1"=100'

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TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

NO.	DATE	REVISION DESCRIPTION	CHECKED

ALTERNATIVE No. 4 - ON-SITE MANAGEMENT PLUS SMALL CLUSTERS FOR MARGINAL SITES NORTH MONTPELIER VILLAGE

DESIGNED	KJC
DRAWN	JEN
CHECKED	BFD
DATE	OCT. 2003
PROJECT NO.	06008
FIGURE NO.	15
SHEET	

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LEGEND

- EAST MONTPELIER ROUTE 2 CLUSTER PROPERTIES
- EAST MONTPELIER ROUTE 14 CLUSTER PROPERTIES

NOTES:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. ORTHO PHOTO FROM STATE OF VERMONT MAPPING PROGRAM
3. WATERLINE LOCATION FROM CRYSTAL SPRINGS WATER COMPANY (1969)

LOCATION PLAN-EAST MONTPELIER

SCALE: 1"=400'

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TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

NO	DATE	REVISION DESCRIPTION	CHECKED

ALTERNATIVE No. 5 - OFF-SITE MNAGEMENT PLUS LARGE CLUSTERS FOR MARGINAL SITES EAST MONPELIER VILLAGE

DESIGNED KJC	PROJECT NO. 06008
DRAWN JEN	FIGURE NO. 16
CHECKED BFD	
DATE OCT. 2003	SHEET

NOTES:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. ORTHO PHOTO FROM STATE OF VERMONT MAPPING PROGRAM
3. WATERLINE LOCATION FROM CRYSTAL SPRINGS WATER COMPANY (1969)

LOCATION PLAN-EAST MONTPELIER

SCALE: 1"=400'

LEGEND

- EAST MONTPELIER ROUTE 2 SUBAREA
- EAST MONTPELIER ROUTE 14 SUBAREA

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NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

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ALTERNATIVE No. 6 - OFF-SITE MNAGEMENT
WITH INDIRECT DISCHARGE
EAST MONPELIER VILLAGE

DESIGNED KJC	PROJECT NO. 06008
DRAWN JEN	FIGURE NO. 17
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DATE OCT. 2003	SHEET

NOTES:

1. PARCEL DATA FROM TOWN OF EAST MONTPELIER (2006)
2. ORTHO PHOTO FROM STATE OF VERMONT MAPPING PROGRAM

LOCATION PLAN-NORTH MONTPELIER
SCALE: 1"=200'

LEGEND

— NORTH MONTPELIER LARGE CLUSTER PROPERTIES

NO.	DATE	REVISON DESCRIPTION	CHECKED

DESIGNED: KJC
DRAWN: JEN
CHECKED: BFD
DATE: OCT. 2003

PROJECT NO. 06008
FIGURE NO. 18
SHEET

ALTERNATIVE No. 6 - OFF-SITE MNAGEMENT WITH INDIRECT DISCHARGE NORTH MONTPELIER VILLAGE

TOWN OF EAST MONTPELIER
EAST MONTPELIER, VERMONT

NEEDS AND FEASIBILITY
WASTEWATER TREATMENT
FOR THE VILLAGES

Forcier Aldrich & Associates
Consulting Engineers
6 Market Place, Suite 2
Essex Junction, VT 05452
(802) 879-7733
(802) 879-1742 (Fax)
FA&A

APPENDIX B

Summary of Property Owner Survey Response

TOWN OF EAST MONTPELIER
WASTEWATER FEASIBILITY STUDY

SUMMARY OF PROPERTY OWNER SURVEY RESPONSES

Survey Responses

Approximate Number of Properties In and Near The Study Areas: 226

Approximate Number of Properties in Study Areas: 143 (of 226)

Total Number of Responses As Percent of All Parcels In and Near Study Area: 43 = 19% (of 226)

Total Number of Responses As Percent of Parcel In Study Area: 35 = 25% (of 143)

Questionnaire Responses

	Total East Montpelier [a]		Total North Montpelier [a]		Total Out of Area [a,b]	
1. Is your property in?						
East Montpelier Village area	27		0		8	
North Montpelier Village area	0		8		0	
2. What is the building type?						
Single family home	14	52%	8	100%	8	100%
Multi family home	1	4%	0	0%	0	0%
Commercial business	3	11%	0	0%	0	0%
Industrial business	0	0%	0	0%	0	0%
Undeveloped/none	1	4%	0	0%	0	0%
3. If your building is commercial or industrial:						
Total sq. ft. of building area (2-EM,	3104	1552	850	425	0	0
# of parking spaces (3-EM,	76	25	2	1	0	0
# of stories in building (2-EM,	4	2	1.5	1	0	0
4A. Has your undeveloped land been tested for wastewater treatment capacity?						
Yes	7	26%	0	0%	1	13%
No	3	11%	5	63%	2	25%
Don't know	0	0%	1	13%	2	25%
4B. If your undeveloped land has been tested, is there capacity for wastewater treatment and dispersal?						
Yes	2	7%	0	0%	0	0%
No	3	11%	1	13%	1	13%
Don't know	2	7%	2	25%	3	38%

	Total East Montpelier [a]		Total North Montpelier [a]		Total Out of Area [a,b]	
5A. What is the source of your drinking water supply?						
Drilled well	3	11%	7	88%	2	25%
Dug well	0	0%	0	0%	0	0%
Spring	1	4%	2	25%	0	0%
Crystal Springs Water Company	11	41%	0	0%	6	75%
Shared water system	1	4%	1	13%	0	0%
Other	1	4%	0	0%	0	0%
Bottled	1	4%	0	0%	0	0%
5B. If your water supply is not from a community system, has your water source been tested?						
Yes	3	11%	5	63%	3	38%
No	0	0%	2	25%	1	13%
Don't know	1	4%	1	13%	0	0%
Not applicable	2	7%	0	0%	1	13%
5C. If your water source has been tested, has it ever been contaminated?	0	0%				
Yes	1	4%	1	13%	3	38%
No	3	11%	5	63%	1	13%
Don't know	3	11%	0	0%	0	0%
6. Is your septic tank or leachfield on you're the same property as the building that it servers?						
Yes	13	48%	7	88%	7	88%
No	3	11%	1	13%	1	13%
7. What is the age of your wastewater (septic) system?						
Years						
0 to 10	4	15%	4	50%	1	13%
11 to 20	2	7%	0	0%	0	0%
21 to 30	2	7%	1	13%	2	25%
31 to 40	2	7%	1	13%	0	0%
41 to 50	1	4%	0	0%	0	0%
System installed prior						
Before 1970	0	0%	0	0%	0	0%
1970 to 1989	2	7%	1	13%	0	0%
1990 to 1995	0	0%	1	13%	1	13%
1996 to 2001	1	4%	2	25%	1	13%
2002 to Present	2	7%	0	0%	0	0%
Don't know	2	7%	0	0%	3	38%

	Total East Montpelier [a]		Total North Montpelier [a]		Total Out of Area [a,b]	
8. Has the wastewater (septic) system for your property/business ever been replaced?						
Yes	9	33%	5	63%	1	13%
Years 0 to 10	6	22%	4	50%	0	0%
11 to 20	0	0%	1	13%	0	0%
21 to 30	0	0%	0	0%	0	0%
31 to 40	2	7%	0	0%	0	0%
41 to 50	0	0%	0	0%	0	0%
No	1	4%	3	38%	4	50%
Don't know	5	19%	0	0%	3	38%
9. What type of septic tank do you have?						
Concrete	13	48%	7	88%	6	75%
Metal	4	15%	0	0%	0	0%
Plastic/Fiberglass	0	0%	0	0%	0	0%
Don't know	0	0%	1	13%	2	25%
10. Which type of wastewater disposal system do you have?						
In-ground leach field	11	41%	6	75%	6	75%
Mound	5	19%	0	0%	0	0%
Dry-well	1	4%	0	0%	1	13%
At-grade	0	0%	0	0%	0	0%
Cesspool	0	0%	0	0%	0	0%
Other	0	0%	0	0%	0	0%
Don't know	1	4%	2	25%	2	25%
11. Does your wastewater system already include treatment options, such as:						
Sand filter	5	19%	1	13%	0	0%
Peat filter	0	0%	0	0%	0	0%
Other	2	7%	2	25%	0	0%
None	1	4%	0	0%	0	0%
Don't know	7	26%	4	50%	7	88%
12. Is your wastewater system shared with other homes or businesses?						
Yes	1	4%	2	25%	0	0%
No	13	48%	6	75%	8	100%
Don't know	3	11%	0	0%	1	13%
13. Does your wastewater system (check as many as apply):						
Periodically backup into the building?	0	0%	0	0%	0	0%
Break out onto the lawn (wet spots with sewage odors)?	1	4%	0	0%	0	0%
Have other problems?	2	7%	1	13%	0	0%
None	4	15%	2	25%	3	38%
Don't know	2	7%	0	0%	0	0%

	Total East Montpelier [a]		Total North Montpelier [a]		Total Out of Area [a,b]	
14. In your opinion, what is the condition of your wastewater system?						
Excellent	8	30%	5	63%	3	38%
Pretty good	4	15%	3	38%	4	50%
So-so	3	11%	0	0%	0	0%
Not so good	1	4%	0	0%	0	0%
Need replacing	1	4%	0	0%	0	0%
15. How often do you have your septic tank pumped?						
Every 1 to 3 years	12	44%	4	50%	5	63%
Every 4 to 6 years	3	11%	2	25%	2	25%
Every 7 to 10 years	2	7%	0	0%	0	0%
Don't have it pumped	0	0%	1	13%	1	13%
16. Do you have a garbage disposal (grinder) in your kitchen?	0	0%				
Yes	1	4%	0	0%	1	13%
No	14	52%	8	100%	7	88%
17. About how much have you spent on your wastewater system in the past 10 years?						
$____for maintenance (pumping and repairs) (19-EM, 7-NM, -OOA)	$17,150	$903	$2,555	$365	$2,755	$394
$____for replacement (4-EM, 1-NM, 0 - OOA)	$36,950	$9,238	$12,000	$12,000	$0	$0
None (1-EM, 1-NM, 1 - OOA)	1	1	1	1	1	1
would be acceptable to a prospective buyer/and or their loan agent?						
Yes	12	44%	6	75%	8	100%
No	4	15%	0	0%	0	0%
Don't know	1	4%	2	25%	0	0%
19. Would you be interested in connecting to a shared or community wastewater treatment system if						
Yes	5	19%	1	13%	1	13%
No	6	22%	3	38%	2	25%
Don't know, need more information	6	22%	4	50%	5	63%
better informed about individual or community wastewater treatment systems, such as:						
Maintenance of your existing system?	1	4%	3	38%	2	25%
How your system works?	1	4%	3	38%	3	38%
Other information	2	7%	1	13%	1	13%
None	3	11%	0	0%	2	25%

	Total East Montpelier [a]		Total North Montpelier [a]		Total Out of Area [a,b]	
21A. Would you be interested in a preliminary on site evaluation of your waste water system?						
Yes	4	15%	4	50%	3	38%
No	10	37%	4	50%	5	63%
Maybe	3	11%	0	0%	0	0%

Comments

- Cost is a huge concern.
- Feel that it would improve water quality in this area.
- Site evaluation welcomed, if the person doing it is knowledgeable.
- Most systems in the village area can not wait for this to develop.
- Wastewater system welcomed.
- E. Montpelier definetly needs a wastewater system.
- Interested in a preliminary on site evaluation at NO expense.
- If there was a connection to a a C.W.T.S we could possibly drill a well.

Notes Regarding Summary of Survey Reponses:

a. Percentages are based on the number of responses in each of the 3 areas: East Montpelier; North Montpelier Village; and Out of Village study areas.

b. The surveys were sent to property owners in and near each village study area. The responses from outside the study areas are noted as "Out of Area".

APPENDIX C

Build-out Analysis Results

Assumptions and Methodologies
- Figure C-1 - ArcGIS 9.1 Model
- Figure C-2 - Development Potential Legend Example
- Figure C-3 - Build Out Legend Example
- Figure C-4 - Development Potential Onsite Analyses
- Figure C-5 - Development Potential Offsite Analyses
- Figure C-6 - Build Out Onsite Analyses
- Figure C-7 - Build Out Offsite Analyses
- Table C1 - Land Use Development Characteristics and Scoring Factors CVRPC GIS Development Potential Analysis
- Table C2 - Minimum Lot Areas for Build Out Scenarios
- Table C3 - Build Out Legend Definitions
- Table C4 - GIS Data Sources
- Table C5 - Current and Build Out Wastewater Flows for Study Areas
- Table C6 - Summary of Current, Design Year and Build Out Wastewater Flows for Study Areas

East Montpelier Wastewater Build Out Assumptions and Methodologies

The Central Vermont Regional Planning Commission (CVRPC) conducted a build out analysis in conjunction with a wastewater assessment performed by Forcier Aldrich & Associates (FA&A). The study area consisted of the villages of East Montpelier and North Montpelier. CVRPC was responsible for 1) a development potential analysis and 2) a parcel-by-parcel build out analysis. This document will outline the assumptions and methodologies used to develop the development potential and build out analyses.

Assumptions and Methodologies

CVRPC staff, FA&A staff, the East Montpelier Wastewater Committee and Planning Commission all contributed to the development and running of the Development Potential and Build Out scenarios.

The study area as decided upon by East Montpelier was limited to the villages of East Montpelier and North Montpelier. These two areas where used as the boundary extents within the development potentials and build outs.

The analysis started with CVRPC attending three meetings; one with each of the following groups, FA&A, East Montpelier Waste Water Committee, and East Montpelier Planning Commission. From these meetings the following list of recommendations were made to CVRPC in regard to the development potential or build out analysis.

1) For the build out change the minimum lot size of Residential and Commercial district from 1 acre to .75 acres per unit.
2) For the development potential include the East Montpelier Conservation Overlay Districts and Potential Growth Areas based on Town Plan for East Village and North Montpelier. The conservation overlay districts should receive a weighted factor of –25 and the potential growth areas should receive a weighted factor of +50.
3) For the development potential create two different scenarios; one with onsite wastewater capabilities of the soil included and one without.
4) For the build out create two different scenarios to analyze the difference in onsite vs. offsite waste water treatment.

With these recommendations, CVRPC moved forward with the creation of the two development potential scenarios using available GIS data (Table C-4).

Development Potential

The development potential is the combination of natural and other features. Each of these features is weighted based on its incentives or limitations to development. The East Montpelier development potential includes 12 features (see Table C-1 for a complete list of these features and corresponding weights).

Table C-1 - CVRPC GIS Development Potential Analysis Land Use Development Characteristics and Scoring Factors

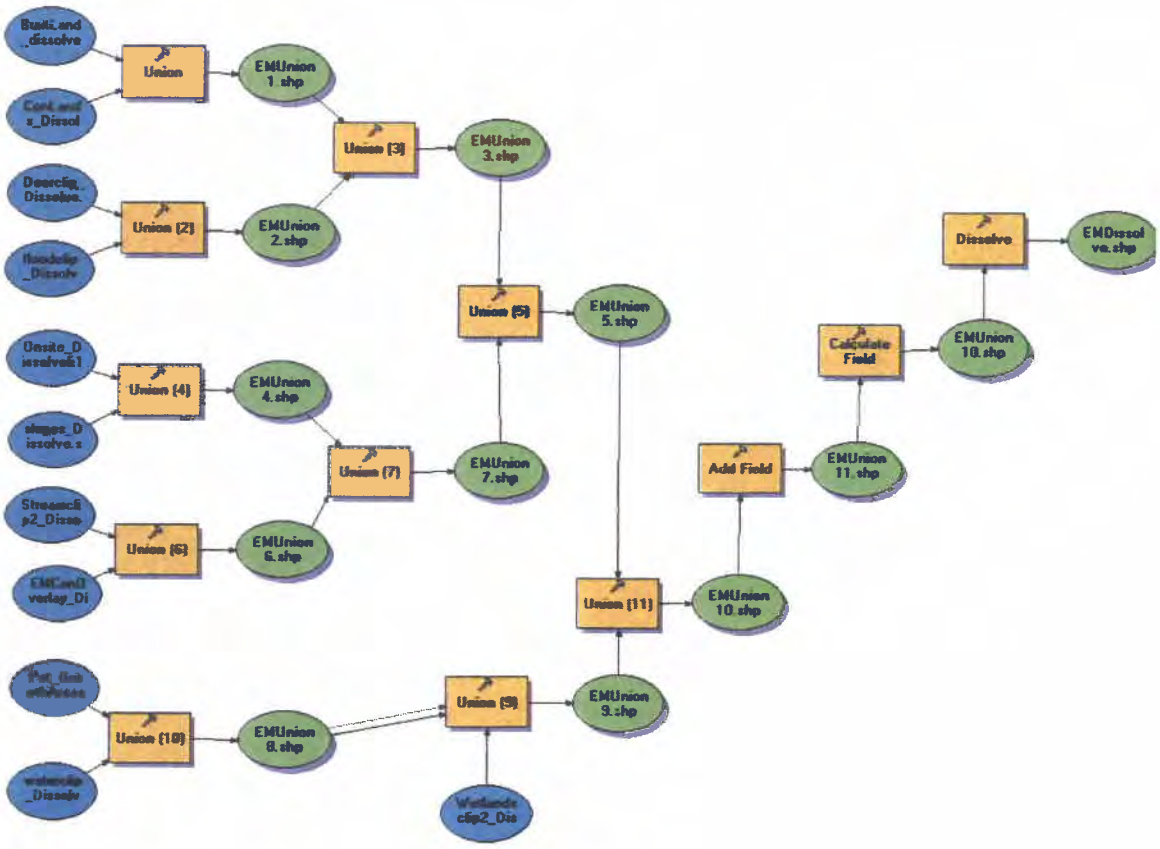
Scoring Range: High > -25, Moderate = -26 to -74, Low = -75 to -199, Minimal = -200 to -1999, Built < -2000

Characteristic Factor (Prohibitive Constraints = -200)

Slope		
	30-99%	-200
	20-29%	-50
	15-19%	-25
	0-14%	0
Flood zone		
	100 yr	-100
	500 yr	-50
Water Service Area		
	Water service	50
Stream Buffer		
	50 ft buffer	-100
Deer Yard		
	Deer Yard	-25
Wetland Buffer		
	Class II + 50 ft buffer	-200
	Class III	-100
	Class III 50 ft. buffer	-50
Prime Agriculture Soil		
	Prime	-25
	Prime b	-25
	State Wide	-25
	State Wide b	-25
Onsite Wastewater Capabilities of the Soil		
	Well Suited	0
	Moderately	0
	Marginal	-100
	Not Suited	-200
	Water	-200
Built land (Existing Built Up Land was separated from the analysis, extracted from LULC, Building Footprints, and E911 sites 100 ft Buffer)		
	Built land	-2,100
Conserved lands (Cons/Pub land and VLT land easements)		
	Conserved lands	-200
Conservation Overlay Districts – Source		
	District	-25
Potential Growth Areas Based on Town Plan East Village and North Montpelier		
	Potential Growth Areas	50

CVRPC combined these 12 features using a process created in ArcGIS 9.1 Model Builder. Please see Figure C-1 for a picture of the model used.

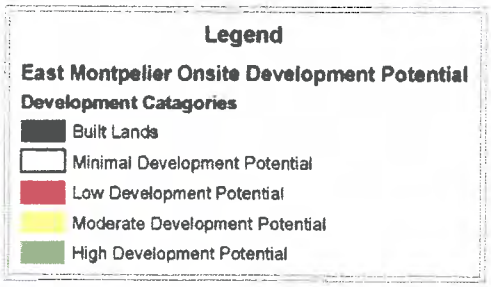
Figure C-1 Development Potential Model Flow Chart



Two distinct development potential scenarios were created for use in the East Montpelier Villages Build Out. The first included the onsite wastewater capabilities of the soil while the second did not. The reason behind the creation of two different development potential strategies was to help the build out calculate the potential units for a scenario of onsite waste water treatment and offsite waste water treatment.

The development potential is broken out into five categories that include where development potential is high, medium, low, or not possible. Areas where development is high are designated by the color green. Regions where development is moderate are yellow. Areas where development is low are colored red. White areas are where development cannot occur because of conservation status. The final areas are black which represents existing development. Please see Figure C-2 below for colors.

Figure C-2 Development Potential Legend Example



The results from the two development potential scenarios can be seen on figure C-4 and C-5 at the end of this report.

Once the development potential scenarios were created, CVRPC set up and ran the build outs.

Build Out

CVRPC utilized ArcView 3.2 to run the Community Build Out Analysis Version 2 as developed by Addison County RPC. Please refer to Build Out Manual Version 2 for a detailed description of the use and running of the Community Build Out Analysis.

The build out analyzes a study area based on its zoning regulations, by using minimum lot sizes, parcels, existing structures. The result is an estimate for the amount of development which could occur per parcel given its current zoning.

CVRPC created two build out scenarios as part of the East Montpelier Waste Water Study. The first used all the parameters listed above and the development potential with the onsite wastewater capabilities. Again, the second build out used all the parameters listed above and the development potential without the onsite wastewater capabilities. The results of these two build outs show what the development capacity of each parcel is in the study areas under the scenarios of onsite waste water treatment and offsite waste water treatment.

The results from the two Build Out scenarios can be seen on figure C-6 and C-7 of this report. Table C-2 shows the districts, uses, and minimum lot sizes used in the build out scenarios.

Table C-2 Minimum Lot Areas for Build Out Scenario

District	Use	Minimum Acres
Agricultural Forest Conservation	Residential	7
Commercial	Commercial	1
Residential and Commercial	Residential	0.75
Residential and Commercial Com	Commercial	0.75
Rural Residential and Agricultural	Residential	3

The build out results are divided into nine categories that depict where development can and cannot occur. The following is a list of categories and the corresponding colors used in the build out.

1) Areas were no development can occur are designated by the color grey.
2) Built Out areas are designated by the color dark blue.
3) Grandfathered areas are designated by the color light blue.
4) Under Min. Acreage areas are designated by the color rose.
5) Density Removed areas are designated by the color pink.
6) Density Relocated areas are designated by the color green.
7) Density Reduced areas are designated by the color orange.
8) Developable areas are designated by the color tan.
9) Unknown areas are designated by the color white.

Please see Figure C-3 for the color and short description of each category and Table C-3 for a more detailed description of each category.

Figure C-3. Build Out Legend Example

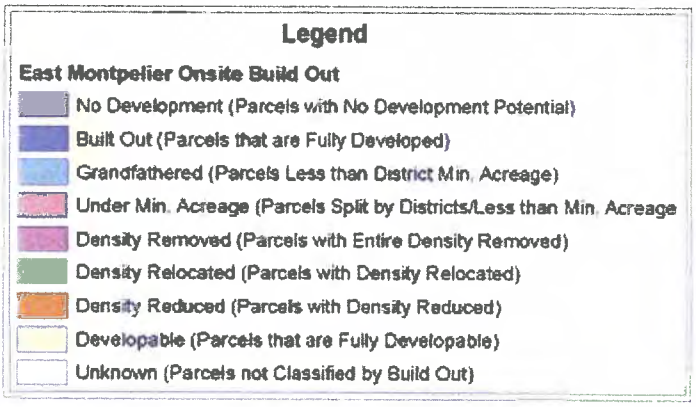


Table C-3. Build Out Legend Definitions

Buildout Potential Category	Legend Color	Code Values	Description:
No Development	Grey	8.	This represents areas of a parcel on which no development can occur. For example, a theme may represent Conservation Easements or Public Lands. Development within those areas is not likely to occur. As a result, any portion of a parcel that falls within such areas can be marked as no development.
Built Out:	Dark Blue	7	This represents parcels that are fully built out. Therefore, no further subdivisions (development) can occur.
Grandfathered	Light Blue	6	This represents areas of a parcel that have no existing development located on it, but the parcel does not meet the minimum acreage requirement for the zoning district(s) in which it falls. It is assumed that it is a pre-existing (grandfathered) parcel. Each grandfathered parcel is given one potential unit.
Under Min. Acreage	Rose	5	This represents areas of a parcel that fall within two different zoning districts and the parcel does not meet the minimum zoning requirement in one of those districts
Density Removed	Pink	4	This represents areas of a parcel that fall entirely within an area where structures cannot be located, such as wetlands, flood plains, etc. These areas are referred to as 'No Build' areas. This essentially means that, while development is possible, there is no permissible place to locate the structures
Density Relocated	Green	3	This represents areas of a parcel that fall partially within an area where structures cannot be located, such as wetlands, flood plains, etc. It is assumed that the 'permissible density' of structures can be located on adjoining areas of the parcel where structures can be located.
Density Reduced	Orange	2	This represents areas of a parcel that fall within an area where structures can be located, such as deeryards, poor onsite wastewater capacity, ect, but are limitations to development, resulting in areas of the parcel having a lower density.
Developable	Tan	1	This represents areas of a parcel that have no restriction to development
Unknown	White	0	This represents areas that cannot be classified by the Build Out as any of the above values

Table C- 4 – GIS Data Sources

Building Footprints: Derived from 1:5000 1996/97 Orthophotography – CVRPC, 2003

Conserved lands: UVM Spatial Analysis Lab, 2005

Conservation Overlay Districts: East Montpelier Zoning Regulations- CVRPC, 2002

Deer Yard: USGS topographic quads, 1:24000 or 1:25000 - Vermont Agency of Natural Resources, 1997

E911 Sites: GPS, 1:5000 Orthophotography, onscreen digitizing - VT Enhanced 911 Board, 2006

Flood Zone: Digitized from FEMA Flood Insurance Rate Maps – CVRPC, 1991-1993 or FEMA Q3 data 1996.

Land Use Land Cover (LULC): Derived from 1:5000 1996/97 Orthophotography – CVRPC, 1998

Parcels: East Montpelier, 2004

Potential Growth Areas: East Montpelier Town Plan - CVRPC, 2006

Slope: Derived from VCGI Hydrography DEM – GrassRoots GIS, 2006

Soil: Natural Resources Conservation Service (NRCS), 2006

Stream Data for Buffer: 1:5000 Vermont Hydrography Dataset - VT Center for Geographic Information (VCGI), 2004

Water Service Area: GrassRoots GIS/FA&A, 2006

Wetlands Data for Buffer: 1:80000 Vermont Significant Wetlands Inventory (VSWI)- Vermont Agency of Natural Resources, 2005

Zoning – East Montpelier Zoning Regulations- CVRPC, 2002

Figure C-4

East Montpelier Village Development Potential Onsite Analysis

North Montpelier Development Potential Onsite Analysis

Legend

East Montpelier Onsite Development Potential

Development Catagories

- Built Lands
- Minimal Development Potential
- Low Development Potential
- Moderate Development Potential
- High Development Potential

0 300 600 1,200 Feet

1 inch equals 600 feet

N W E S

GIS

Figure C-5

East Montpelier Village Development Potential Offsite Analysis

North Montpelier Development Potential Offsite Analysis

Legend

East Montpelier Offsite Development Potential

Development Catagories

- Built Lands
- Minimal Development Potential
- Low Development Potential
- Moderate Development Potential
- High Development Potential

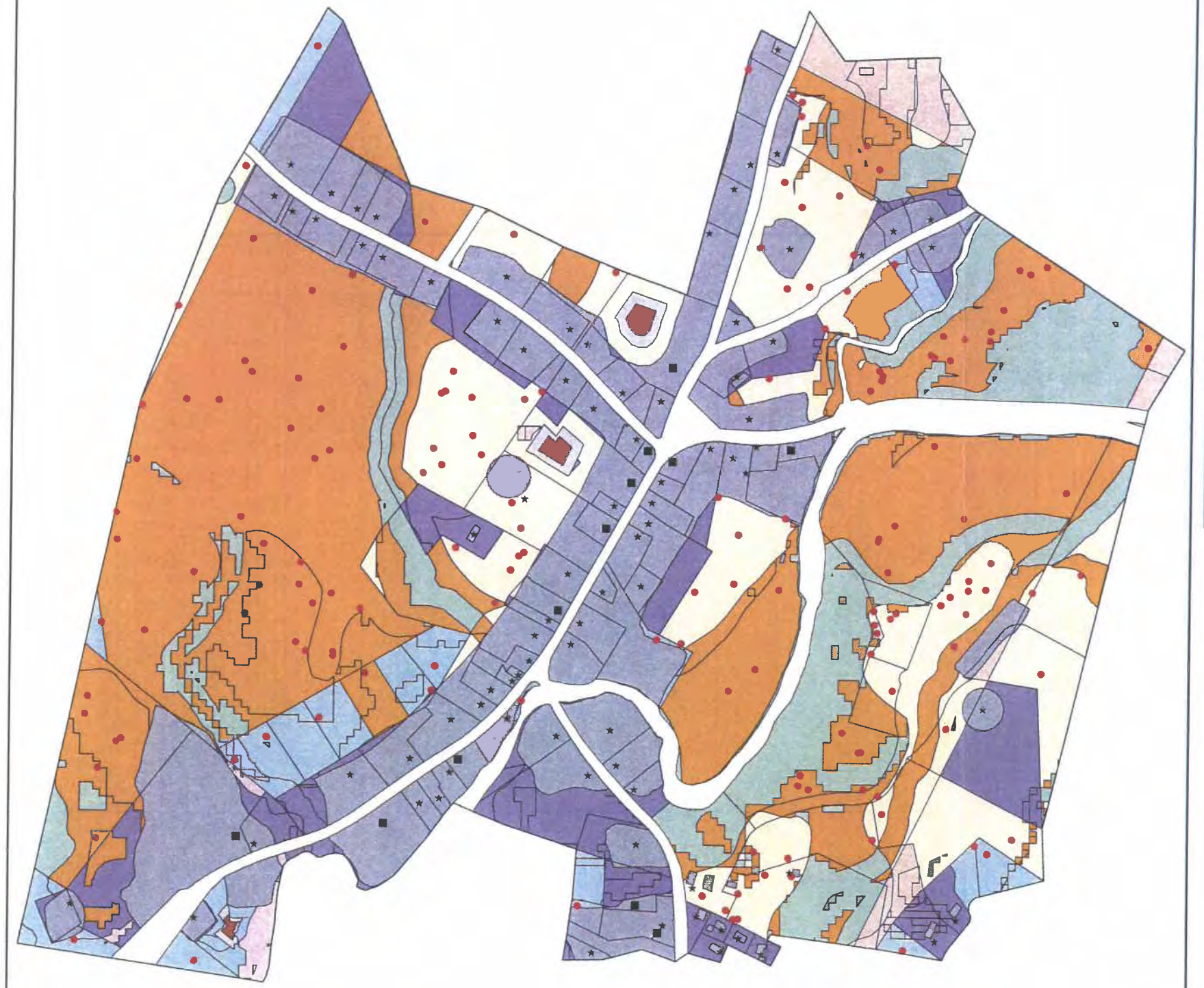
0 300 600 1,200 Feet

1 inch equals 600 feet

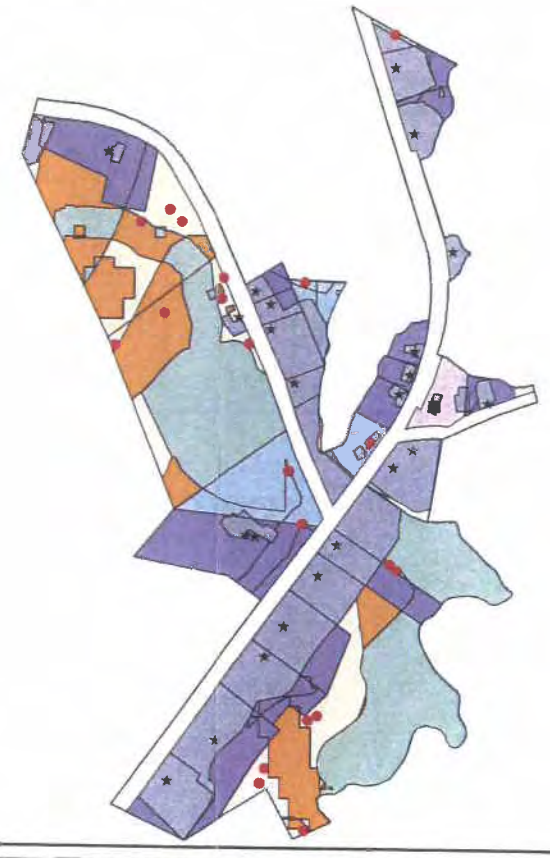
GIS
CENTRAL VERMONT REGIONAL PLANNING COMMISSION

Figure C-6

East Montpelier Village Build Out Onsite Analysis



North Montpelier Build Out Onsite Analysis



Legend

East Montpelier Onsite Build Out

- No Development (Parcels with No Development Potential)
- Built Out (Parcels that are Fully Developed)
- Grandfathered (Parcels Less than District Min. Acreage)
- Under Min. Acreage (Parcels Split by Districts/Less than Min. Acreage
- Density Removed (Parcels with Entire Density Removed)
- Density Relocated (Parcels with Density Relocated)
- Density Reduced (Parcels with Density Reduced)
- Developable (Parcels that are Fully Developable)
- Unknown (Parcels not Classified by Build Out)

Existing Structures

- Residential
- Commercial

Potential Residential Points Randomly Placed

Potential Commercial Development

- Building Footprint
- Parking Area

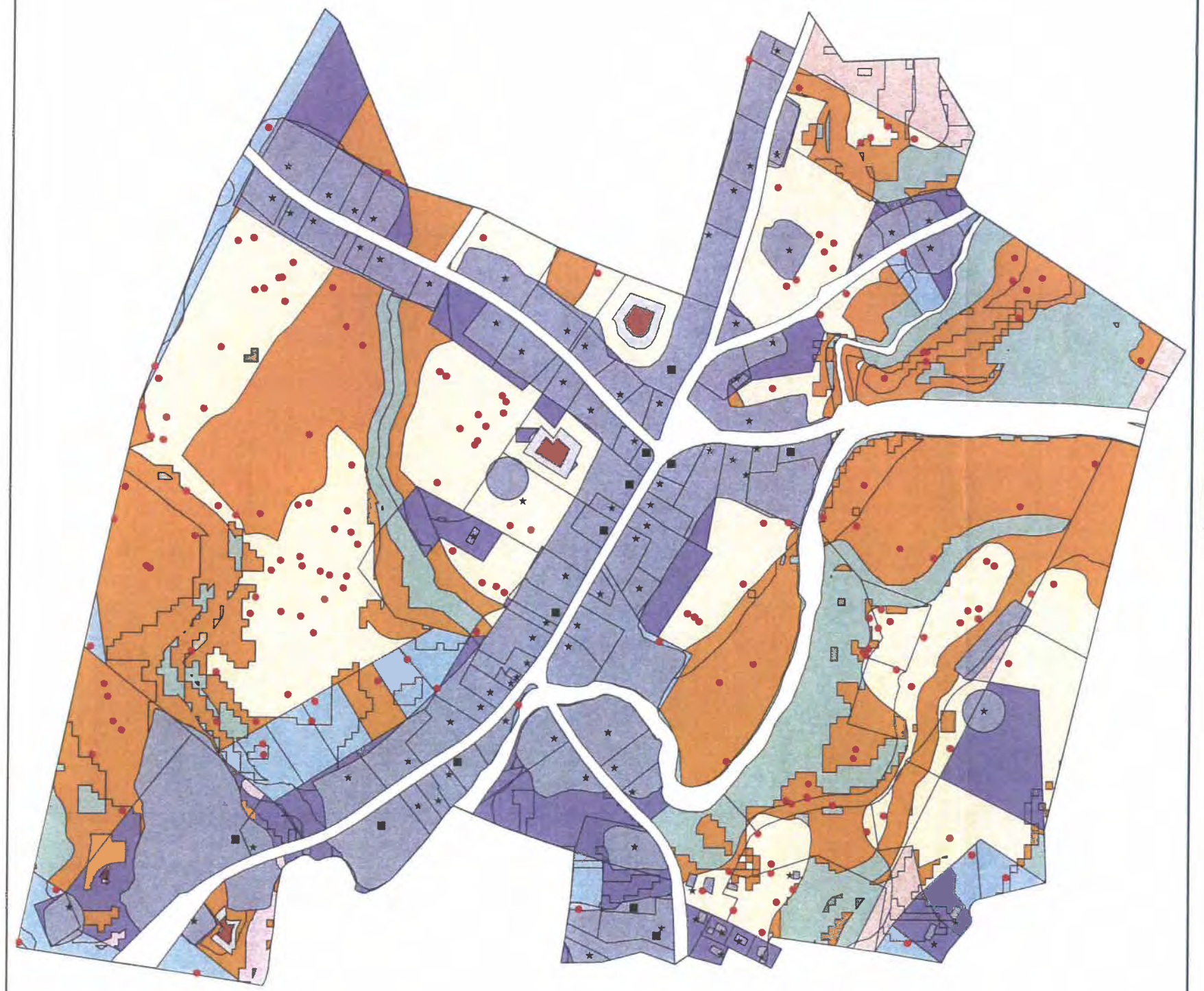
0 300 600 1,200 Feet

1 inch equals 600 feet

GIS

Figure C-7

East Montpelier Village Build Out Offsite Analysis



North Montpelier Build Out Offsite Analysis

Legend

East Montpelier Offsite Build Out

- No Development (Parcels with No Development Potential)
- Built Out (Parcels that are Fully Developed)
- Grandfathered (Parcels Less than District Min. Acreage)
- Under Min. Acreage (Parcels Split by Districts/Less than Min. Acreage
- Density Removed (Parcels with Entire Density Removed)
- Density Relocated (Parcels with Density Relocated)
- Density Reduced (Parcels with Density Reduced)
- Developable (Parcels that are Fully Developable)
- Unknown (Parcels not Classified by Build Out)

Existing Structures

- Residential
- Commercial

Potential Residential Points Randomly Placed

Potential Commercial Development

- Building Footprint
- Parking Area

0 300 600 1,200 Feet

1 inch equals 600 feet

GIS

Table C5

Current and Build-Out Wastewater Flows For Study Areas

Subarea	Map	Block	Lot	Physical Address	Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
					Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
East Montpelier Village Study Area																						
1	21	52	29	70 QUAKER RD	D	R	0.58	1	3		420	245	1	3			420	1	3			245
1	21	51	35	75 QUAKER ROAD	D	R	0.88	1	2		280	245	1	2			280	1	2			245
1	21	52	22	115 MCKNIGHT ROAD	D	R	9.9252	1	2		280	245	1	2			280	1	2			245
1	21	51	38.2	115 QUAKER ROAD	D	R	0.82	1	3		420	245	1	3			420	1	3			245
	21	51	33	QUAKER ROAD	U		10.429				0	0	11	33			4,620	11	33			2,695
1	21	52	28	120 QUAKER ROAD	D	R	0.60	1	3		420	245	1	3			420	1	3			245
1	21	52	20	130 QUAKER RD.	D	R	10.311	1	2		280	245	1	2			280	1	2			245
1	21	52	27	140 QUAKER ROAD	D	R	1.01	1	3		420	245	1	3			420	1	3			245
1	21	51	32	155 QUAKER ROAD	D	R	1.17	1	4		490	245	1	4			490	1	4			245
1	21	51	31	195 QUAKER ROAD	D	R	2.03	1	4		490	245	1	4			490	1	4			245
1	21	52	21	210 QUAKER RD	D	R	2.98	1	4		490	245	1	4			490	1	4			245
1	21	51	30	265 QUAKER ROAD	D	R	0.49	1	3		420	245	1	3			420	1	3			245
1	21	51	9	315 QUAKER ROAD	D	R	0.89	2	5		560	490	2	5			560	2	5			490
1	21	52	23	330 QUAKER ROAD	D	R	1.28	1	3		420	245	1	3			420	1	3			245
1	21	51	10	335 QUAKER ROAD	D	R	0.35	1	3		420	245	1	3			420	1	3			245
1	21	52	24	350 QUAKER ROAD	D	R	0.63	1	2		280	245	1	2			280	1	2			245
1	21	51	12	385 QUAKER ROAD	D	R	0.68	1	3		420	245	1	3			420	1	3			245
1	21	51	12	385 QUAKER ROAD	D	R	0.68	1	3		420	245	1	3			420	1	3			245
1	21	52	25	390 QUAKER ROAD	D	R	0.98	1	3		420	245	1	3			420	1	3			245
1	21	51	13	405 QUAKER ROAD	D	R	0.34	1	3		420	245	1	3			420	1	3			245
1	21	51	13	405 QUAKER ROAD	D	R	0.34	1	3		420	245	1	3			420	1	3			245
1	21	51	15	425 QUAKER ROAD	D	R	0.68	1	2		280	245	1	2			280	1	2			245
1	21	52	26	430 QUAKER ROAD	D	R	16.49	1	3		420	245	1	3			420	1	3			245
Subarea 1 Subtotals											8,890	4,655					13,510					8,330

Table C5

Current and Build-Out Wastewater Flows For Study Areas

Subarea	Map	Block	Lot	Physical Address	Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
					Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
										Use	8,900	4,700					13,600					8,400
2	21	52	19	105 KELTON RD	D	R	1.27	1	4		490	245	1	4			490	1	4			245
2	21	52	18	175 KELTON RD	D	R	0.88	1	3		420	245	1	3			420	1	3			245
2	21	52	17	185 KELTON RD	D	R	1.05	1	3		420	245	1	3			420	1	3			245
2	21	52	16	200 KELTON RD	D	R	0.58	1	3		420	245	1	3			420	1	3			245
2	21	52	9	285 KELTON RD	D	R	0.60	1	2		280	245	1	2			280	1	2			245
2	21	52	33	40 KELTON ROAD (Town Offices)	D	I					150	150					150					150
2	21	52	15	90 KELTON RD	D	R	7.78	1	5		560	245	7	23			1,820	7	23			1,715
2	21	52	10.5	KELTON RD	U		10.854				0	0	5	15			2,100	5	15			1,225
2	21	51	16	VINCENT FLATS ROAD	U		9.5918				0	0	2	6			840	2	6			490
2	21	52	32	75 RTE 14 NORTH EAST MONTPELIER	D	C	4.50			4200	300	300				27,516	2,752				27,516	2,752
2	21	52	32	160 RTE 14 NORTH EAST MONTPELIER	D	R & C	4.50	1	3		420	245	1	3	1		420	1	3	1		245
2	21	52	32	110 RTE 14 N	U						0	0					0					0
2	21	52	36	160 RTE 14 N	D	R	1.68	1	4		490	245	1	4			490	1	4			245
2	21	52	14.111	335 VT RTE. 14 N	U		0.87				0	0	2	6			840	2	6			490
2	21	52	14.12	305 VT RTE. 14 N	D	R	0.64	1	3		420	245	1	3			420	1	3			245
2	21	52	14.2	265 VT RTE. 14 N	D	R	0.44	1	2		280	245	1	2			280	1	2			245
2	21	52	12	320 VT RTE. 14	D	R	0.93	1	2		280	245	1	2			280	1	2			245
2	21	52	37	RTE. 2 (LARGER LOT)	D	C					0	0	17	51			7,140	17	51			4,165
2	21	52	14.112	VT ROUTE 14 N	U		1.0187				0	0	1	3			420	1	3			245
2	21	52	14.111	RTE. 14	D	R	2.6955	1	3		420	245	1	3			420	1	3			245
Subarea 2 Subtotals											5,350	3,390					20,402					13,927
										Use	5,400	3,400					20,400					14,000
3	21	52	56	2713 US RTE. 2	D	R	0.67	1	3		420	245	1	3			420	1	3			245

Table C5

Current and Build-Out Wastewater Flows For Study Areas

Subarea	Map	Block	Lot	Physical Address	Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
					Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
3	21	51	73	2283 RTE. 2	D	R	0.73	1	5		560	245	1	5			560	1	5			245
3	21	51	71	2348 US RTE. 2	D	R	0.37	1	2		280	245	1	2			280	1	2			245
3	21	51	36	25 QUAKER ROAD	D	R	0.3518	1	2		280	245	1	2			280	1	2			245
3	21	51	72.3	2419 RTE. 2	D	C	10.44			25 empl.	375	375				1,092	109				1,664	166
3	21	51	72.1	2427 RTE. 2	D	C	1.03	1	3		420	245	1	3			420	1	3			245
3	21	51	51.1	2537 US RTE. 2	D	R	2.46	2	5		700	490	2	5			700	2	5			490
3	21	51	69	2540 RTE. 2	D	C	2.95			1300	130	130				1,300	130				1,300	130
3	21	51	60	2574 US RTE. 2	D	R	0.46	1	4		490	245	1	4			490	1	4			245
3	21	51	52	2589 U.S. RTE. 2	D	R	1.33	1	3		420	245	1	3			420	1	3			245
3	21	51	43	26 EVERGREEN LN	D	R	0.30	1	2		280	245	1	2			280	1	2			245
3	21	51	61	2600 RTE. 2	D	R	0.33	3	9		1,260	735	3	9			1,260	3	9			735
3	21	51	63	2624 U.S RTE. 2, EAST MONTPELIER	D	R & C	0.52	1	4	600	490	245	1	4	1	600	490	1	4	1	600	245
3	21	51	53	2641 RTE 2, VILLAGE OF E. MONTPELIER	D	R	1.21	1	4		490	245	1	4			490	1	4			245
3	21	51	64	2682 US RTE. 2	D	R	0.59	1	1		140	245	1	3			420	1	3			245
3	21	51	54	2685 U.S RTE 2, EAST MONTPELIER	D	R	1.00	1	2		280	245	1	2			280	1	2			245
3	21	51	57	2719 RTE. 2	D	R	0.07	1	4		490	245	1	4			490	1	4			245
3	21	51	58	2727 US RTE. 2	D	R	0.54	1	5		560	245	1	5			560	1	5			245
3	21	52	52	2764 US RTE. 2	D	R	1.00	1	2		280	245	1	2			280	1	2			245
3	21	51	42	2783 RTE. 2	D	C	0.67			1500	414	414			1	1,500	414			1	1,500	414
3	21	52	51	2784 US RTE. 2	D	R	0.92	1	1		140	245	1	1			140	1	1			245
3	21	52	49	2812 U.S. RT 2	D	R	0.26	1	4		490	245	1	4			490	1	4			245
3	21	51	41.1	2817 US RTE. 2 LAW OFFICES	D	C	0.99				30	30					30					30
3	21	51	41.2	2839 US RTE. 2	D	R	4.00	1	3		420	245	2	6			840	2	6			490
3	21	52	48	2844 RTE. 2	D	R	0.48	1	4		490	245	1	4			490	1	4			245

Table C5

Current and Build-Out Wastewater Flows For Study Areas

					Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
Subarea	Map	Block	Lot	Physical Address	Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
3	21	52	40	2875 RTE. 2	D	C	14.28			1400	140	140	8	24			3,360	8	24			1,960
3	21	52	46	2892 US RTE. 2	D	R	2.36	2	5		700	490	2	5			700	2	5			490
3	21	52	39	2893 US RTE. 2	D	R	1.39	1	4		490	245	1	4			490	1	4			245
3	21	51	59	29 EVERGREEN LN.	D	R	7.43	1	4		490	245	5	15			2,100	5	15			1,225
3	21	52	47	2878 RTE. 2	D	R	0.77	1	3		420	245	1	3			420	1	3			245
3	21	51	38.1	2915 US RTE. 2 store	D	R	3.70	1	3	6000	430	845				23,710	2,371				24,719	2,472
3	21	51	44	2930 RTE. 2	D	R	1.95	1	3		420	245	1	3			420	1	3			245
3	21	51	37	2947 RTE 2	D	R	0.24	1	2		280	245	1	2			280	1	2			245
3	21	52	38	2952 US RTE. 2	D	C	0.47			1700	15	15			1	1,700	15			1	1,700	15
3	21	51	39	3000 RTE. 2	D	C	0.25			930	45	45			1	930	45			1	930	45
3	21	51	40	3030 RTE. 2	D	R	0.53	1	3		420	245	1	3			420	1	3			245
3	21	52	37	3035 RTE. 2	D	R	43.071	2	5		700	490	2	5			700	2	5			490
3	21	52	41	3042 US RTE. 2	D	C	0.35			816	82	82			1	816	82			1	816	82
3	21	52	43	3044 RTE. 2	D	C	1.7005				0	0	1	3			420	1	3			245
3	21	52	42	3070 RTE. 2	D	C	0.60			940	94	94			1	940	94			1	940	94
3	21	52	44	37 EVERGREEN LN.	D	R	0.31	1	2		280	245	1	2			280	1	2			245
3	21	52	53	RTE 2(CEMETARY)	D	I	2.8571				0	0	1	3			420	1	3			245
3	21	51	51.2	US RTE. 2	D		1.6585	1	3		326	245	2	6			326	2	6			490
3	21	51	51.3	US RTE. 2	D		1.4609	1	3		326	245	1	3			326	1	3			245
3	21	51	51.4	US RTE. 2	D		1.4397	1	3		326	245	1	3			326	1	3			245
3	21	51	51.5	US RTE. 2	D		1.3833	1	3		326	245	1	3			326	1	3			245
3	21	51	51.6	US RTE. 2	D		1.1404	1	3		326	245	1	3			326	1	3			245
3	21	51	51.7	US RTE. 2	D		1.1612	1	3		326	245	1	3			326	1	3			245
3	21	51	56	US RTE. 2	D	R	0.12	1	3		420	245	1	3			420	1	3			245

Table C5

Current and Build-Out Wastewater Flows For Study Areas

Subarea	Map	Block	Lot	Physical Address	Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
					Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
3	21	52	45	2910 RTE 2	D	R	0.54	1	3		420	245	1	3			420	1	3			245
3	21	52	52	2764 RTE. 2	D	R	0.54	1	3		420	245	1	3			420	1	3			245
3	21	51	55	2689 RTE. 2	D	R	0.54	1	3		420	245	1	3			420	1	3			245
Subarea 3 Subtotals											18,969	13,195					27,014					18,393
										Use	19,000	13,200					27,000					18,400
4	21	52	62	73 ST PAUL'S SQUARE	D	R	0.31	1	5		560	245	1	5			560	1	5			245
4	21	52	54	2390 VT RTE. 14 S	D	R	1.84	1	2		280	245	1	2			280	1	2			245
4	21	52	57.1	11 STONEY CORNERS ROAD	D	R	3.46	1	4		560	245	2	7			980	2	7			490
4	21	52	57.21	PINE RIDGE RD	U		47.034				0	0	18	54			7,560	19	57			4,655
4	21	52	57.22	RTE. 14 OFF	U		10.24				0	0	11	33			4,620	11	33			2,695
4	21	52	57.23	RTE. 14 OFF	U		1.4236				0	0	1	3			420	1	3			245
4	21	52	57.24	RTE. 14 OFF	U		1.7585				0	0	2	6			840	3	9			735
4	21	52	57.25	430 STONY CORNERS RD.	U		5.6729				0	0	1	3			420	2	6			490
4	21	52	57.26	LOT 5, STONEY CORNERS, E. MONTPELIER	U		6.35				0	0	1	3			420	1	3			245
4	21	52	58	RTE. 14 OFF	U		10.373				0	0	0	0			0	1	3			245
4	21	52	59	RTE. 14 STONEY CORNERS ROAD	U		5.0504				0	0	3	9			1,260	3	9			735
4	21	52	60	30 STONEY CORNERS	D	R	5.57	1	4		560	245	5	16			2,240	5	16			1,225
4	21	52	62	73 PAULS SQUARE	D	R	0.39	1	3		420	245	1	3			420	1	3			245
4	21	52	63	67 PAULS SQUARE	D	R	0.27	1	3		420	245	1	3			420	1	3			245
4	21	52	64	61 PAULS SQUARE	D	R	0.28	1	1		140	245	1	1			140	1	1			245
4	21	51	65	55 PAULS SQUARE	D	R	1.37	4	8		1,120	980	4	8			1,120	4	8			980
4	21	52	65	2415 RTE. 14	D	R	0.34	1	3		420	245	1	3			420	1	3			245
4	21	51	66	2365 RTE. 14	D	R	4.26	2	5		700	490	2	5			700	2	5			490
4	21	52	66	2210 RTE. 14	D	R	0.33	1	3		420	245	1	3			420	1	3			245

Table C5

Current and Build-Out Wastewater Flows For Study Areas

					Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
Subarea	Map	Block	Lot	Physical Address	Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
4	21	51	67	2275 RTE. 14 S	D	R	1.73	1	3		420	245	1	3			420	1	3			245
4	21	52	67	223 PINE RIDGE RD.	D	R	1.1135	1	3		420	245	1	3			420	1	3			245
4	21	52	68	255 PINE RIDGE RD.	D	R	1.08	1	3		420	245	1	3			420	1	3			245
4	21	51	68.1	2235 RTE. 14 S	D	C	1.32			3500	350	350			3,500	350				3500	350	350
4	21	51	68.2	2205 RTE. 14	D	C	1.21			1800	180	180			1,800	180				1800	180	180
4	21	51	68.3	RTE. 14	D	R	1.1798	1	4		560	245	1	4			560	1	4			245
4	21	51	68.4	2165 RTE. 14 S	D	R	2.04	1	2		280	245	1	2			280	1	2			245
4	21	52	69	275 PINE RIDGE ROAD	D	R	0.83	1	3		420	245	1	3			420	1	3			245
4	21	52	70	PINE RIDGE RD	D	R	0.6269	1	3		420	245	1	3			420	1	3			245
4	21	52	71	PINE RIDGE RD	U		1.5018				0	0	1	3			420	1	3			245
4	21	52	55	2360 RTE 14 S	D	R	0.92	1	4		560	245	1	4			560	1	4			245
4	21	51	14	VINCENT FLATS ROAD	D	R	63.642	1	3		420	245	32	96			13,440	54	96			13,230
4	21	52	31	VINCENT FLATS ROAD: KELTON R[CHURCH]	D	C	0.44				300	300					300					300
4	21	52	37	RTE. 14	D	C					30	30					300					30
4				79 Paul's Scaure	D	R		1	3		420	245	1	3			420	1	3			245
4				155 Carleton Blvd.	D	R		1	3		420	245	1	3			420	1	3			245
4				180 Carleton Blvd.	D	R		1	3		420	245	1	3			420	1	3			245
4				200 Carleton Blvd.	D	R		1	3		420	245	1	3			420	1	3			245
4				130 Carleton Blvd.	D	R		1	3		420	245	1	3			420	1	3			245
4				110 Carleton Blvd	D	R		1	3		420	245	1	3			420	1	3			245
4				98 Carleton Blvd.	D	R		1	3		420	245	1	3			420	1	3			245
4				85 Carleton Blvd.	D	R		1	3		420	245	1	3			420	1	3			245
4				80 Carleton Blvd.	D	R		1	3		420	245	1	3			420	1	3			245
4				2090 Rte. 14S	D	R		1	3		420	245	1	3			420	1	3			245

Table C5

Current and Build-Out Wastewater Flows For Study Areas

Subarea	Map	Block	Lot	Physical Address	Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
					Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
4				2110 Rte. 14S	D	R		1	3		420	245	1	3			420	1	3			245
4				2140 Rte. 14S	D	R		1	3		420	245	1	3			420	1	3			245
4				2160 Rte. 14S	D	R		1	3		420	245	1	3			420	1	3			245
Subarea 4 Subtotals											15,840	9,925					46,660					34,425
										Use	15,900	10,000					46,700					34,500
5	20		3.1	355 FACTORY STREET	D	R		1	2		280	245	3	9			1,260	3	9			735
5	20		3.2	305 FACTORY ST., M. MONTPELIER	D	R	1.44	1	2		280	245	1	2			280	1	2			245
5	20		7	RTE. 14 N	D	R	0.1682	1	3		420	245	1	3			420	1	3			245
5	20		8	3320 RTE 14 N	D	R	0.63	1	2		280	245	1	2			280	1	2			245
5	20		9	3268 RTE. 14 N	U						0	0					0					0
5	20		10	3200 RTE. 14	D	R	0.15	1	4		560	245										245
5	20		12.1	BUTTERFIELD RD.	D	R	3.4386	1	3		420	245	1	3			420	1	3			245
5	20		13	35 BUTTERFIELD RD.	D	R	0.31	2	5		700	490	2	5			700	2	5			490
5	20		15	2040 VT RTE. 14	D	R & C	0.58	1	2	600	340	340	1	2	1	600	340	1	2	1	600	340
5	20		16	2023 RTE 14	D	R		1	3		420	245	1	3			420	1	3			245
5	20		17	2051 & 3070 RTE. 14	D	R	0.84	4	8		1,120	980	4	8			1,120	4	8			980
5	20		18	RTE 14 POWER STATION	D		0.5031				0	0										
5	20		19	3135 14N	D	R	0.28	1	5		560	245	1	5			560	1	5			245
5	20		20	3125 RTE. 14	D	R	0.21	2	5		700	490	2	5			700	2	5			490
5	20		21	3105 RTE. 14 N. MONTPELIER	D	R	0.38	1	2		280	245	1	2			280	1	2			245
5	20		22	RTE. 14 N	D	R	0.4553	2	5		700	490	2	5			700	2	5			490
5	20		24	90 Factory Street	D	R	0.22	1	2		280	245	1	2			280	1	2			245
5	20		26	139 FACTORY ST., N. MONTPELIER	D	R	0.59	1	2		280	245	1	2			280	1	2			245
5	20		27	CAMP ON FAC TORY STREET	D	R	0.4812	1	3		420	245	1	3			420	1	3			245

Table C5

Current and Build-Out Wastewater Flows For Study Areas

Subarea	Map	Block	Lot	Physical Address	Current Use						Current Flows		Full Build Out Use On-Site				Full Build Out Flows	Full Build Out Use Off-Site				Full Build Out Flows
					Developed or Undeveloped	Residential or Commercial	GIS Area (ac)	Number of Units	Number of Bedrooms	Commercial Sqft.	On-Site	Large Cluster	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	On-Site	Number of Units	Number of Bedrooms	Commercial	Commercial Sqft.	Off-Site
5	20		28	140 Factory Street	D	R	0.24	1	2		280	245	1	2			280	1	2			245
5	20		29	150 FACTORY RD.	D	R	0.24	1	3		420	245	1	3			420	1	3			245
5	20		30	135 Factory Street	D	R	5.95	1	3		420	245	2	6			840	5	15			1,225
5	20		32	2969 &2971 VT ROUTE 14 N	D	R	2.14	6	12		1,680	1,470	6	12			1,680	6	12			1,470
5	20		35.2	2830 VT RTE. 14 N	D	R	0.99	1	3		420	245	1	3			420	1	3			245
5	20		36	2850 ROUTE 14 N	D	R	34.44	1	2		280	245	1	2			280	1	2			245
5	20		37	2930 VT RTE. 14N	D	R	1.05	2	5		700	490	2	5			700	2	5			490
5	20		38	2950 RTE. 14	D	R	1.25	4	5		700	980	4	5			700	4	5			980
5	20		39	2978 RTE. 14	D	R	6.64	3	5		700	735	7	17			2,380	7	17			1,715
5	20		40	3010 VT RTE. 14 N	D	R	0.87	2	7		980	490	2	7			980	2	7			490
5	20			3205 Rte.14 N	D	R		1	3		420	245	1	3			420	1	3			245
5	20			225 Butterfield Rd.	D	R		1	3		420	245	1	3			420	1	3			245
5	20			Route 214	D	R		1	3		420	245	1	3			420	1	3			245
Subarea 5 Subtotals											15,880	11,855					18,400					14,305

Table C6

Summary of Current, Design Year and Build-Out Wastewater Flows for Study Areas

Subarea	Initial Year (2008)		Design Year (2028)		Full Build Out	
	(On-Site)	(Large Cluster)	(On-Site)	(Large Cluster)	(On-Site)	(Large Cluster)
1 Quaker Road	8,900	4,700	10,700	5,700	13,510	8,330
2 Rte 14 N Kelton Rd.	5,400	3,400	6,500	4,100	20,400	14,000
3 Rte. 2	19,000	13,200	22,800	15,900	2,700	18,400
4 Rte 14 S	15,900	10,000	19,100	12,000	46,700	34,500
East Montpelier Village Study Area Total	49,200	31,300	59,100	37,700	83,310	75,230
5 North Montpelier	15,900	11,900	19,100	14,300	18,400	14,300

APPENDIX D

Wastewater Needs Investigation

Table D-1 Summary of Water Supply and Wastewater Permit Information
Table D-2 East Montpelier Vermont Ancillary Soil Suitability Ratings

Table D-1
Summary of Permit Information

Subarea	Address	Type of Permit	Type of System	Date of Permit or Inspection	Use[1]	Bedrooms	ESHGW (in)	Soil	Perc Rate (min/in.)	Design Flow (gpd)	Notes
1	1 McKnightRd.	Town	Replacement Mound	1998	sfr	3 - 4	12 - 15	Silt Loam			
1	115 McKnight Rd	Town	Replacement Mound	1998	sfr	3	12	Silty Sand	10	450	
1	115 Quaker Road	Town	Replacement Inground	1995	sfr	3	46	Silty Sand	20	450	
1	140 Quaker Road	Town	Replacement Mound	1996	sfr	3					
1	430 Quaker Road	Town	Replacement Mound	1998	sfr	3	21-23	Silt Loam			
2	40 Kelton Rd	State	Replacement Mound	1994	town office					150	Town of EM
2	75 Rt 14 North	State	Replacement Inground	1988	offices		60			300	assumed ESHGW based on 2' deepsystem ; replaced drywell system Artesian well inside building that serves this bldg, Brick Church and Wood Frame Bldg behind church.
2	105 Kelton Rd	State	Water Condition	2002	sfr	4				600	
3	3000 Rt 2	Town	Replacement Inground	1985	sfr		30 perched; 84 possible				Off-Site system on A. LaPerle's lot
3	2839 Rt 2	Town	New Mound	1999	sfr	4	25-32	Silt Loam	9		
3	2589 Rt 2	Town	Replacement Mound	2004	sfr	3					
3	2915 Rt 2	Town									Failed System for store, home and 2 garages
3	2537 Rt 2	State	New Inground	2006	cluster		28	Sand Loam	9	2280	seven lot subdivision cluster system
3	3000 Rt 2	Town	Replacement Inground	1985	sfr		30"	Fine Sandy Loam	10		
3	2839 Rt 2	State	Replacement Mound	2000	sfr	3	18	Silt Loam	9	450	
3	2365 Rt 14	State	Replacement Inground	1999	2 unit apt	5	70	Medium Sand		675	
3	2727 Rt 2	Town	Replacement Inground	2002	sfr	3	>72"	Sandy Loam	2	450	
3	2817 Rt 2	State	Mound	2005	12 employee coffe roasting, office & 8 seat bakery					414	
4	73 Paul's Square Off	Town	Replacement Inground	1987	sfr	3	42	Fine Sand	10	450	
4	55 Paul's Square Off	Town		2003	sfr	4	24			600	Permit Denied
4	430 Stony Corner's Road	Town		2004	sfr						Vacant
4	295 Pine Ridge Road	Town	inground	2003	sfr	3				450	
5	35 Butterfield Rd	State	inground	1998	1 apt, 165 per assembly area, 3 employees		60	Fine Sand	8.5	1188	
5	2830 Rt 14 N	Town	Replacement Inground	2004	sfr	3				450	
5	2850 Rt 14 N	Town	Replacement Inground	2002	sfr	4				600	
5	355 Factory Rd	Town	Replacement At-Grade	2002	sfr	4				600	

Notes:
1 sfr = Single Family Residence; apt. = Apartment

Table D-2
Ancillary Soil Suitability Ratings

East Montpelier Vermont Ancillary Soil Suitability Ratings (Natural Resources Conservation Service)

Soil Suitability Rating[1]	Soil Mapping Unit Abbreviation	Soil Mapping Unit Name	WAT-SHALL[2] (FT)	WAT-DEEP[3] (FT)	ROCK-SHAL[4] (IN)	ROCK-DEEP[5] (IN)	OWTS Type[6]	Primary Potential OWTS Limitations	Estimated Percolation Rate (min/in)	Estimated Replacement Area Application Rate (gpd/ft²)	Estimated LLR factor (f)	Estimated soil thickness (ft)	Estimated Linear Loading Rate (ggd/ft)
	26A	ADAMS LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	6	6			I		9	1.00	7.50	1.50	11.25
Ia	26B	ADAMS LOAMY FINE SAND, 3 TO 8 PERCENT SLOPES	6	6			I		9	1.00	22.40	1.50	33.6
Ia	26C	ADAMS LOAMY FINE SAND, 8 TO 15 PERCENT SLOPES	6	6			I		9	1.00	52.40	1.50	78.6
Ic	43B	SALMON VERY FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES	6	6			I		29	0.56	4.40	1.50	6.6
Ic	43C	SALMON VERY FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	6	6			I		29	0.56	13.50	1.50	20.25
Ic	90B	DUMMERSTON FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES	6	6	60	60	I		19	0.69	4.40	1.50	6.6
Ic	90C	DUMMERSTON FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	6	6	60	60	I		19	0.69	13.50	1.50	20.25
Ic	91C	DUMMERSTON FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES, VERY STONY	6	6	60	60	I		29	0.56	13.50	1.50	20.25
Id	43D	SALMON VERY FINE SANDY LOAM, 15 TO 25 PERCENT SLOPES	6	6			I		19	0.69	26.20	1.50	39.3
Id	90D	DUMMERSTON FINE SANDY LOAM, 15 TO 25 PERCENT SLOPES	6	6	60	60	I		19	0.69	26.20	1.50	39.3
Id	91D	DUMMERSTON FINE SANDY LOAM, 15 TO 35 PERCENT SLOPES, VERY STONY	6	6	60	60	I		19	0.69	26.20	1.50	39.3
IIc	66B	VERSHIRE-DUMMERSTON COMPLEX, 3 TO 8 PERCENT SLOPES, ROCKY	6	6	20	60	M	bedrock	19	0.37	4.40	1.17	5.148
IIc	66C	VERSHIRE-DUMMERSTON COMPLEX, 8 TO 15 PERCENT SLOPES, ROCKY	6	6	20	60	M	bedrock	19	0.37	13.50	1.17	15.795
IId	66D	VERSHIRE-DUMMERSTON COMPLEX, 15 TO 25 PERCENT SLOPES, ROCKY	6	6	10	40	M	bedrock & slope	19	0.37	26.20	0.33	8.646
IIe	26E	ADAMS LOAMY FINE SAND, 25 TO 60 PERCENT SLOPES	6	6			I	slope	9	1.00	52.40	1.50	78.6
IIf	43E	SALMON VERY FINE SANDY LOAM, 25 TO 50 PERCENT SLOPES	6	6			I	slope	29	0.56	26.20	1.50	39.3
IIg	2A	ONDAWA FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES	6	6			I	flooding	9	1.00	1.50	1.50	2.25
IIg	21A	SUNDAY FINE SAND, 0 TO 3 PERCENT SLOPES	6	6			I	flooding	9	1.00	3.70	1.50	5.55
IIg	59A	WAITSFIELD SILT LOAM, 0 TO 3 PERCENT SLOPES	6	6			I	flooding	19	0.69	0.70	1.50	1.05
IIh	33A	MACHIAS FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES	1.5	2.5			M	groundwater	19	0.50	1.50	1.00	1.5
IIIa	67C	GLOVER-VERSHIRE COMPLEX, 8 TO 15 PERCENT SLOPES, VERY ROCKY	6	6	10	40	M	bedrock	19	0.37	1.00	0.33	0.33
IIIa	67D	GLOVER-VERSHIRE COMPLEX, 15 TO 35 PERCENT SLOPES, VERY ROCKY	6	6	10	40	M	bedrock	19	0.37	26.20	0.33	8.646
IIIb	60A	WEIDER VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES	1.5	3			M	groundwater	19	0.37	1.50	1.00	1.5
IIIc	44B	LAMOINE SILT LOAM, 3 TO 8 PERCENT SLOPES	0.5	1.5			M	groundwater	59	0.12	2.20	0.33	0.726
IIIc	92B	BUCKLAND SILT LOAM, 3 TO 8 PERCENT SLOPES	1	2	60	60	M	groundwater	59	0.12	2.20	0.50	1.1
IIId	18C	CABOT SILT LOAM, 8 TO 15 PERCENT SLOPES, VERY STONY	0	1.5			M	groundwater	59	0.12	6.70	0.33	2.211
IIId	44C	LAMOINE SILT LOAM, 8 TO 15 PERCENT SLOPES	0.5	1.5			M	groundwater	59	0.12	6.70	0.33	2.211
IIId	92C	BUCKLAND SILT LOAM, 8 TO 15 PERCENT SLOPES	1	2	60	60	M	groundwater	59	0.12	6.70	0.50	3.35
IIId	93C	BUCKLAND SILT LOAM, 8 TO 15 PERCENT SLOPES, VERY STONY	1	2			M	groundwater	59	0.12	6.70	0.50	3.35
IIIe	41D	BUXTON SILT LOAM, 15 TO 25 PERCENT SLOPES	1.5	3			M	groundwater	59	0.12	13.10	1.00	13.1
IIIe	93D	BUCKLAND SILT LOAM, 15 TO 35 PERCENT SLOPES, VERY STONY	1	2			M	groundwater	59	0.12	13.10	0.50	6.55
IVa	3A	RUMNEY FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	0	1.5			U	groundwater	-	-	-	-	-
IVa	4A	SUNNY SILT LOAM, 0 TO 2 PERCENT SLOPES	0	1.5			U	groundwater	-	-	-	-	-
IVa	17A	CABOT SILT LOAM, 0 TO 3 PERCENT SLOPES	0	1.5			U	groundwater	-	-	-	-	-
IVa	18B	CABOT SILT LOAM, 0 TO 8 PERCENT SLOPES, VERY STONY	0	1.5			U	groundwater	-	-	-	-	-
IVa	45A	SCANTIC SILT LOAM, 0 TO 3 PERCENT SLOPES	0	1			U	groundwater	-	-	-	-	-
IVa	58A	GRANGE SILT LOAM, 0 TO 3 PERCENT SLOPES	0	1.5			U	groundwater & slope	-	-	-	-	-
IVb	67E	GLOVER-VERSHIRE COMPLEX, 35 TO 60 PERCENT SLOPES, VERY ROCKY	6	6	10	40	U	bedrock & slope	-	-	-	-	-
IVd	41E	BUXTON SILT LOAM, 25 TO 45 PERCENT SLOPES	1.5	3			U	permeability, groundwater & slope	-	-	-	-	-
NR	100	PITS, SAND AND PITS, GRAVEL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source: ftp://ftp-fc.sc.egov.usda.gov/VT/Soils/top20/wash20.dbf

NOTES
1. 2003 Ancilliary Soil Ratings for Residential Onsite Waste Disposal in Vermont (VT NRCS)
2. Shallow Estimated Depth to Seasonal High Groundcwater
3. Deep Estimated Depth to Seasonal High Groundcwater
4. Shallow Estimated Depth to Bedrock
5. Deep Estimated Depth to Bedrock
6. Onsite Wastewater Treatment System Type (I = inground; M = mound)

APPENDIX E

References for Decentralized Wastewater Alternatives Analysis
EPA Onsite and Clustered (Decentralized) Wastewater Management Models - Summary and Description of Management Models

Appendix E.
Needs and Feasibility Study Wastewater Treatment
for the Villages in the Town of East Montpelier

REFERENCES FOR DECENTRALIZED WASTEWATER ALTERNATIVES ANALYSIS

A. California, State of. 1995. Greywater Guide Book. Department of Water Resources.

B. Del Porto, D., Steinfeld, C. 1998. The Composting Toilet System Book. Center for Ecological Pollution Prevention, Concord, MA

C. Leverenz, H.; Tchabanoglos, G; Darby, J.. 2002. Review of Technologies for the Onsite Treatment of Wastewater in California. prepared for the California State Water Resources Control Board. Sacramento, CA

D. National Small Flows Clearinghouse. 1998. Composting Toilet Systems Technical Fact Sheet.

E. Salmon, Chris, Sarah Oliver, Clair Millar, Jonathan Crockett. 2003. Demonstration Project: Composting Toilet Technology In Urban Apartments & Agricultural Trials for Beneficial Reuse Of Residues. GHD Pty Ltd. Melbourne, Victoria, Australia

F. Paloheimo and LeCraw, 1996. Reusing Treated Wastewater in Domestic Housing: the Toronto Healthy House Project. Presented at: Disposal Trenches, Pre-Treatment and Re-Use of Wastewater Conference, Waterloo, Ontario, Canada, May 13, 1996.

G. Thompson, Roger. 2006. Personal communication in telephone conversation with Bruce Douglas on November 8, 2006.

H. USEPA, 2002. Onsite Wastewater Treatment Systems Handbook.

I. USEPA, 2003. Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems

J. USEPA. 2005, Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems.

K. Van Houten, R. ~1987. A Field Review of Composting Toilet Systems. Prepared for the Vermont Department of Environmental Conservation.

Table 1: Summary of Management Models

TABLE 1: SUMMARY OF MANAGEMENT MODELS

TYPICAL APPLICATIONS	PROGRAM DESCRIPTION	BENEFITS	LIMITATIONS
MODEL 1 - HOMEOWNER AWARENESS MODEL			
• Areas of low environmental sensitivity where sites are suitable for conventional onsite systems.	• Systems properly sited and constructed based on prescribed criteria. • Owners made aware of maintenance needs through reminders. • Inventory of all systems	• Code-compliant system. • Ease of implementation; based on existing, prescriptive system design and site criteria. • Provides an inventory of systems that is useful in system tracking and area-wide planning.	• No compliance/problem identification mechanism. • Sites must meet siting requirements. • Cost to maintain database and owner education program.
MODEL 2 - MAINTENANCE CONTRACT MODEL			
• Areas of low to moderate environmental sensitivity where sites are marginally suitable for conventional onsite systems due to small lots, shallow soils, or low-permeability soils. • Small clustered systems.	• Systems properly sited and constructed. • More complex treatment options, including mechanical components or small clusters of homes. • Requires service contracts to be maintained. • Inventory of all systems. • Service contract tracking system.	• Reduces the risk of treatment system malfunctions. • Protects homeowner investment.	• Difficulty in tracking and enforcing compliance because it must rely on the owner or contractor to report a lapse in a valid contract for services. • No mechanism provided to assess effectiveness of maintenance program.
MODEL 3 - OPERATING PERMIT MODEL			
• Areas of moderate environmental sensitivity such as wellhead or source water protection zones, shellfish growing waters, or bathing/water contact recreation. • Systems treating high-strength wastes or large-capacity systems.	• Establishes system performance and monitoring requirements. • Allows engineered designs but may provide prescriptive designs for specific receiving environments. • Regulatory oversight by issuing renewable operating permits that may be revoked for noncompliance. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring. • Minimum for large-capacity systems.	• Allows systems in more environmentally sensitive areas. • Operating permit requires regular compliance monitoring reports. • Identifies noncompliant systems and initiates corrective actions. • Decreases need for regulation of large systems. • Protects homeowner investment.	• Higher level of expertise and resources for regulatory authority to implement. • Requires permit tracking system. • Regulatory authority needs enforcement powers.
MODEL 4 - RESPONSIBLE MANAGEMENT ENTITY (RME) OPERATION AND MAINTENANCE MODEL			
• Areas of moderate to high environmental sensitivity where reliable and sustainable system operation and maintenance (O&M) is required, e.g., sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Clustered systems.	• Establishes system performance and monitoring requirements. • Professional O&M services through RME (either public or private). • Provides regulatory oversight by issuing operating or NPDES permits directly to the RME. (System ownership remains with the property owner.) • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	• O&M responsibility transferred from the system owner to a professional RME that is the holder of the operating permit. • Identifies problems needing attention before failures occur. • Allows use of onsite treatment in more environmentally sensitive areas or for treatment of high-strength wastes. • Can issue one permit for a group of systems. • Protects homeowner investment.	• Enabling legislation may be necessary to allow RME to hold operating permit for an individual system owner. • RME must have owner approval for repairs; may be conflict if performance problems are identified and not corrected. • Need for easement/right of entry. • Need for oversight of RME by regulatory authority.
MODEL 5 - RESPONSIBLE MANAGEMENT ENTITY (RME) OWNERSHIP MODEL			
• Areas of greatest environmental sensitivity where reliable management is required. Includes sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Preferred management program for clustered systems serving multiple properties under different ownership (e.g., subdivisions).	• Establishes system performance and monitoring requirements. • Professional management of all aspects of decentralized systems through public/private RMEs that own or manage individual systems. • Qualified, trained, owners and licensed professional owners/operators. • Provides regulatory oversight by issuing operating or NPDES permit. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	• High level of oversight if system performance problems occur. • Simulates model of central sewerage, reducing the risk of noncompliance. • Allows use of onsite treatment in more environmentally sensitive areas. • Allows effective area-wide planning/watershed management. • Removes potential conflicts between the user and RME. • Greatest protection of environmental resources and owner investment.	• Enabling legislation and/or formation of special district may be required. • May require greater financial investment by RME for installation and/or purchase of existing systems or components. • Need for oversight of RME by regulatory authority. • Private RMEs may limit competition. • Homeowner associations may not have adequate authority.

Note: If applicable, NPDES requirements under the CWA or UIC requirements under the SDWA supercede any less stringent or inconsistent provision.

APPENDIX A: MANAGEMENT MODELS

This appendix presents a description of activities associated with each program element and identifies the party responsible for each activity. A detailed discussion is presented in the Management Handbook. Activities in bold are activities added to program elements from the preceding Management Model.

Note: If applicable, National Pollutant Discharge Elimination System (NPDES) requirements under the Clean Water Act (CWA) or Underground Injection Control (UIC) requirements under the Safe Drinking Water Act (SDWA) supercede any less stringent or inconsistent provisions. Program elements in each model help inform the state, tribe, or EPA in establishing NPDES permit requirements.

MANAGEMENT MODEL 1: HOMEOWNER AWARENESS

Objective: To ensure that conventional onsite systems are sited and constructed properly in accordance with appropriate state, tribal, and local regulations and codes; that they are periodically inspected; and, if necessary, that they are repaired by the Owner. The Regulatory Authority maintains a record of the location of all systems and periodically provides the Owner/User with notices regarding operation and preventive maintenance recommendations.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program or rule changes.
	Service Provider	• Be informed of existing rules and review and comment on any proposed program and/or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules and review and comment on any proposed program and/or rule changes. • Participate in advisory committees established by the Regulatory Authority.
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend its evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells.
	Owner/User	• Regularly maintain system in proper working order.
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, and pumpers/haulers. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and O&M procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements.
	Owner/User	• When using third-party services, contract with only the appropriate certified/licensed Service Providers.
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources.
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation.

MANAGEMENT MODEL 1: HOMEOWNER AWARENESS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
DESIGN	Regulatory Authority	• Codify prescriptive, preengineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria.
	Designer	• Obtain a certification/license to practice. • Design a treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design.
CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Perform final construction inspection for compliance assurance and inventory data collection. • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct the system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed contractor/installer to construct system. • Submit final record drawings of constructed system to Regulatory Authority.
OPERATION & MAINTENANCE	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • Send timely reminder to Owner of when scheduled preventive maintenance is due.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Owner	• Perform recommended routine maintenance or hire a certified/licensed pumper/hauler to perform maintenance. • Hire a certified/licensed pumper/hauler to periodically inspect, service, and remove septage for proper treatment and disposal.
	User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system.
RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 (Use and Disposal of Sewage Sludge), 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• Obtain certification/license to practice. • Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Conduct final construction inspections to ensure compliance with approved plans and permit requirements. • Perform compliance inspections at point-of-sale, change-in-use of properties, "targeted areas," and systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal.
	Pumper/Hauler	• Inform Owner of any noncompliant items observed during routine servicing of system.
	Owner	• Periodically perform a "walk-over" inspection of the system and correct any deficiencies.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY
CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedule with Owner for correcting documented noncompliance items. • Administer enforcement program, including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply.
	Designer	• Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Owner	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings of system. • Maintain maintenance records of system. • Provide drawings, specifications, and maintenance records to new property owner at time of property transfer.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.

MANAGEMENT MODEL 1: HOMEOWNER AWARENESS

MANAGEMENT MODEL 2: MAINTENANCE CONTRACTS

Objective: To allow use of more complex mechanical treatment options or small clusters through the requirement that maintenance contracts be maintained between the Owner and maintenance provider to ensure appropriate and timely system component maintenance by qualified technicians over the service life of the system.

MANAGEMENT MODEL 2: MAINTENANCE CONTRACTS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend its evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • **Establish minimum performance criteria for manufactured component approvals.** • **Establish minimum maintenance requirements for approved systems.**
	Owner/User	• Regularly maintain system in proper working order.
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, and pumpers/haulers. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and O&M procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements.
	Owner/User	• When using third-party services, contract only with the appropriate certified/licensed Service Providers.
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • **Establish alternative site acceptance criteria for approved systems providing enhanced pretreatment.**
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 DESIGN	Regulatory Authority	• Codify prescriptive, preengineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • **Administer an evaluation program for approving manufactured components for use with pre-engineered designs.**
	Designer	• Obtain certification/license to practice. • Design a treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design.
 CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Perform final construction inspection for compliance assurance and inventory data collection. • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner. • **Require Owner to submit a copy of system O&M manual to the Regulatory Authority.**
	Contractor/ Installer	• Obtain certification/license to practice. • Construct the system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • **Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations.** • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed contractor/installer to construct system. • Submit final record drawings of constructed system to Regulatory Authority. • **Submit a copy of system O&M manual to Regulatory Authority to record required maintenance.**
 OPERATION & MAINTENANCE	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • Send timely reminder to Owner when scheduled preventive maintenance is due. • **Administer a program that requires the Owner to attest periodically that he or she holds a valid contract with a certified/licensed operator to perform scheduled and any necessary maintenance according to the maintenance requirements described in submitted O&M manual.** • **Require Owner to submit a maintenance report signed/sealed by certified/licensed operator immediately following scheduled maintenance.**
	Operator	• **Obtain certification/license to practice.** • **Inspect and service system as necessary in accordance with the submitted O&M manual.** • **Certify to Owner that the required maintenance was performed in a timely manner, describing any system deficiencies observed.** • **Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.**
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner	• Hire a certified/licensed pumper/hauler to periodically inspect, service, and remove septage or other residuals for proper treatment and disposal. • **Maintain contractual agreement with a certified/licensed operator to perform scheduled maintenance as required.** • **Inform Regulatory Authority of any change in maintenance contract status.**
	User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 2: MAINTENANCE CONTRACTS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 (Use and Disposal of Sewage Sludge), 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
 COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Conduct final construction inspections to ensure compliance with approved plans and permit requirements. • Perform compliance inspections at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • **Administer program for confirming that Owners hold valid maintenance contracts with certified/licensed operators and for monitoring timely submittals of certified maintenance reports.**
	Operator or Pumper/Hauler	• Inform Owner of any noncompliant items observed during routine servicing of system.
	Owner	• Periodically perform a "walk-over" inspection of the system and correct any deficiencies. • **Attest to the Regulatory Authority that a valid contract exists with a certified/licensed operator to perform necessary system maintenance.** • **Submit a maintenance report signed/sealed by a certified/licensed Service Provider immediately following scheduled maintenance.**
 CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedule with Owner for correcting documented noncompliant items. • Administer enforcement program, including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply.
	Designer	• Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Owner	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
 RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public. • **Administer an Owner/Service Provider maintenance contract compliance and certified maintenance report tracking system.** • **Record maintenance contract requirement on property deed.** • **Administer a certified maintenance report tracking system.**
	Operator	• Provide certified report of all maintenance and observed system deficiencies to Owner.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings and **O&M manual** of system. • Maintain maintenance records of system. • Provide drawings, specifications, **O&M manual**, and maintenance records to new property owner at time of property transfer.
 FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 3: OPERATING PERMITS

Objective: To issue renewable/revocable operating permits to system Owner that stipulate specific and measurable performance criteria for the treatment system and periodic submittals of compliance monitoring reports. The performance criteria are based on risks to public health and water resources posed by wastewater dispersal in the receiving environment. Operating permits allow the use of clustered or onsite systems on sites with a greater range of site characteristics.

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
 PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend its evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
 PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • Establish minimum maintenance requirements for approved systems. • **Establish performance criteria necessary to protect public health and water resources for each defined receiving environment in Regulatory Authority's jurisdiction.**
	Owner/User	• Operate and regularly maintain system in proper working order. • **Operate system to comply with performance criteria stipulated in operating permit.**
 TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer a training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, pumpers/haulers, and **inspectors**. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and O&M procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements.
	Owner/User	• When using third-party services, contract with only the appropriate certified/licensed Service Providers.
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • **Establish defining characteristics for each receiving environment in the Regulatory Authority's jurisdiction.**
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 3: OPERATING PERMITS

MANAGEMENT MODEL 3: OPERATING PERMITS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
DESIGN	Regulatory Authority	• Codify prescriptive, preengineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • **Administer a plan review program for engineered designs to meet stipulated performance criteria.** • **Require submission of routine operation and emergency contingency plans that will sustain system performance and avoid unpermitted discharges.**
	Designer	• Obtain certification/license to practice. • Certified/licensed designer to design treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design.
CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • **Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications.** • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner. • Require Owner to submit a copy of system O&M manual to the Regulatory Authority.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct the system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • **Certify that construction of the system is substantially in conformance with the approved plans and specifications.**
	Owner	• Hire a certified/licensed contractor/installer to construct system. • Submit final record drawings of constructed system to Regulatory Authority. • Submit a copy of system O&M manual to Regulatory Authority to record required maintenance.
OPERATION & MAINTENANCE	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • **Administer a program of renewable/revocable operating permits that are issued to Owner stipulating system performance criteria, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with permit.** • **Track and review compliance monitoring reports to ensure that systems are operating in accordance with operating permits.**
	Operator	• Obtain certification/license to practice. • **Inspect and service system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations.** • Certify to Owner that the required maintenance was performed in a timely manner, describing any system deficiencies observed. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Owner	• Hire a certified/licensed pumper/hauler or operator to maintain system. • Maintain system in proper working order. • **Operate and maintain the system in accordance with O&M manual and/or operating permit stipulations.** • **Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit.**
	User	• Follow recommendations provided by Regulatory Authority and/or Service Providers to ensure that undesirable or prohibited materials are not discharged to system.

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MANAGEMENT MODEL 3: OPERATING PERMITS

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • **Administer a program to monitor timely submittals of acceptable compliance maintenance reports.** • **Notify Owner of impending scheduled submittals of compliance monitoring reports.** • **Perform system inspections randomly and/or at time of operating permit renewal.**
	Operator or Pumper/Hauler	• Inform Owner of any noncompliant items observed during routine servicing of system.
	Owner	• Submit compliance monitoring reports to Regulatory Authority as stipulated in operating permit. • **Submit compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit.**
CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedule with Owner for correcting documented noncompliant items. • Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply. • **Require system inspection by certified inspector at time of operating permit renewal.**
	Designer	• Provide Owner with documents (drawings, specifications, modifications, etc.) that may be required by Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Inspector	• **Obtain certification/license to practice.** • **Inspect treatment system for compliance with operating permit prior to permit renewal.**
	Owner	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, and inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public. • **Administer a tracking system for operating permits.** • **Administer a tracking database for compliance reports.**
	Operator or Inspector	• Provide certified report of all maintenance and observed system deficiencies to Owner. • **Perform system monitoring as stipulated in Owner's operating permit.**
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings and O&M manual of system. • Maintain maintenance records of system. • Submit compliance monitoring reports to Regulatory Authority. • Provide drawings, specifications, O&M manual, and maintenance records to new property owner at time of property transfer.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

Objective: To ensure that onsite/decentralized systems consistently meet their stipulated performance criteria through Responsible Management Entities that are responsible for operation and performance of systems within their service areas.

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Hold public meetings to inform the public of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	Owner/User	• Be informed of purpose, use, and care of treatment system. • Be informed of existing rules and review and comment on any proposed program and/or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	RME	• **Inform Owner/User of care and use of system.** • **Inform Owner/User of RME requirements and prohibited uses of system.**
PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
	RME	• **Develop criteria (e.g., site evaluation, design, construction) to be required of systems for acceptance into O&M program and inform Owners.** • **Continuously evaluate existing wastewater treatment needs and forecast future needs.**
PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • Establish minimum maintenance requirements for approved systems. • Establish performance criteria necessary to protect public health and water resources for each defined receiving environment in the Regulatory Authority's jurisdiction.
	Owner	• Regularly maintain system components in proper working order. • **Comply with any RME requirements regarding care and use of the system.**
	RME	• **Operate systems to comply with performance criteria stipulated in the operating permits.**
TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, operators, pumpers/haulers, and inspectors. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and operation and maintenance procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• When using third-party services, contract only with the appropriate certified/licensed Service Providers.
	RME	• **When using third-party services, contract with only the appropriate certified/licensed Service Providers.** • **Ensure that RME staff who operate and/or maintain systems obtain appropriate certification(s)/license(s) to practice.** • **Arrange for supplemental training as needed for Service Providers and/or staff to manage, operate, and/or maintain systems.**

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • Establish the defining characteristics of each receiving environment in the Regulatory Authority's jurisdiction. • **Approve and oversee site evaluation procedures required by RME for system acceptance in the O&M program to ensure that system designs are appropriate for the sites and their stipulated performance criteria.**
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	Owner	• Hire a certified/licensed site evaluator to perform site evaluation. • **Comply with any additional siting requirements established by RME for system acceptance in the O&M program.**
DESIGN	Regulatory Authority	• Codify prescriptive, pre-engineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • Administer a plan review program for engineered designs to meet stipulated performance criteria. • Require submission of routine operation and emergency contingency plans that will sustain system performance and avoid unpermitted discharges.
	Designer	• Obtain certification/license to practice. • Design treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	Owner	• Hire a certified/licensed designer to prepare system design. • Comply with any additional design requirements established by the RME for system acceptance in the O&M program.
CONSTRUCTION	Regulatory Authority	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications. • Require that record drawings of constructed system be submitted to the Regulatory Authority by Owner. • Require Owner to submit a copy of system O&M manual to the Regulatory Authority and RME.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to Owner. • Provide Owner with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to Owner. • Certify that construction of the system is substantially in conformance with the approved plans and specifications.
	Owner	• **Comply with any additional construction requirements established by the RME for system acceptance in the O&M program.** • Hire a certified/licensed designer to prepare system design. • Submit final record drawings of constructed system to Regulatory Authority. • Submit a copy of the system O&M manual to the Regulatory Authority and RME to record required maintenance.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
OPERATION & MAINTENANCE	Regulatory Authority	• Provide Owner/User with educational materials regarding system use and care. • Administer a program of renewable/revocable operating permits that are issued to RME, stipulating system performance criteria, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with operating permit stipulations. • Track and review compliance monitoring reports to ensure that systems are operating in accordance with operating permits. • **Consider replacing individual system operating permits with general permits issued to the RME for classes of systems.**
	Operator	• Inspect and service the system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations. • Perform system monitoring as stipulated in RME's operating permit. • Certify to RME that the required maintenance and monitoring was performed in a timely manner and noting any system deficiencies. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of treatment and dispersal system.
	Owner/User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system. • Maintain system components in proper working order. • **Comply with any RME requirements regarding care and use of system.**
	RME	• **Operate and maintain systems in accordance with the stipulated operating permit requirements.** • **Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit.** • Hire a certified/licensed pumper/hauler or operator to maintain system.
RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans to ensure that sufficient capacities are always available.
	Pumper/Hauler	• **Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of wastewater treatment system residuals.**
	RME	• Hire a certified/licensed pumper/hauler to remove, treat, and dispose of residuals. • **Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals.** • **Inventory available residuals handling/treatment capacities and develop contingency plans when insufficient capacities are available.**
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • Administer a program to monitor timely submittals of acceptable compliance maintenance reports. • Perform system inspections randomly and/or at time of operating permit renewal.
	Inspector	• **Obtain certification/license to practice.** • **Perform system compliance inspections for RME in accordance with prevailing Regulatory Authority requirements.**
	RME	• **Submit compliance monitoring reports to the Regulatory Authority as stipulated in operating permit.** • **Submit compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit.** • **Conduct regular reviews of management program with Owner/User and Regulatory Authority to optimize system operation program.** • **Hire a certified/licensed inspector to inspect system compliance status.**

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 4: RME OPERATION AND MAINTENANCE

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedules with RME for correcting documented noncompliance items. • Administer enforcement program including fines and/or penalties for failure to comply with compliance requirements. • Obtain necessary authority to enter property to correct imminent threats to public health if the Owner/User fails to comply. • Require system inspection by certified inspector at time of operating permit renewal. • **Negotiate compliance schedules with RME, Owner/User, or both, for correcting documented noncompliance items.**
	Designer	• Provide Owner/RME with documents (drawings, specifications, modifications, etc.) that may be required by the Regulatory Authority prior to corrective actions.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Inspector	• Inspect treatment system for compliance with operating permit prior to permit renewal.
	Owner	• Comply with terms and conditions of the negotiated compliance schedule for component replacement/repairs. • Submit required documents for corrective actions to Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
	RME	• **Comply with terms and conditions of the negotiated compliance schedule for system performance.**
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, performed maintenance, and inspection reports) of all systems. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing that is available to the public. • Administer a tracking system for operating permits. • Administer a tracking database for compliance reports. • **Administer periodic financial, management, and technical audits of RME.**
	Operator or Inspector	• Provide certified report of all maintenance and observed system deficiencies to RME. • Provide certified report of all observed system deficiencies to Owner. • Perform system monitoring as stipulated in RME's operating permit.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	Owner	• Maintain approved record drawings and O&M manual of system. • Maintain maintenance records of system. • Provide drawings, specifications, O&M manual, and maintenance records to new property owner at time of property transfer.
	RME	• **Maintain system monitoring and service records.** • **Inventory, collect, and provide permit information to Regulatory Authority.**
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the management program. • Provide a listing of financial assistance programs available to Owner/User and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist Owners in upgrading their systems.
	RME	• **Conduct regular reviews of management program with Owner/User and Regulatory Authority to optimize operations.**

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 5: RME OWNERSHIP

Objective: To provide professional management of the planning, siting, design, construction, operation, and maintenance of onsite/decentralized systems through Responsible Management Entities that own and manage individual and clustered systems within their service areas.

MANAGEMENT MODEL 5: RME OWNERSHIP

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
PUBLIC EDUCATION AND PARTICIPATION	Regulatory Authority	• Educate Owner/User on purpose, use, and care of treatment system. • Provide public review and comment periods of any proposed program and/or rule changes.
	Service Provider	• Be informed of existing rules, and review and comment on any proposed program or rule changes. • Participate in advisory committees established by the Regulatory Authority.
	RME	• Inform User of care and use of system. • Inform User of RME requirements and prohibited uses of system.
	User	• Be informed of purpose, use, and care of treatment system.
PLANNING	Regulatory Authority	• Coordinate program rules and regulations with state, tribal, and local planning and zoning and other water-related programs. • Evaluate potential risks of wastewater discharges to limit environmental impacts on receiving environments during the rule making process. • Limit potential risks of environmental impacts from residuals management program and evaluate available handling/treatment capacities. • Inform local planning authority of rule changes and recommend their evaluation of potential impacts on land use.
	Developer	• Hire planners, certified site evaluators, and designers to ensure that all lots of proposed subdivision plats meet requirements for onsite treatment prior to final plat.
	RME	• Continuously evaluate existing wastewater treatment needs and forecast future needs. • **Require developers to submit proposed subdivision plats to RME for review and comment to ensure compatibility with RME requirements.** • **Plan most cost-effective approach to meeting treatment needs through appropriate mix of central sewerage, clusters, and individual onsite systems.**
PERFORMANCE	Regulatory Authority	• Establish system failure criteria to protect public health, e.g., wastewater backups in building, wastewater ponding on ground surface, insufficient separation from ground water or wells. • Establish minimum maintenance requirements for approved systems. • Establish performance criteria necessary to protect public health and water resources for each defined receiving environment in the Regulatory Authority's jurisdiction.
	RME	• Operate, maintain, and repair systems to comply with performance criteria stipulated in the operating permits.
	User	• Comply with any RME requirements regarding care and use of the system.
TRAINING AND CERTIFICATION/ LICENSING	Licensing Board/ Regulatory Authority	• Develop and administer training, testing, and certification/licensing program for site evaluators, designers, contractors, pumpers/haulers, inspectors, and operators. • Maintain a current certified/licensed Service Provider listing.
	Service Provider	• Obtain appropriate certification(s)/license(s) and continuing education as required. • Obtain training from the manufacturer or vendor regarding appropriate use, installation requirements, and operation and maintenance procedures of any proprietary equipment to be installed. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	RME	• When using-third party services, contract with only certified/licensed Service Providers. • RME staff who site, **design, construct**, operate, and/or maintain systems must obtain appropriate certification(s)/license(s) to practice. • Arrange for supplemental training as needed for Service Providers and/or staff to manage, operate, and/or maintain systems.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 5: RME OWNERSHIP

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
 SITE EVALUATION	Regulatory Authority	• Codify prescriptive requirements for site evaluation procedures. • Codify criteria for treatment site characteristics suitable for permitted designs that will prevent unacceptable impacts on ground and surface water resources. • Establish the defining characteristics of each receiving environment in the Regulatory Authority's jurisdiction. • Approve and oversee site evaluation procedures used by RME to ensure that system designs are appropriate for the sites and their stipulated performance criteria.
	Site Evaluator	• Obtain certification/license to practice. • Describe site and soil characteristics, determine suitability of site with respect to code requirements, and estimate site's hydraulic and treatment capacity. • Comply with applicable federal, state, tribal, and local requirements in the evaluation of sites for wastewater treatment and dispersal.
	RME	• Hire a certified/licensed site evaluator to perform site evaluation.
 DESIGN	Regulatory Authority	• Codify prescriptive, pre-engineered designs that are suitable for treatment sites that meet the appropriate prescriptive site criteria. • Administer the plan review program for engineered designs to meet stipulated performance criteria. • Require routine operation and emergency contingency plans that will sustain system performance and avoid the submission of unpermitted discharges.
	Designer	• Obtain certification/license to practice. • Design treatment system that is compatible with the site and soil characteristics described by the site evaluator. • Comply with applicable federal, state, tribal, and local requirements in the design of wastewater treatment and dispersal systems.
	RME	• Hire a certified/licensed designer to prepare system design.
 CONSTRUCTION	Regulatory Design	• Administer a permitting program for system construction, including Regulatory Authority review of proposed system siting and design plans. • Require designer of record to certify that completed system construction is in substantial compliance with approved plans and specifications. • Require that record drawings of constructed system be submitted to the Regulatory Authority by RME.
	Contractor/ Installer	• Obtain certification/license to practice. • Construct system in accordance with the approved plans and specifications. • Prepare record drawings of completed system and submit to RME. • Provide RME with an O&M manual describing component manufacturer's maintenance and troubleshooting requirements/recommendations. • Comply with applicable federal, state, tribal, and local requirements in the design and construction of wastewater treatment and dispersal systems.
	Designer of Record	• Approve proposed field changes and submit to RME. • Certify that construction of the system is substantially in conformance with the approved plans and specifications.
	RME	• Hire a certified/licensed designer to prepare system design. • Submit final record drawings of constructed system to Regulatory Authority. • Submit a copy of system O&M manual to the Regulatory Authority to record required maintenance.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

MANAGEMENT MODEL 5: RME OWNERSHIP

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
OPERATION & MAINTENANCE	Regulatory Authority	• Provide User with educational materials regarding system use and care. • Administer a program of renewable/revocable operating permits that are issued to RME that stipulate system performance, compliance monitoring reporting schedule, term of permit, and renewal option upon documented compliance with operating permit stipulations. • Track and review compliance monitoring reports to ensure that systems are operating in accordance with operating permits. • Consider replacing individual system operating permits with general permits issued to RME for classes of systems.
	Operator	• Inspect and service system as necessary in accordance with the submitted O&M manual and/or operating permit stipulations. • Perform system monitoring as stipulated in RME's operating permit. • Certify to RME that the required maintenance and monitoring were performed in a timely manner and noting any system deficiencies. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	Pumper/Hauler	• Obtain certification/license to practice. • Inspect and service system as necessary. • Comply with applicable federal, state, tribal, and local requirements in the operation and maintenance of the treatment and dispersal system.
	User	• Follow recommendations provided by Regulatory Authority, Service Providers, and/or Owner to ensure that undesirable or prohibited materials are not discharged to system. • Comply with any RME requirements regarding care and use of system.
	RME	• Operate and maintain systems in accordance with the stipulated operating permit requirements. • Submit compliance monitoring reports to the Regulatory Authority according to the schedule stipulated in the operating permit. • Hire a certified/licensed pumper/hauler or operator to maintain system.
RESIDUALS MANAGEMENT	Regulatory Authority	• Administer a tracking system for residuals hauling, treatment, and disposal and review to evaluate compliance with 40 CFR Part 503 Use and Disposal of Sewage Sludge, 40 CFR Part 257, and applicable state, tribal, and local requirements. • Inventory available residuals handling/treatment capacities and develop contingency plans when capacities available are insufficient.
	Pumper/ Hauler	• Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of wastewater treatment system residuals.
	RME	• Hire a certified/licensed pumper/hauler to remove, treat, and dispose of residuals. • Comply with applicable federal, state, tribal, and local requirements in the pumping, hauling, treatment, and disposal of treatment system residuals. • Inventory available residuals handling/treatment capacities and develop contingency plans when capacities available are insufficient.
COMPLIANCE INSPECTIONS/ MONITORING	Regulatory Authority	• Perform inspection programs at point-of-sale, change-in-use of properties, "targeted areas," and/or systems reported to be in violation. • Conduct compliance inspections of residuals hauling, treatment, and disposal. • Administer a program to monitor timely submittals of acceptable compliance maintenance reports. • Perform system inspections randomly and/or at the time of operating permit renewal.
	Inspector	• Obtain certification/license to practice. • Perform system compliance inspections for RME in accordance with prevailing Regulatory Authority requirements.
	RME	• Submit compliance monitoring reports to Regulatory Authority as stipulated in operating permit. • Submit a compliance inspection report signed/sealed by a certified/licensed inspector prior to applying for renewal of operating permit. • Conduct regular reviews of management program with Regulatory Authority to optimize system operation program. • Hire a certified/licensed inspector to inspect system compliance status.

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

PROGRAM ELEMENT	RESPONSIBLE PARTY	ACTIVITY[1]
CORRECTIVE ACTIONS	Regulatory Authority	• Negotiate compliance schedules with RME for correcting documented noncompliance items. • Administer the enforcement program including fines and/or penalties for failure to comply with compliance requirements. • Require system inspection by a certified inspector at time of operating permit renewal. • Negotiate compliance schedules with RME for correcting documented noncompliance items.
	Designer	• Provide RME with documents (drawings, specifications, modifications, etc.) that may be required by the Regulatory Authority prior to corrective action.
	Contractor/ Installer	• Perform required repairs, modifications, and upgrades as necessary.
	Inspector	• Inspect treatment system for compliance with operating permit prior to permit renewal.
	RME	• Comply with terms and conditions of the negotiated compliance schedule. • Submit required documents for corrective actions to the Regulatory Authority. • Hire appropriate certified/licensed Service Providers to perform required corrective actions.
RECORD KEEPING, INVENTORY, & REPORTING	Regulatory Authority	• Administer a database inventory (locations, site evaluations, record drawings, permits, and inspection reports) of all systems within the Regulatory Authority's jurisdiction. • Maintain a residuals treatment and disposal tracking system. • Maintain a current certified/licensed Service Provider listing, which is available to the RMEs. • Administer a tracking system for operating permits. • Administer a tracking database for compliance reports. • Administer financial, management, and technical audits of RME.
	Operator or Inspector	• Provide a certified report of all maintenance and observed system deficiencies to RME. • Provide a certified report of all observed system deficiencies to Owner. • Perform system monitoring as stipulated in RME's operating permit.
	Pumper/Hauler	• Prepare and submit records of residuals handling as required.
	RME	• Maintain system monitoring and service records. • Inventory, collect, and provide permit information to Regulatory Authority.
FINANCIAL ASSISTANCE & FUNDING	Regulatory Authority	• Provide the legal and financial support to sustain the regulatory program. • Provide a listing of financial assistance programs available to RME and the qualifying criteria for each program. • Consider implementing a state or local financing program to assist RME in upgrading systems.
	RME	• Conduct regular reviews of management program with Regulatory Authority to optimize operations.

MANAGEMENT MODEL 5: RME OWNERSHIP

[1] *Activities in bold are activities added to program elements from the preceding Management Model.*

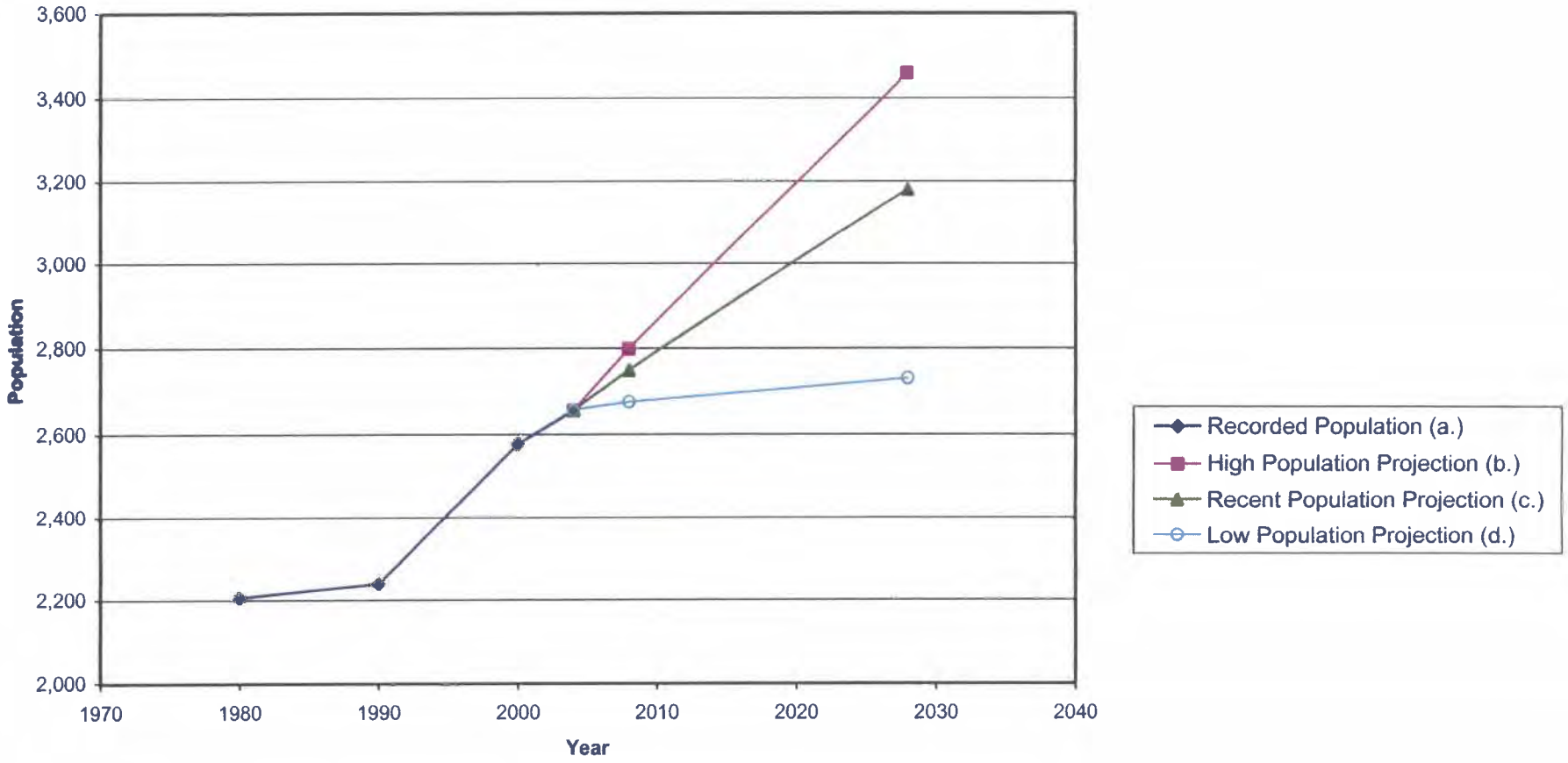
APPENDIX F

Wastewater Alternatives Analysis

Figure F-1 Population Projections
Table F-1 Wastewater Flow Projections Alternative No. 4 - Onsite Management Plus Small Clusters for Marginal Sites
Table F-2 Wastewater Flow Projections Alternative No. 5 - Onsite Management Plus Large Clusters for Marginal Sites
Table F-3 Wastewater Flow Projections Alternative No. 6 - Large Cluster Indirect Discharge
Table F-4 Wastewater Flow Projections Alternative No. 7 - Large Cluster Direct Discharge

TOWN OF EAST MONTPELIER

FIGURE F-1 POPULATION PROJECTIONS



NOTES:

(a.) U.S. Census (1980, 1990, 2000); 2004 Vermont Population Estimates, Vermont Department of Health (2004).

(b.) Projection based on extrapolating using rate of 1990 - 2000 population increase.

(c.) Projection based on extrapolating using rate of 2000 - 2004 population increase.

(d.) Projection based on extrapolating using rate of 1980 - 1990 population increase.

Table F-1
Wastewater Flow Projections
Alternative No. 4- On-Site Management Plus Small Clusters for Marginal Sites

AREA, SITE & USE CATEGORY	INITIAL YEAR (2008) QUANTITY	VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS	DESIGN YEAR (2028) QUANTITY	VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS
North Montpelier								
North Montpelier Small Cluster Site								
Residential Units	18 Units	4,518 Gal. (2.)	4,518	18	22 Units	245 Gal./Unit (3.)	5,390	22
Commercial Units								
Store			600	2			600	2
Sub-Total			5,118	21			5,990	24
			Use 5,200				Use 6,000	
Montpelier Village								
Kelton Road Small Cluster Site								
Residential Units	5 Units	1,575 Gal. (2.)	1,575	5	6 Units	1,830 Gal. (2.)	1,830	6
Sub-Total			1,575	5			1,830	6
			Use 1,600				Use 1,900	
Quaker Hill Small Cluster Site								
Residential Units	7 Units	2,065 Gal. (2.)	2,065	7	8 Units	2,280 Gal. (2.)	2,280	8
Sub-Total			2,065	7			2,280	8
			Use 2,100				Use 2,300	
Route 2 Center Cluster								
Residential Units	5 Units	1,575 Gal. (2.)	1,575	6	6 Units	1,830 Gal. (2.)	1,830	6
Commercial Units								
370 Rt. 2	940 SF	10 gpd/100 s.f.	94	1	940 SF	10 gpd/100 s.f.	94	1
2952 Rt. 2	1,700 SF	10 gpd/100 s.f.	170	1	1,700 SF	10 gpd/100 s.f.	170	1
3000 Rt. 2	930 SF	10 gpd/100 s.f.	93	1	930 SF	10 gpd/100 s.f.	93	1
3042 Rt. 2	816 SF	10 gpd/100 s.f.	82	1	816 SF	10 gpd/100 s.f.	82	1
Church		Estimate	300	1		Estimate	300	1
Future Commerial Growth/Allowance						Estimate	148	1
Sub-Total			2,314	11			2,716	12
			Use 2,400				Use 2,800	
Route 2 South Cluster								
Residential Units	11 Units	3,036 Gal. (2.)	3,036	7	13 Units	3,484 Gal. (2.)	3,484	13
Commercial Units								
2540 Rt. 2	1,300 SF	10 gpd/100 s.f.	130	1	1,300 SF	10 gpd/100 s.f.	130	1
Future Commerial Growth/Allowance						Estimate	130	1
Sub-Total			3,166	8			3,744	15
			Use 3,200				Use 3,800	
Route 14 South Cluster								
Existing Residential Units	12 Units	3,264 Gal. (2.)	3,264	12	15 Units	3,900 Gal. (2.)	3,900	15
Sub-Total			3,264	12			3,900	15
			Use 3,300				Use 3,900	

Notes:

1. VTEPR Vermont Environmnetal Protection Rules, Chapter 1, Subchapter 7, Section 1-504- Design Flow.
2. Table 1 (b), VT EPR- When five or more single family residential units are connected to a single soil based disposal system, Table 1(b) may be used to determine the flow based on the number of units connected.
3. Table 1 (b), VT EPR- When more than 20 single family residential units are connected to a single soil based disposal system, the flow rate is 245 gallons per day per single family unit.
4. The number of residential units was increased by 20% from the Initial Year (2008) to the Design Year (2028). The future Commercial Growth/Allowance was calculated by increasing the the Initial Year (2008) commercial flow by 20%.

Table F-2
Wastewater Flow Projections
Alternative No. 5- On-Site Management Plus Large Cluster For Marginal Sites

AREA, SITE & USE CATEGORY	INITIAL YEAR (2008) QUANTITY	VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS	DESIGN YEAR (2028) QUANTITY	VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS
North Montpelier								
North Montpelier Large Cluster Site								
Residential Units	18 Units	4,518 Gal. (2.)	4,518	18	22 Units	245 Gal./Unit (3.)	5,292	18
Commercial Units								
Store			600	2			600	2
Commercial Growth Allocation			0				120	1
Sub-Total			5,118	20			6,012	21
			Use 5,200				Use 6,100	
Montpelier Village								
Route 2 Cluster Site								
Residential Units	25 Units	245 Gal./Unit (3.)	6,125	25	30 Units	245 Gal./Unit (3.)	7,350	30
Commercial Units								
370 Rt. 2	940 SF	10 gpd/100 s.f.	94	1	940 SF	10 gpd/100 s.f.	94	1
2952 Rt. 2	1,700 SF	10 gpd/100 s.f.	170	1	1,700 SF	10 gpd/100 s.f.	170	1
3000 Rt. 2	930 SF	10 gpd/100 s.f.	93	1	930 SF	10 gpd/100 s.f.	93	1
3042 Rt. 2	816 SF	10 gpd/100 s.f.	82	1	816 SF	10 gpd/100 s.f.	82	1
Church		Estimate	300	1		Estimate	300	1
2540 Rt. 2	1,300 SF	10 gpd/100 s.f.	130	1	1,300 SF	10 gpd/100 s.f.	130	1
Commercial Growth Allocation							174	1
Sub-Total			6,994	31			8,392	37
			Use 7,000				Use 8,400	
Route 14 Cluster Site								
Existing Residential Units	12 Units	3,264 Gal. (2.)	3,264	12	15 Units	3,900 Gal. (2.)	3,900	15
Sub-Total			3,264	12			3,900	15
			Use 3,300				Use 3,900	

Notes:

1. VTEPR Vermont Environmnetal Protection Rules, Chapter 1, Subchapter 7, Section 1-504- Design Flow.
2. Table 1 (b), VT EPR- When five or more single family residential units are connected to a single soil based disposal system, Table 1(b) may be used to determine the flow based on the number of units connected.
3. Table 1 (b), VT EPR- When more than 20 single family residential units are connected to a single soil based disposal system, the flow rate is 245 gallons per day per single family unit.
4. The number of residential units was increased by 20% from the Initial Year (2008) to the Design Year (2028). The future Commercial Growth/Allowance was calculated by increasing the the Initial Year (2008) commercial flow by 20%.

Table F-3
Wastewater Flow Projections
Alternative No. 6- Large Cluster Indirect Discharge

AREA, SITE & USE CATEGORY	INITIAL YEAR (2008) QUANTITY		VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS	DESIGN YEAR (2028) QUANTITY		VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS
North Montpelier										
North Montpelier Large Cluster Site										
Residential Units	47	Units	245 Gal./Unit (2.)	11,515	47	56	Units	245 Gal./Unit (2.)	13,818	47
Commercial Units										
Store				600	2				600	2
Commercial Growth Allocation									120	1
Sub-Total				12,115	49				14,538	50
				Use 12,200					Use 14,600	
Montpelier Village										
Route 2 Cluster Site										
Residential Units	81	Units	245 Gal./Unit (3.)	19,845	25	97	Units	245 Gal./Unit (3.)	23,814	97
Commercial Units										
370 Rt. 2	940	SF	10 gpd/100 s.f.	94	1	940	SF	10 gpd/100 s.f.	94	1
2419 Rt. 2	25	Empl.	15 gpd/employee	375	2	25	Empl.	15 gpd/employee	375	2
2540 Rt. 2	1,300	SF	10 gpd/100 s.f.	130	1	1,300	SF	10 gpd/100 s.f.	130	1
2624 Rt. 2	600	SF		490	2	600	SF		490	2
2783 Rt. 2	1,500	SF	10 gpd/100 s.f.	414	1	1,500	SF	10 gpd/100 s.f.	414	1
2875 Rt. 2	1,400	SF	10 gpd/100 s.f.	140	1	1,400	SF	10 gpd/100 s.f.	140	1
2915 Rt. 2	6,000	SF	10 gpd/100 s.f.	600	2	6,000	SF	10 gpd/100 s.f.	600	2
2952 Rt. 2	1,700	SF	10 gpd/100 s.f.	170	1	1,700	SF	10 gpd/100 s.f.	170	1
3000 Rt. 2	930	SF	10 gpd/100 s.f.	93	1	930	SF	10 gpd/100 s.f.	93	1
3042 Rt. 2	816	SF	10 gpd/100 s.f.	82	1	816	SF	10 gpd/100 s.f.	82	1
Church			Estimate	300	1			Estimate	300	1
3070 Rt. 2	940	SF	10 gpd/100 s.f.	94	1	940	SF	10 gpd/100 s.f.	94	1
Commercial Growth Allocation									596	1
Sub-Total				22,827	40				27,392	113
				Use 22,900					Use 27,400	
Route 14 Cluster Site										
Residential Units	37	Units	245 Gal./Unit (3.)	9,065	37	44	Units	245 Gal./Unit (3.)	10,878	44
Commercial Units	0			0		0			0	
75 Rt. 14	4,200	SF	10 gpd/100 s.f.	420	2	4,200	SF	10 gpd/100 s.f.	420	2
2205 Rt. 14	1,800	SF	10 gpd/100 s.f.	180	1	1,800	SF	10 gpd/100 s.f.	180	1
2235 Rt. 14	3,500	SF	10 gpd/100 s.f.	350	2	3,500	SF	10 gpd/100 s.f.	350	2
Commercial Growth Allocation				0	0			Estimate	190	1
Sub-Total				10,015	42				12,018	50
				Use 10,000					Use 12,100	

Notes:

1. VTEPR Vermont Environmnetal Protection Rules, Chapter 1, Subchapter 7, Section 1-504- Design Flow.
2. Table 1 (b), VT EPR- When more than 20 single family residential units are connected to a single soil based disposal system, the flow rate is 245 gallons per day per single family unit.
3. The number of residential units was increased by 20% from the Initial Year (2008) to the Design Year (2028). The future Commercial Growth/Allowance was calculated by increasing the the Initial Year (2008) commercial flow by 20%.

Table F-4
Wastewater Flow Projections
Alternative No. 7- Large Cluster Direct Discharge

AREA, SITE & USE CATEGORY	INITIAL YEAR (2008) QUANTITY	VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS	DESIGN YEAR (2028) QUANTITY	VTEPR (1.) FLOW VALUES	FLOW ESTIMATE (gpd)	EQUIVALENT USERS
North Montpelier								
Residential Units	47 Units	245 Gal./Unit (2.)	11,515	47	56 Units	245 Gal./Unit (2.)	13,818	47
Commercial Units								
Store			600	2			600	2
Commercial Growth Allocation							120	1
Sub-Total			12,115 Use 12,200	49			14,538 Use 14,600	50
Montpelier Village								
Residential Units	118 Units	245 Gal./Unit (3.)	28,910	118	142 Units	245 Gal./Unit (3.)	34,692	142
Commercial Units								
370 Rt. 2	940 SF	10 gpd/100 s.f.	94	1	940 SF	10 gpd/100 s.f.	94	1
2419 Rt. 2	25 Empl.	15 gpd/employee	375	2	25 Empl.	15 gpd/employee	375	2
2540 Rt. 2	1,300 SF	10 gpd/100 s.f.	130	1	1,300 SF	10 gpd/100 s.f.	130	1
2624 Rt. 2	600 SF		490	2	600 SF		490	2
2783 Rt. 2	1,500 SF	10 gpd/100 s.f.	414	1	1,500 SF	10 gpd/100 s.f.	414	1
2875 Rt. 2	1,400 SF	10 gpd/100 s.f.	140	1	1,400 SF	10 gpd/100 s.f.	140	1
2915 Rt. 2	6,000 SF	10 gpd/100 s.f.	600	2	6,000 SF	10 gpd/100 s.f.	600	2
2952 Rt. 2	1,700 SF	10 gpd/100 s.f.	170	1	1,700 SF	10 gpd/100 s.f.	170	1
3000 Rt. 2	930 SF	10 gpd/100 s.f.	93	1	930 SF	10 gpd/100 s.f.	93	1
3042 Rt. 2	816 SF	10 gpd/100 s.f.	82	1	816 SF	10 gpd/100 s.f.	82	1
Church		Estimate	300	1		Estimate	300	1
3070 Rt. 2	940 SF	10 gpd/100 s.f.	94	1	940 SF	10 gpd/100 s.f.	94	1
75 Rt. 14	4,200 SF	10 gpd/100 s.f.	420	2	4,200 SF	10 gpd/100 s.f.	420	2
2205 Rt. 14	1,800 SF	10 gpd/100 s.f.	180	1	1,800 SF	10 gpd/100 s.f.	180	1
2235 Rt. 14	3,500 SF	10 gpd/100 s.f.	350	2	3,500 SF	10 gpd/100 s.f.	350	2
Commercial Growth Allocation			0	0		Estimate	786	3
Sub-Total			32,842 Use 33,000	138			39,410 Use 39,500	165

Notes:
1. VTEPR Vermont Environmnetal Protection Rules, Chapter 1, Subchapter 7, Section 1-504- Design Flow.
2. Table 1 (b), VT EPR- When more than 20 single family residential units are connected to a single soil based disposal system, the flow rate is 245 gallons per day per single family unit.
3. The number of residential units was increased by 20% from the Initial Year (2008) to the Design Year (2028). The future Commercial Growth/Allowance was calculated by increasing the the Initial Year (2008) commercial flow by 20%.

APPENDIX G

Municipal Infrastructure Project Cost Estimates

Table G-1 Construction Cost Estimate Alternative 1A
Table G-2 Construction Cost Estimate Alternative 4
Table G-3 Construction Cost Estimate Alternative 5
Table G-4 Construction Cost Estimate Alternative 6
Table G-5 Preliminary Total Estimated Project Costs Alternative 1A
Table G-6 Preliminary Total Estimated Project Costs Alternative 4
Table G-7 Preliminary Total Estimated Project Costs Alternative 5
Table G-8 Preliminary Total Estimated Project Costs Alternative 6
Table G-9 Preliminary Best Case Project Cost Estimate Summary

Table G-1
Construction Cost Estimate
Alternative No. 1A
Small Cluster System for Failed System

Description Description Of Item	Quantity	Unit	Unit Price	Cost (*) (ENR 7017)
Low Pressure Sewer Mains	700	L.F.	$32	$22,400
Low Pressure Sewer Services	225	L.F.	$25	$5,600
Gravity Sewer Services	30	L.F.	$30	$900
Septic Tank Effluent Pumping Systems	3	EA.	$14,400	$43,200
Abandonment of Existing Septic Tanks	3	EA.	$1,500	$4,500
Low Pressure Sewer Manholes	0	EA.	$6,000	$0
Rock Excavation	5	C.Y.	$120	$600
Boulder Excavation	5	C.Y.	$40	$200
Misc. Extra & Below Grade Excavation	10	C.Y.	$30	$300
Excavation and Replacement of Unsuitable Materials	10	C.Y.	$30	$300
Gravel Roads and Drives	30	L.F.	$12	$400
Permanent Bituminous Pavement Repair	17	S.Y.	$50	$800
Class "B" Concrete	2	C.Y.	$200	$400
Calcium Chloride	1	TON	$600	$600
Rigid Trench Insulation	25	L.F.	$5	$100
Construction Photographs	1	L.S.	$100	$100
Silt Fence	5,000	L.F.	$2	$10,000
Temporary Stone Check Dams	2	E.A.	$100	$200
Erosion Control Blankets	100	S.Y.	$2	$200
Mound Wastewater Disposal System	1	L.S.	$67,500	$67,500
Preparation of Site and Miscellaneous Work (8%)	1	L.S.	$12,720	$12,720
Bonds (1.5%)	1	L.S.	$3,000	$3,000
Subtotal Construction Cost Estimate (ENR 7017) *				$174,100
Construction Cost Estimate (ENR 8950) **				$222,100

* ENR COST INDEX VALUE = 7017 FOR OCTOBER, 2004. **USE** **$230,000**
** ESTIMATED ENR COST INDEX VALUE = 8950 FOR JANUARY, 2009.

Total EU's= 5
Design Flow= 1,225 gpd

Note:
1) ENR = Engineering News Record
2) The estimated 2009 ENR Cost Index Value (8950) was confirmed using the actual trends in the ENR Cost Index from April 2005 to October 2006 and then projecting the trend to January 2009.

Table G-2
Construction Cost Estimate
Alternative No. 4
Small Clusters for Failed & Marginal Sites

Description Description Of Item	Quantity	Unit	Unit Price	Cost (*) (ENR 7017)
Low Pressure Sewer Mains	14,600	L.F.	$32	$467,200
Low Pressure Sewer Services	3,900	L.F.	$25	$97,500
Gravity Sewer Services	520	L.F.	$30	$15,600
Septic Tank Effluent Pumping Systems	52	EA.	$14,400	$748,800
Abandonment of Existing Septic Tanks	52	EA.	$1,500	$78,000
Low Pressure Sewer Manholes	18	EA.	$6,000	$108,000
Rock Excavation	200	C.Y.	$120	$24,000
Boulder Excavation	50	C.Y.	$40	$2,000
Misc. Extra & Below Grade Excavation	50	C.Y.	$30	$1,500
Excavation and Replacement of Unsuitable Materials	50	C.Y.	$30	$1,500
Gravel Roads and Drives	550	L.F.	$12	$6,600
Permanent Bituminous Pavement Repair	147	S.Y.	$50	$7,400
Class "B" Concrete	4	C.Y.	$200	$800
Calcium Chloride	3	TON	$600	$1,800
Rigid Trench Insulation	1,000	L.F.	$5	$5,000
Construction Photographs	1	L.S.	$500	$500
Silt Fence	5,000	L.F.	$2	$10,000
Temporary Stone Check Dams	10	E.A.	$100	$1,000
Erosion Control Blankets	10,000	S.Y.	$2	$20,000
Wastewater Disposal Systems				
Kelton Road Cluster, Q= 1,900 gpd	1	L.S.	$47,500	$47,500
Quaker Hill Cluster, Mound, Q=2,300 gpd	1	L.S.	$69,000	$69,000
Route 2 Center Cluster, Q=2,800 gpd	1	L.S.	$70,000	$70,000
Route 2 South Cluster, Q=3,800 gpd	1	L.S.	$95,000	$95,000
Route 14 Cluster, Q= 3,900 gpd	1	L.S.	$97,500	$97,500
North Montpelier Cluster, Q=6,000 gpd	1	L.S.	$150,000	$150,000
Preparation of Site and Miscellaneous Work (8%)	1	L.S.	$127,840	$127,840
Bonds (1.5%)	1	L.S.	$34,500	$34,500
Subtotal Construction Cost Estimate (ENR 7017) *				$2,288,600
Construction Cost Estimate (ENR 8950) **				$2,919,100

* ENR COST INDEX VALUE = 7017 FOR OCTOBER, 2004. **USE** **$2,900,000**
** ESTIMATED ENR COST INDEX VALUE = 8950 FOR JANUARY, 2009.

Total EU's= 62

Note:
1) ENR = Engineering News Record
2) The estimated 2009 ENR Cost Index Value (8950) was confirmed using the actual trends in the ENR Cost Index from April 2005 to October 2006 and then projecting the trend to January 2009.

Table G-3
Construction Cost Estimate
Alternative No. 5
Large Clusters for Failed & Marginal Sites

Description Description Of Item	Quantity	Unit	Unit Price	Cost (*) (ENR 7017)
Low Pressure Sewer Mains	19,400	L.F.	$32	$620,800
Low Pressure Sewer Services	3,900	L.F.	$25	$97,500
Gravity Sewer Services	520	L.F.	$30	$15,600
Septic Tank Effluent Pumping Systems	52	EA.	$14,400	$748,800
Abandonment of Existing Septic Tanks	52	EA.	$1,500	$78,000
Low Pressure Sewer Manholes	18	EA.	$6,000	$108,000
Rock Excavation	200	C.Y.	$120	$24,000
Boulder Excavation	50	C.Y.	$40	$2,000
Misc. Extra & Below Grade Excavation	50	C.Y.	$30	$1,500
Excavation and Replacement of Unsuitable Materials	50	C.Y.	$30	$1,500
Gravel Roads and Drives	550	L.F.	$12	$6,600
Permanent Bituminous Pavement Repair	147	S.Y.	$50	$7,400
Class "B" Concrete	4	C.Y.	$200	$800
Calcium Chloride	3	TON	$600	$1,800
Rigid Trench Insulation	1,000	L.F.	$5	$5,000
Construction Photographs	1	L.S.	$500	$500
Silt Fence	5,000	L.F.	$2	$10,000
Temporary Stone Check Dams	10	E.A.	$100	$1,000
Erosion Control Blankets	10,000	S.Y.	$2	$20,000
Wastewater Disposal Systems				
Route 2 Cluster, Q= 8,400 gpd	1	L.S.	$237,000	$237,000
Route 14 Cluster, Q=3,900 gpd	1	L.S.	$97,500	$97,500
North Montpelier Cluster, Q=6,000 gpd	1	L.S.	$150,000	$150,000
Preparation of Site and Miscellaneous Work (8%)	1	L.S.	$140,080	$140,080
Bonds (1.5%)	1	L.S.	$36,000	$36,000
Subtotal Construction Cost Estimate (ENR 7017) *				$2,411,400
Construction Cost Estimate (ENR 8950) **				$3,075,700

* ENR COST INDEX VALUE = 7017 FOR OCTOBER, 2004. **USE** **$3,100,000**
** ESTIMATED ENR COST INDEX VALUE = 8950 FOR JANUARY, 2009.

Total EU's= 62

Note:
1) ENR = Engineering News Record
2) The estimated 2009 ENR Cost Index Value (8950) was confirmed using the actual trends in the ENR Cost Index from April 2005 to October 2006 and then projecting the trend to January 2009.

Table G-4
Construction Cost Estimate
Alternative No. 6
Large Clusters for All Systems

Description Description Of Item	Quantity	Unit	Unit Price	Cost (*) (ENR 7017)
Low Pressure Sewer Mains	21,100	L.F.	$32	$675,200
Low Pressure Sewer Services	9,900	L.F.	$25	$247,500
Gravity Sewer Services	1,400	L.F.	$30	$42,000
Septic Tank Effluent Pumping Systems	131	EA.	$14,400	$1,886,400
Abandonment of Existing Septic Tanks	131	EA.	$1,500	$196,500
Low Pressure Sewer Manholes	18	EA.	$6,000	$108,000
Rock Excavation	200	C.Y.	$120	$24,000
Boulder Excavation	75	C.Y.	$40	$3,000
Misc. Extra & Below Grade Excavation	75	C.Y.	$30	$2,300
Excavation and Replacement of Unsuitable Materials	75	C.Y.	$30	$2,300
Gravel Roads and Drives	700	L.F.	$12	$8,400
Permanent Bituminous Pavement Repair	200	S.Y.	$50	$10,000
Class "B" Concrete	6	C.Y.	$200	$1,200
Calcium Chloride	5	TON	$600	$3,000
Rigid Trench Insulation	2,000	L.F.	$5	$10,000
Construction Photographs	1	L.S.	$1,000	$1,000
Silt Fence	5,000	L.F.	$2	$10,000
Temporary Stone Check Dams	20	E.A.	$100	$2,000
Erosion Control Blankets	15,000	S.Y.	$2	$30,000
Wastewater Disposal Systems				
Route 2 Cluster, Q=27,400 gpd	1	L.S.	$822,000	$822,000
Route 14 Cluster, Q=12,100 gpd	1	L.S.	$363,000	$363,000
North Montpelier Cluster, Q=14,600 gpd	1	L.S.	$438,000	$438,000
Preparation of Site and Miscellaneous Work (8%)	1	L.S.	$261,040	$261,040
Bonds (1.5%)	1	L.S.	$78,000	$78,000
Subtotal Construction Cost Estimate (ENR 7017) *				$5,224,900
Construction Cost Estimate (ENR 8950) **				$6,664,300

* ENR COST INDEX VALUE = 7017 FOR OCTOBER, 2004. **USE** **$6,600,000**
** ESTIMATED ENR COST INDEX VALUE = 8950 FOR JANUARY, 2009.

Total EU's= 131

Note:
1) ENR = Engineering News Record
2) The estimated 2009 ENR Cost Index Value (8950) was confirmed using the actual trends in the ENR Cost Index from April 2005 to October 2006 and then projecting the trend to January 2009.

Table G-5
Preliminary Total Project Cost Estimate
Alternative No. 1A
Small Cluster System for Failed System

ITEM DESCRIPTION	TOTAL COST
CONSTRUCTION (1.)	
Construction Cost	$230,000
CONSTRUCTION SUBTOTAL	$230,000
CONSTRUCTION CONTINGENCY	
Construction Contingency (10%)	$23,000
CONSTRUCTION CONTINGENCY SUBTOTAL	$23,000
ENGINEERING (STEPs I, II & III)	
State Allownance (23%)	$53,000
STEP I- Predesign Services	
Archaeological Allowance Phase 1A Only	$2,000
Permits- Wetlands Etc.	$2,000
Bond Vote Allowance	$2,000
Special Stream/Groundwater Indirect Discharge Rules Study	$0
ENGINEERING SERVICES SUBTOTAL	$59,000
OTHER PROJECT COSTS	
Administrative and Legal (1%)	$5,000
Land Surveys and Purchases	$10,000
Easements and Rights-of-Way	$1,000
Permits- Allowance	$1,000
Short Term Interest	$9,000
Billing System	$0
OTHER PROJECT COSTS SUBTOTAL	$26,000
ESTIMATED TOTALS	$338,000
USE :	$330,000

Notes:
1. Based on ENR 8950, January 2009.

Table G-6
Preliminary Total Project Cost Estimate
Alternative No. 4
Small Clusters for Failed & Marginal Sites

ITEM DESCRIPTION	TOTAL COST
CONSTRUCTION (1.)	
Construction Cost	$2,900,000
CONSTRUCTION SUBTOTAL	$2,900,000
CONSTRUCTION CONTINGENCY	
Construction Contingency (10%)	$290,000
CONSTRUCTION CONTINGENCY SUBTOTAL	$290,000
ENGINEERING (STEPs I, II & III)	
State Allownance (23%)	$650,000
STEP I- Predesign Services	
Archaeological Allowance Phase 1A Only	$50,000
Permits- Wetlands Etc.	$10,000
Bond Vote Allowance	$5,000
Special Stream/Groundwater Indirect Discharge Rules Study	$0
ENGINEERING SERVICES SUBTOTAL	$715,000
OTHER PROJECT COSTS	
Administrative and Legal (1%)	$30,000
Land Surveys and Purchases	$50,000
Easements and Rights-of-Way	$10,000
Permits- Allowance	$10,000
Short Term Interest	$50,000
Billing System	$5,000
OTHER PROJECT COSTS SUBTOTAL	$150,000
ESTIMATED TOTALS	$4,055,000
USE :	$4,000,000

Notes:

1. Based on ENR 8950, January 2009.

Table G-7
Preliminary Total Project Cost Estimate
Alternative No. 5
Large Clusters for Failed & Marginal Sites

ITEM DESCRIPTION	TOTAL COST
CONSTRUCTION (1.)	
Construction Cost	$3,100,000
CONSTRUCTION SUBTOTAL	$3,100,000
CONSTRUCTION CONTINGENCY	
Construction Contingency (10%)	$310,000
CONSTRUCTION CONTINGENCY SUBTOTAL	$310,000
ENGINEERING (STEPs I, II & III)	
State Allownance (23%)	$650,000
STEP I- Predesign Services	
Archaeological Allowance Phase 1A Only	$40,000
Permits- Wetlands Etc.	$10,000
Bond Vote Allowance	$5,000
Special Stream/Groundwater Indirect Discharge Rules Study	$150,000
ENGINEERING SERVICES SUBTOTAL	$855,000
OTHER PROJECT COSTS	
Administrative and Legal (1%)	$30,000
Land Surveys and Purchases	$40,000
Easements and Rights-of-Way	$8,000
Permits- Allowance	$10,000
Short Term Interest	$50,000
Billing System	$5,000
OTHER PROJECT COSTS SUBTOTAL	$138,000
ESTIMATED TOTALS	$4,403,000
USE :	$4,400,000

Notes:

1. Based on ENR 8950, January 2009.

Table G-8
Preliminary Total Project Cost Estimate
Alternative No. 6
Large Clusters for All Systems

ITEM DESCRIPTION	TOTAL COST
CONSTRUCTION (1.)	
Construction Cost	$6,600,000
CONSTRUCTION SUBTOTAL	$6,600,000
CONSTRUCTION CONTINGENCY	
Construction Contingency (10%)	$660,000
CONSTRUCTION CONTINGENCY SUBTOTAL	$660,000
ENGINEERING (STEPs I, II & III)	
State Allownance (23%)	$1,500,000
STEP I- Predesign Services	
Archaeological Allowance PH 1A Only	$30,000
Permits- Wetlands Etc.	$10,000
Bond Vote Allowance	$5,000
Special Stream/Groundwater IDRs Study	$450,000
ENGINEERING SERVICES SUBTOTAL	$1,995,000
OTHER PROJECT COSTS	
Administrative and Legal (1%)	$40,000
Land Surveys and Purchases	$40,000
Easements and Rights-of-Way	$8,000
Permits- Allowance	$10,000
Short Term Interest	$100,000
Billing System	$5,000
OTHER PROJECT COSTS SUBTOTAL	$198,000
ESTIMATED TOTALS	$9,453,000
USE :	$9,500,000

Notes:

1. Based on ENR 8950, January 2009.

Table G-9

Preliminary Best Case[1] First Year User Cost Estimates

ALTERNATIVE[2]	TOTAL PROJECT[3] COST	TOTAL ANNUAL[4] BOND COST	TOTAL EQUIVALENT USERS (EU)[5]	ANNUAL BOND COST COST/EU	O&M COST OF $300/EU, 1ST YR	TOTAL 1ST YR EU COST
1A	$330,000	$7,000	5	$1,400	$300	$1,700
4	$4,000,000	$89,000	62	$1,435	$300	$1,735
5	$4,400,000	$100,000	62	$1,613	$300	$1,913
6	$9,500,000	$220,000	131	$1,679	$300	$1,979

NOTES:

1. BEST CASE:
   - A FULLY ELIGIBLE 35% VT GRANT.
   - SOME AMOUNT OF RD GRANT.
   - MANDATORY CONNECTION (100% OF THE POSSIBLE USERS ARE CONNECTED)
2. ALTERNATIVES
   - ALTERNATIVE NO. 1A- REPLACE FAILED CLUSTER SYSTEM
   - ALTERNATIVE NO. 4- ON-SITE MANAGEMENT PLUS SMALL CLUSTERS FOR FAILED AND MARGINAL SITES
   - ALTERNATIVE NO. 5- ON-SITE MANAGEMENT PLUS LARGE CLUSTERS FOR FAILED AND MARGINAL SITES
   - ALTERNATIVE NO. 6- OFF-SITE MANAGEMENT WITH LARGE CLUSTERS FOR ALL SYSTEMS
3. ASSUMES CONSTRUCTION IN 2009.
4. ASSUMES ANR SRF LOAN, 20 YEARS @ 2%.
5. AN EU IS SINGLE FAMILY HOME, AN APARTMENT, A MOBILE HOME, OR THE EQUIVALENT NON-RESIDENTIAL USER. THE MINIMUM EU IS 1.0 EU.

APPENDIX H

Private Infrastructure Project Cost Estimates

Table H-1 Typical Onsite System Construction Costs
Table H-2 Private Onsite Infrastructure Financing Annual Payments
Table H-3 Private Wastewater Infrastructure Management Action Plan Cost Estimates for Alternative 1a Onsite Systems
Table H-4 Private Wastewater Infrastructure Management Action Plan Cost Estimates for Alternative 2 and Alternative 3 Onsite Systems
Table H-5 Private Wastewater Infrastructure Management Action Plan Cost Estimates for Alternative 4 and Alternative 5 Onsite Systems

Table H-1
Typical On-Site System Construction Costs [1]

System Type	Estimated Cost Range ENR 7017 [2]	Estimated Cost Range ENR 8950 [3]
Conventional Septic Tank/Gravity Disposal System	$7,500 - $10,000	$9,600 - 12,800
Septic Tank/Pump Station/Pressured In-Ground or At-Grade Disposal System	$12,000 - $15,000	$15,300 - $19,100
Septic Tank/Pump Station/Mound Disposal System	$18,000 - $30,000	$23,000 - $38,300
Septic Tank/Filtrate Treatment/Pump Station/Pressured In-Ground or At-Grade Disposal System	$20,000 - $23,000	$25,500 - $29,300
Septic Tank/Filtrate Treatment/Pump Station/Mound Disposal System	$26,000 - $38,000	$33,200 - $48,500

Notes:
(1) To expand the construction cost estimates to Total Project Costs multiply the construction costs x 20% and add to the construction cost.
(2) ENR 7017: October 2004
(3) ENR 8950: January 2009

Table H-2
Private Onsite Infrastructure Financing Annual Payments

System Type	Estimated Construction Cost [1]	Annual Payments 3.00% SRF Loan 20 Year Term	Annual Payments Home Equity Loan 7.00% Loan 20 Year Term
Conventional Septic Tank/Gravity Disposal System	$8,000	$538	$755
Septic Tank/Pump Station/Pressured In-Ground or At-Grade Disposal System	$13,000	$874	$1,227
Septic Tank/Filtrate Treatment/Pump Station/Pressured In-Ground or At-Grade Disposal System	$25,000	$1,680	$2,360
Septic Tank/Pump Station/Mound Disposal System	$30,000	$2,016	$2,832
Septic Tank/Filtrate Treatment/Pump Station/Mound Disposal System	$38,000	$2,554	$3,587

Notes:

(1) The estimated construction cost is from Table H-1. Costs estimated as of 12/06. To expand the construction cost estimates to Total Project Costs multiply the construction costs x 20% and add to the construction cost.

Table H-3
Cost Estimates For Alternative 1A Individual On-Site Systems

Program Components	Equivalent Users	Unit	Unit Cost	Years				
				Initial Year Set Up Cost	Y2 Cost	Y3 Cost	Y4 Cost	Y5 - Y20 Annual Cost
Public Education/Outreach[1]	210	Systems	$20	$4,200	$2,100	$2,100	$2,100	$1,050
System Inventory[2]	210	Systems	$10	$2,100	$1,160	$1,160	$1,160	$460
Recordkeeping[3]	210	Systems	$25	$5,250	$1,550	$1,550	$1,550	$2,000
Equipment Purchases	1	Lump Sum	$6,000	$6,000	$2,000	$2,000	$2,000	$2,000
Inspections[4]	210	Systems	$750	$5,000	$52,500	$52,500	$52,500	$8,000
Initial Equipment Purchases	1	Lump Sum	$1,000	$1,000	$200	$200	$200	$200
Loan Program for System Upgrades[5]								
Start-Up (program administration)	80	Hours	$50	$4,000	$1,000	$1,000	$1,000	$500
			Total	$27,550	$60,510	$60,510	$60,510	$14,210
			Annual Onsite System User Fee:	$131	$288	$288	$288	$68
			Minimum Annual Onsite O&M[6]	80	80	80	80	80
			Total Annual Cost Per EU	$211	$368	$368	$368	$148

Notes

1. Year 1: Two mailings and two meetings in each village; Years 2 - 4: one meeting and mailing in each village; Years 5-20: One meeting and mailing per year.
2. Year 1: full cost; Years 2-4: 25% initial cost while inventory is updated due to inspections; Years 5-20: 10% initial cost to update inventory as needed.
3. Year 1: full cost to set up data base; Years 2-4: 33% initial cost while data from inspections is entered, Years 5-20: fixed rate to enter O&M and upgrade data
4. Year 1: initial cost to set up program; Years 2-4: conduct detailed initial inspections with contractor hired by owners to expose system; Years 5-20 conduct "check-up" inspections every three years to confirm system is operating properly.
5. Year 1: Cost to establish program and establish qualification and priority criteria for loans
6. Assumed Septic Tank Pumping every three years at $240/pump out. Dispersal & Treatment System O&M borne by user. All repair, and upgrade costs borne by users.

Table H-4
Private Wastewater Infrastructure Management Action Plan
Cost Estimates For Alternative 2 and Alternative 3 Individual On-Site Systems

Program Components	Equivalent Users	Unit	Unit Cost	Years				
				Initial Year Set Up Cost	Y2 Cost	Y3 Cost	Y4 Cost	Y5 - Y20 Annual Cost
Public Education/Outreach[1]	210	Systems	$20	$4,200	$2,100	$2,100	$2,100	$1,050
System Inventory[2]	210	Systems	$10	$2,100	$1,160	$1,160	$1,160	$460
Recordkeeping[3]	210	Systems	$25	$5,250	$1,550	$1,550	$1,550	$2,000
Equipment Purchases	1	Lump Sum	$6,000	$6,000	$2,000	$2,000	$2,000	$2,000
Inspections[4]	210	Systems	$750	$5,000	$52,500	$52,500	$52,500	$8,000
Initial Equipment Purchases	1	Lump Sum	$1,000	$1,000	$200	$200	$200	$200
Loan Program for System Upgrades[5]								
Start-Up (program administration)	80	Hours	$50	$4,000	$1,000	$1,000	$1,000	$500
			Total	$27,550	$60,510	$60,510	$60,510	$14,210
Annual Onsite System User Fee:				$131	$288	$288	$288	$68
Minimum Annual Onsite O&M[6]				80	80	80	80	80
Total Annual Cost Per EU				$211	$368	$368	$368	$148

Notes

1. Year 1: Two mailings and two meetings in each village; Years 2 - 4: one meeting and mailing in each village; Years 5-20: One meeting and mailing per year.
2. Year 1: full cost; Years 2-4: 25% initial cost while inventory is updated due to inspections; Years 5-20: 10% initial cost to update inventory as needed.
3. Year 1: full cost to set up data base; Years 2-4: 33% initial cost while data from inspections is entered, Years 5-20: fixed rate to enter O&M and upgrade data
4. Year 1: initial cost to set up program; Years 2-4: conduct detailed initial inspections with contractor hired by owners to expose system; Years 5-20 conduct "check-up" inspections every three years to confirm system is operating properly.
5. Year 1: Cost to establish program and establish qualification and priority criteria for loans

6. Assumed Septic Tank Pumping every three years at $240/pump out. Dispersal & Treatment System O&M borne by user. All repair, and upgrade costs borne by users.

TABLE H-5
TOWN OF EAST MONTPELIER
WASTEWATER FEASIBILITY STUDY
PRIVATE WASTEWATER INFRASTRUCTURE MANAGEMENT ACTION PLAN
COST ESTIMATES FOR ALTERNATIVE 4 AND ALTERNATIVE 5 INDIVIDUAL ONSITE SYSTEMS

Program Components	Equivalent Users	Unit	Unit Cost	Years				
				Initial Year Set Up Cost	Y2 Cost	Y3 Cost	Y4 Cost	Y5 - Y20 Annual Cost
Public Education/Outreach[1]	192	Systems	$20	$3,840	$1,920	$1,920	$1,920	$960
System Inventory[2]	192	Systems	$10	$1,920	$1,160	$1,160	$1,160	$460
Recordkeeping[3]	192	Systems	$25	$4,800	$1,550	$1,550	$1,550	$2,000
Equipment Purchases	1	Lump Sum	$6,000	$6,000	$2,000	$2,000	$2,000	$2,000
Inspections[4]	192	Systems	$750	$5,000	$48,000	$48,000	$48,000	$8,000
Initial Equipment Purchases	1	Lump Sum	$1,000	$1,000	$200	$200	$200	$200
Loan Program for System Upgrades[5]								
Start-Up (program administration)	80	Hours	$50	$4,000	$1,000	$1,000	$1,000	$500
			Total	$26,560	$55,830	$55,830	$55,830	$14,120
			Annual Onsite System User Fee:	$138	$291	$291	$291	$74
			Minimum Annual Onsite O&M[6]	80	80	80	80	80
			Total Annual Cost Per EU	$218	$371	$371	$371	$154

Notes

1. Year 1: Two mailings and two meetings in each village; Years 2 - 4: one meeting and mailing in each village; Years 5-20: One meeting and mailing per year.
2. Year 1: full cost; Years 2-4: 25% initial cost while inventory is updated due to inspections; Years 5-20: 10% initial cost to update inventory as needed.
3. Year 1: full cost to set up data base; Years 2-4: 33% initial cost while data from inspections is entered, Years 5-20: fixed rate to enter O&M and upgrade data
4. Year 1: initial cost to set up program; Years 2-4: conduct detailed initial inspections with contractor hired by owners to expose system; Years 5-20 conduct "check-up" inspections every three years to confirm system is operating properly.
5. Year 1: Cost to establish program and establish qualification and priority criteria for loans
6. Assumed Septic Tank Pumping every three years at $240/pump out. Dispersal & Treatment System O&M borne by user. All repair, and upgrade costs borne by users.