Wastewater Solutions for Vermont Communities

Vermont Department of Housing and Community Affairs

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Wastewater Solutions for Vermont Communities

Vermont's long time goal of encouraging compact development in and around existing settlements and planned growth centers is challenged by a lack of wastewater treatment solutions. More than 200 historic village centers have no public wastewater treatment facilities. Failed septic systems are suspected to be common and efforts to create new housing and businesses are often stymied by the lack of sewage treatment facilities. Federal grants that were once readily available for constructing large, centralized public wastewater treatment facilities have been consistently cut. How can towns prosper and grow in these circumstances?

Centralized sewage treatment plants are no longer the only solution. Recent technological advancements in small-scale wastewater treatment, changes in permitting, and innovations in the way wastewater treatment systems can be managed now offer new solutions that can also be more cost effective. And while the days of big-money give-aways are over, a variety of smaller funding sources are available to help pay for infrastructure investments.

Along with an introduction to the new technological and funding options for wastewater solutions, this publication helps community leaders learn about the critical need to engage the public in the wastewater planning process. Every project needs to begin by defining the problem and a vision for where the community is going. This will help prevent over-engineering and keep solutions within the scale and cost range appropriate for each community. In Vermont, we have just begun to explore the varied, fine-tuned strategies for treating and managing wastewater, commonly referred to as "decentralized" approaches, which are introduced in this publication.

Our job at the Department of Housing and Community Affairs, through the downtown, planning, housing, community development, and historic preservation programs, is to help individuals and our local and regional partners create and maintain healthy, vibrant communities in Vermont. We hope this publication, along with the workshops, conference, and other events taking place throughout the coming year, will help solve wastewater problems and thus bring needed housing and new business vitality to Vermont's communities.

Department of Housing and Community Affairs
Division of Community Planning and Revitalization
January, 2008

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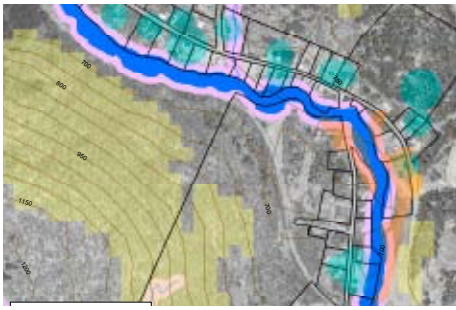
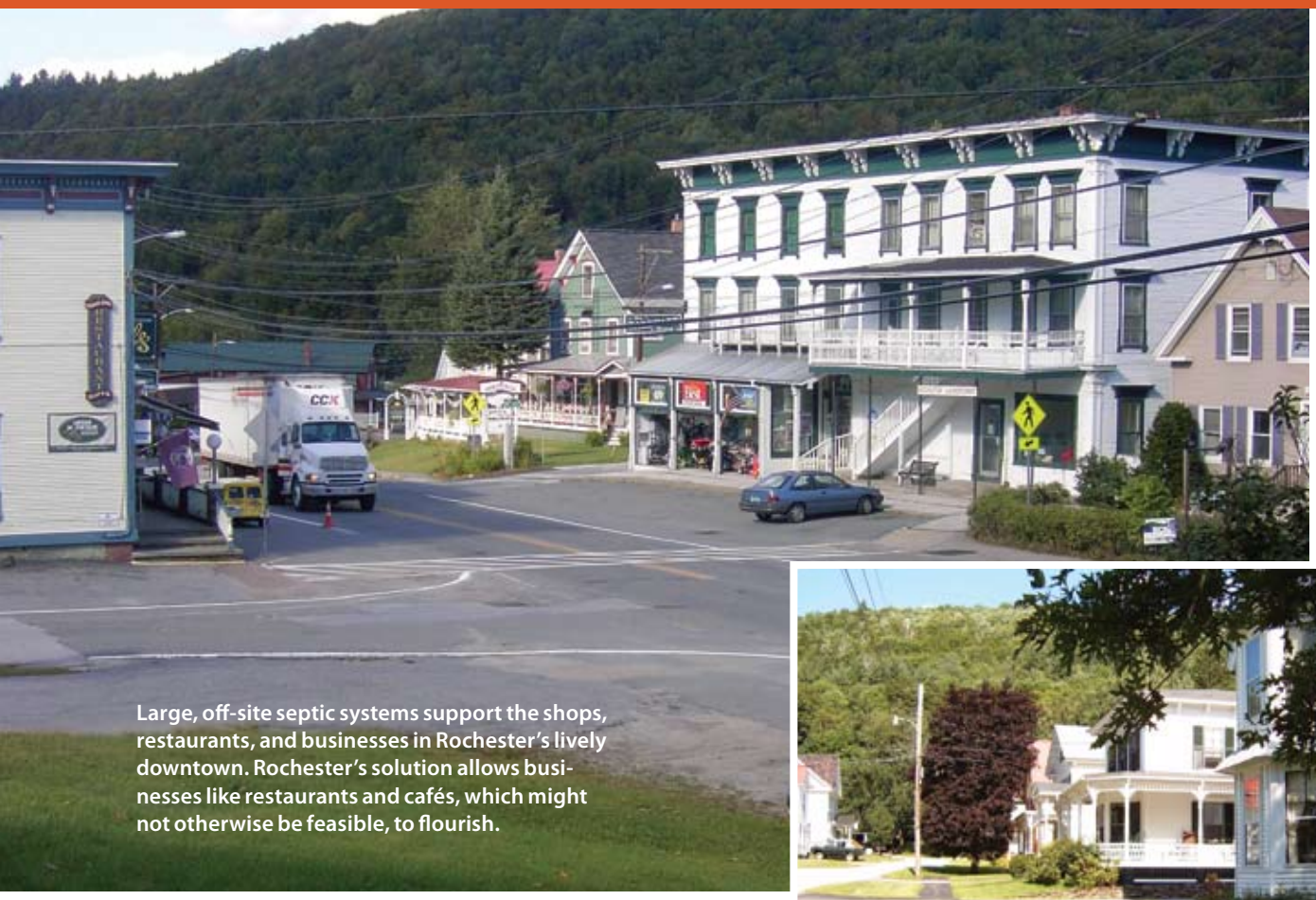




KEN JONES

Large, off-site septic systems support the shops, restaurants, and businesses in Rochester's lively downtown. Rochester's solution allows businesses like restaurants and cafés, which might not otherwise be feasible, to flourish.

HEATKERNEL ©2005

The houses on small lots near Rochester's town green are also served by off-site septic systems, while houses on larger lots are served by individual on-site septic systems.

Introduction

One Town's Story

People in the Vermont town of Rochester wanted a vital community center. They had a clear vision that finding a wastewater solution would allow their community to remain a bustling and active place. Town officials and wastewater committee members established a public decision making process to build community support for the solution, because an assessment of current conditions showed that the village couldn't grow or change without more wastewater capacity. The Town used engineers and other technical help to design and implement a solution that best fit their needs.

What did it take to address Rochester's needs?

- Acknowledgement of a problem
- Technical support
- Funding

What did Rochester gain by solving its wastewater issue?

- Protection of water resources
- New businesses and housing

What is the story of your community?

A Guide for Solving Wastewater Problems

It's not easy to find, design, and build wastewater solutions for a community of users—such as village centers, downtowns, growth areas, and town centers—with different needs, limited money, and different uses of land and water. Not easy—but not impossible either. Communities in Vermont and across the country have implemented solutions that manage wastewater safely and effectively.

This guide describes the steps along a wastewater planning path that includes:

- defining the problem and the goal,
- assessing local conditions,
- building a decision making mechanism that ensures a fair and effective solution,
- obtaining technical assistance, and
- growing your community's understanding of the regulatory requirements and financing opportunities that will be part of the overall solution.

This is a guide and not a cookbook, so it cannot present or predict a vision or a solution for your community. Only you and your neighbors can build that clear vision and take your own steps in meeting your wastewater needs.

Ultimately, many members of your community will need to participate in your wastewater solution. Getting your community together to figure out what your goals are, then acting in pursuit of those goals, can save you both time and money.

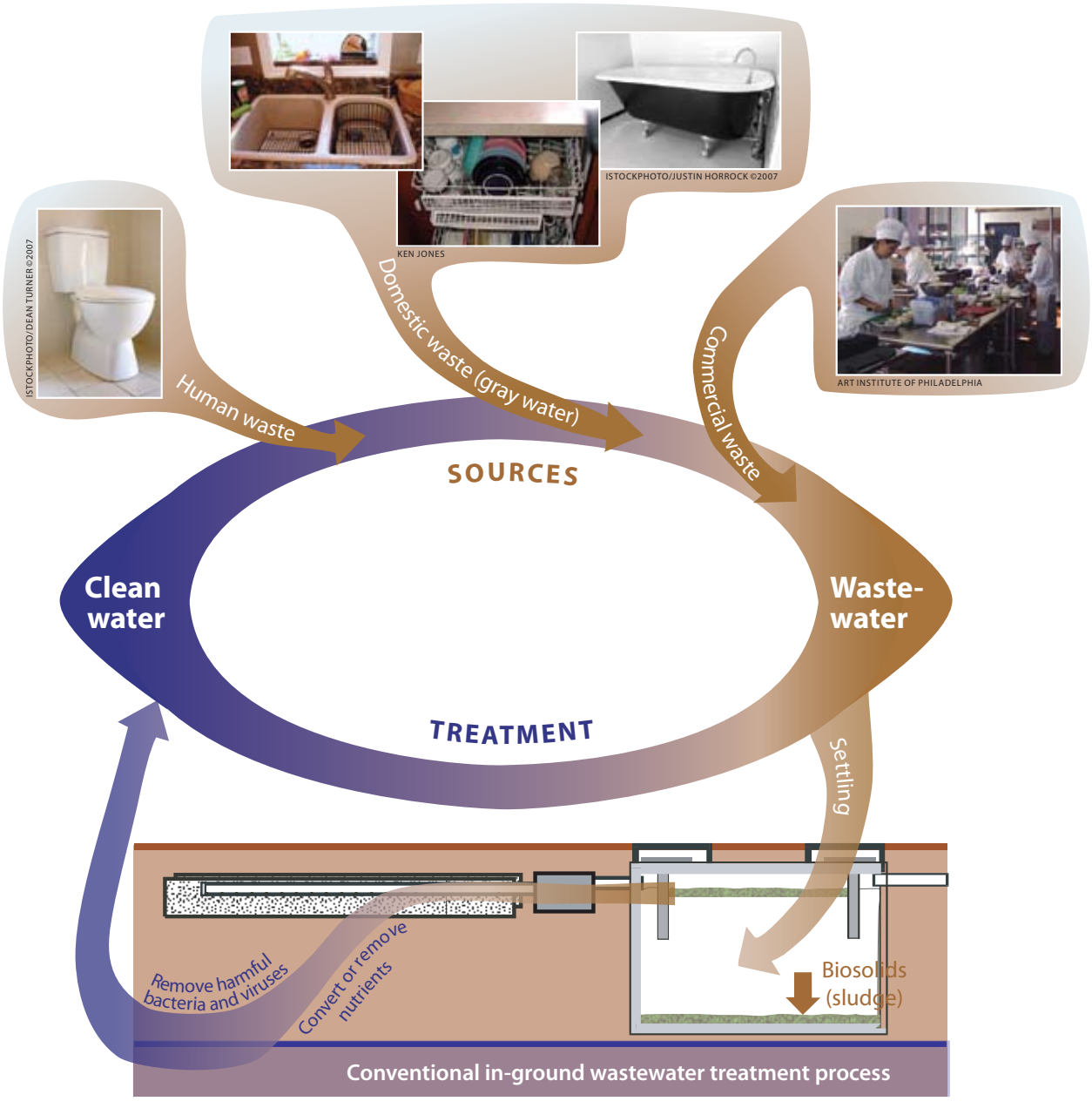
Assessing the current conditions around wastewater treatment in your community helps define both problems and potential solutions.

Wastewater Basics

Why Care about Wastewater?

Wastewater affects our water resources and needs to be managed in order to ensure that clean water is available in the long run, for ourselves, for others, and for the environment. Clean water is a finite resource and is everyone's concern.

**What is wastewater in your community?
A hidden hazard? A financial burden?
An obstacle to community growth issues?
A possible resource?**



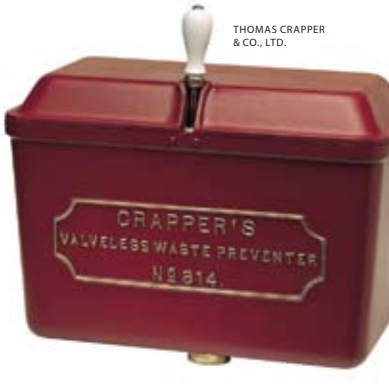
A Short History of Vermont Wastewater

During early colonial times, chamber pots and outhouses were often used to remove human waste from the home. The result was largely the disposal of that waste on the ground or in shallow trenches.

In Vermont, as elsewhere throughout the northeastern United States, larger settlements clustered around rivers and lakes. One of the attributes of these locations was the ability to pipe untreated human waste to adjacent water bodies for disposal.

In the early 20th century, the advent of indoor plumbing and flush toilets meant larger volumes of wastewater, but not necessarily better treatment of that waste. For rural homeowners, indoor plumbing often resulted in wastes being piped to the pits or shallow trenches once used for the outhouse, or in 'straight piping' wastewater to nearby ponds or rivers. In larger communities, the first central sewer systems improved sanitation and public health (but not water quality) by piping wastewater directly to rivers and lakes.

As the 20th century progressed, technologies for both rural homes and settled areas enhanced the ability of communities to more effectively treat their wastes and reduce the transmittal of microbial diseases and nutrient loading to local waters. At the same time, the environmental impacts of historic wastewater treatment practices became more apparent, and laws, rules, and policies were gradually enacted to help fix these problems.



Indoor plumbing improved public health but also had environmental consequences.

J.D. MADSEN

Untreated human waste affects aquatic life.

Modern regulations protect our health and sensitive waters like Lake Champlain.

Changing Times, New Management Strategies

Centralized systems

In the 1970s and 1980s, significant federal and state grant funding was available to build centralized wastewater treatment infrastructure. Centralized systems convey untreated sewage by pipe to a central treatment plant that usually discharges treated water to a large body of water, such as a river. About 100 Vermont municipalities built or upgraded their sewage treatment facilities during that period, and these systems serve about half of the state's population today. In the late 1980s, federal funding transitioned from grants to principally loans, and state grants were focused on the remaining direct sewage pollution problems (like straight pipes), combined sewer overflows, and phosphorus removal at existing treatment plants.

While federal and state loans and grants are still the primary financing sources for community wastewater projects, new wastewater facilities are expensive and loans must be repaid by the communities building them. Today's financial reality is that new centralized sewer projects often result in high sewer user rates that communities find unattractive.

In the 1990s, it became clear that the high costs of the centralized approach meant that centralized sewers would not be able to meet all wastewater needs. There was also a growing realization that sewers were not the best answer to every community's situation. Due to sprawling settlement patterns, growing threats to groundwater, rivers, and lakes, and skyrocketing costs for large infrastructure projects, more and more communities are looking to decentralized solutions.

Decentralized systems

A decentralized system can include conventional or advanced on-site septic tank systems with dispersal trenches that serve individual homes and businesses, larger septic systems that serve a cluster of buildings on one or more properties, and a sewer system that connects to a neighborhood or community treatment unit (often called a "package plant") that discharges to a ground dispersal system or to surface water. Like centralized sewer systems, decentralized systems require local management that ensures larger septic systems, small package plants, and advanced treatment septic systems are maintained and operated correctly. Management programs can be administered by a municipality, or by a special district or local utility that is set up to oversee these systems. The figure on the next page shows how individual systems and clustered systems can work together in a community.

Centralized wastewater treatment systems tend to induce growth wherever the infrastructure is located. In contrast, innovative onsite systems and decentralized wastewater management can be flexible tools for integrating environmental protection, land use goals, and wastewater treatment. The decentralized option can be used in a more targeted way so that communities are able to envision their land use and environmental protection goals first, and then develop wastewater management solutions to best serve those goals.

For more about the value of the decentralized approach to wastewater treatment, see the recent report titled Valuing Decentralized Wastewater Technologies, available at www.rmi.org/images/PDFs/Water/W04-21_ValuWstWtr.pdf.

1700

NATURAL RESOURCES CONSERVATION SERVICE

Wastewater disposal on ground or in trenches

1800

1900

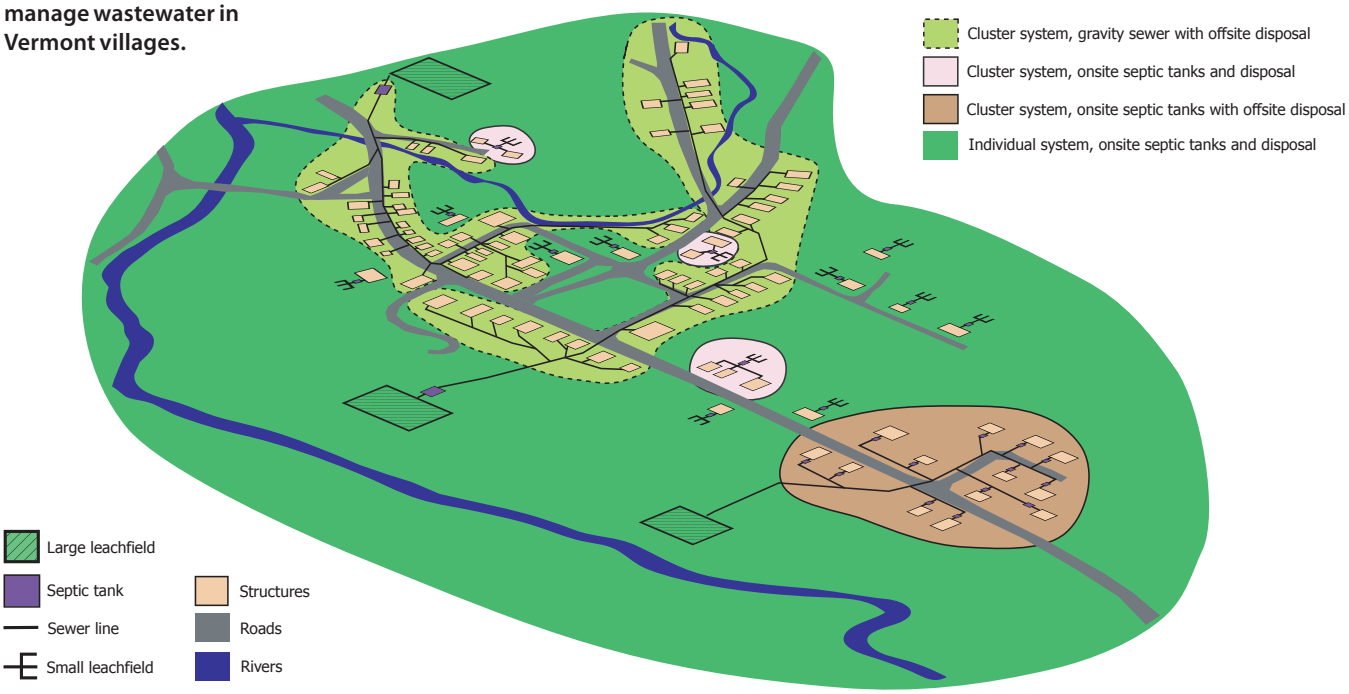
KENTUCKY DIVISION OF WATER

Indoor plumbing; straight pipes; first sewers

Vermont's first planning law

Vermont's first zoning law

A variety of collection and treatment solutions can be used to manage wastewater in Vermont villages.



Some advantages of decentralized wastewater systems

- Decentralized options give communities more tools for growth management, as facilities can be built where the need is without "inducing" growth along a sewer main.
- Decentralized systems can recharge water tables and maintain stream base flows. The effluent (treated wastewater) from soil-based systems replenishes local groundwater.
- The risks and costs of wastewater system failure are likely to be less for decentralized systems than centralized systems, since the systems are smaller and don't discharge to surface waters.

How do we make it all fit?

There are many newer wastewater treatment technologies that can help maintain the vitality of New England villages. Rhode Island has had significant experience in "making it fit" in dense settlements. You can find out more in an illustrated report from the University of Rhode Island titled Creative Community Design and Wastewater Management, available at www.ndwrcdp.org/userfiles/WUHT0030_post.pdf.

1970

Act 250 state land use law

First septic system rules

Clean Water Act; start of federal grants for treatment plants

1986

Federal loans replace grants for sewers

First state rules for large septic systems

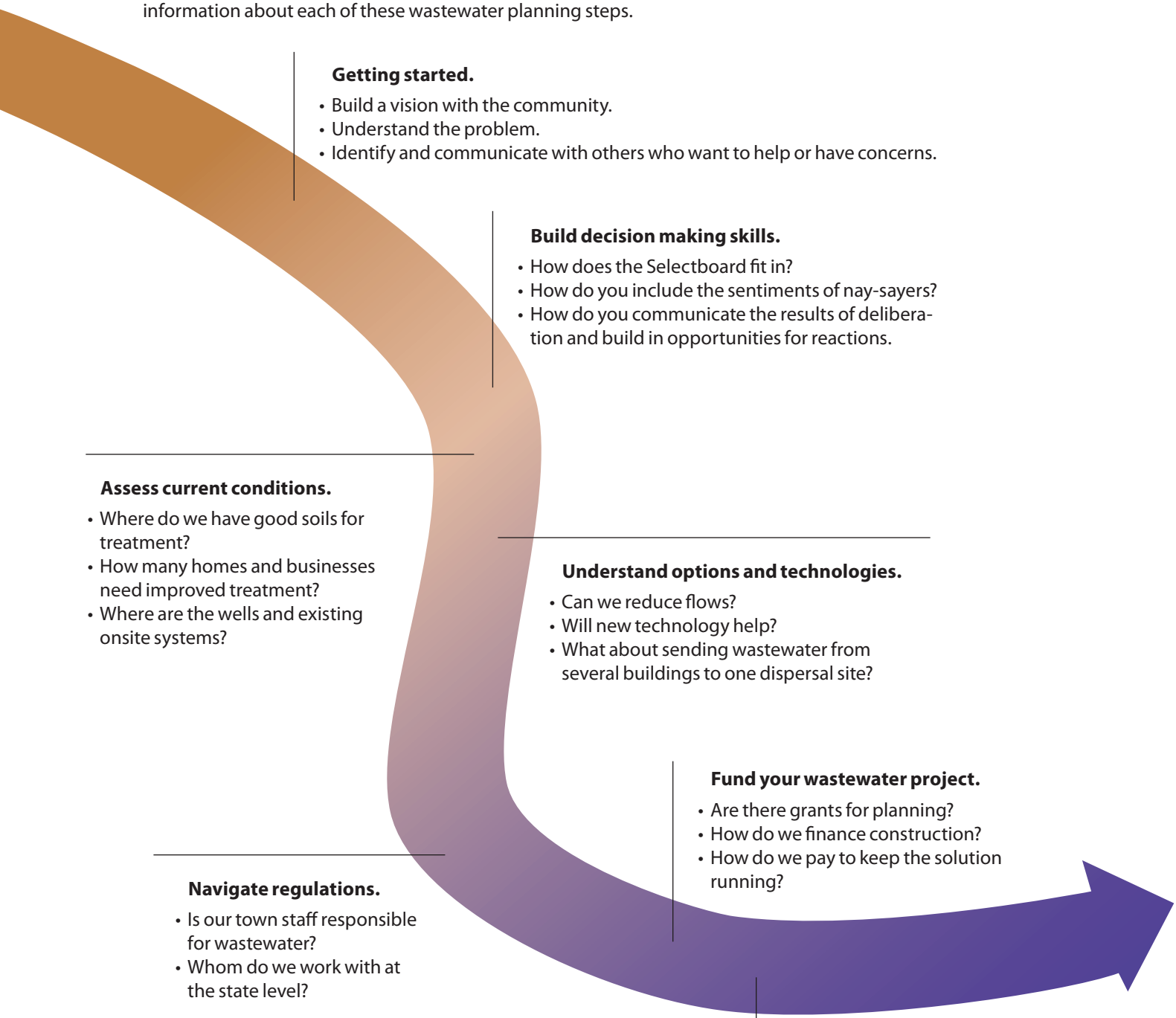
2000

Alternative septic systems allowed.

All septic systems need permit.

A Path to Solutions

No matter where your community's wastewater planning path begins, it will have several different steps. It will also have places where you can stop along the way, or where you can re-assess before moving ahead with a major decision. The following pages contain more information about each of these wastewater planning steps.



Getting started.

- Build a vision with the community.
- Understand the problem.
- Identify and communicate with others who want to help or have concerns.

Build decision making skills.

- How does the Selectboard fit in?
- How do you include the sentiments of nay-sayers?
- How do you communicate the results of deliberation and build in opportunities for reactions.

Assess current conditions.

- Where do we have good soils for treatment?
- How many homes and businesses need improved treatment?
- Where are the wells and existing onsite systems?

Understand options and technologies.

- Can we reduce flows?
- Will new technology help?
- What about sending wastewater from several buildings to one dispersal site?

Fund your wastewater project.

- Are there grants for planning?
- How do we finance construction?
- How do we pay to keep the solution running?

Navigate regulations.

- Is our town staff responsible for wastewater?
- Whom do we work with at the state level?

Get outside help.

- When do we need professional assistance?
- How can we choose the best engineer?

Getting Started: Ask the Right Questions

Whether your goal is to address current wastewater problems, avoid future problems, or support future development, starting with the right questions will help determine your motivation and vision. Communities often start with a "problem statement" that will help drive the motivation and define the vision. A problem statement will help clarify what information is needed and the types of assessment your community will initially undertake.

Each community's problems, conditions, and solutions are unique. Below are examples of limitations or problems that have motivated some Vermonters to envision wastewater solutions in their communities.

Warren's drinking water was at risk.

Is wastewater a factor preventing new housing in your village?

In Westford, residents want to know if the historic village area, which is designated for growth in their town's plan but has large areas of shallow groundwater, can support even modest new development.

Is wastewater a threat to your community's health?

In Warren's village center, testing showed that 30% of home drinking water systems were at risk from bacterial contamination – some of it resulting from poorly managed wastewater.

Is wastewater a threat to your rivers, lakes, or ground-water sources?

Along the Georgia Shore, residents are concerned that old septic systems may harm Lake Champlain's water quality.

Is wastewater an obstacle to providing important community services?

The Waitsfield and Moretown Elementary Schools are unable to serve hot lunch to their students because there is insufficient wastewater capacity for their kitchens.

The Town of Cabot wanted to build senior citizens' housing units but did not have the wastewater capacity to allow for new construction.

KEN JONES

Waitsfield students needed hot lunches.

AMY MACRELLIS

Westford wanted to grow its village area.

Getting Started: What Is Your Vision?

If you don't know what success looks like for your wastewater planning effort or solution, it is going to be hard—maybe impossible—to reach your goal.

Some examples of community goals and visions include:

- Increase the number of homes in the village
- Eliminate the release of wastewater to the river
- Protect all existing drinking water supplies
- Reduce the volume of wastewater created
- Protect outlying areas from future development
- Utilize new technologies for wastewater treatment
- Determine how much growth the "growth center" can support
- Ensure that all citizens' voices are heard.

Find our more about how to determine what your community's vision for a wastewater solution is at the Community Tool Box: http://ctb1.ku.edu/en/promisingapproach/.

Talk with others in your community. What does the future look like? Do you want to grow? To fix a problem? Something else?

What's the vision in your town plan?

Most Vermont towns have adopted a municipal plan that may already define a vision relevant to your wastewater treatment concerns. At a minimum, the town plan will articulate goals and objectives for the future of the town. Before initiating an entirely new process to address wastewater issues, look to see what your town plan says and check in with the local planning commission to see where they are in the town planning process.

To remain current and to keep the town eligible for certain benefits, towns must update their municipal plans every five years, and this process is initiated by the planning commission. Required elements of municipal plans (listed in 24 V.S.A. §4382) range across a broad spectrum of local concerns from housing and infrastructure, to natural and cultural resource protection. While a series of public hearings are required by law before the town plan can be adopted, municipalities are strongly encouraged to use a variety of means to actively engage citizens in all aspects of the planning process. (See "planning goals" listed in 24 V.S.A. §4302(b)(2).)

Addressing wastewater within the broader context of the municipal plan can help ensure that all issues of concern to local citizens are raised and the resulting vision ties into all aspects of the community.

Decision Making

The earlier and more often others in your community are involved in the public process of decision making, the more likely you are to end up with a successful wastewater solution. Below are some steps to consider in building your decision making process.

Establish an advisory body.
Small towns work through voluntary participation of local citizens. The issue of wastewater requires a handful of citizens to focus on the issues and take responsibility for ensuring that the first few steps are accomplished with local participation.

Provide information to the public.
Local democracy thrives on an informed public and suffers when information is not freely available. Keeping a public notebook at the library or town office or posting information on a municipal website are ways to keep people updated.

Get input and feedback.
The solution for your community will require public, homeowner, and local business investment. Keeping as many people as possible involved in the decision making process diminishes the challenges of getting agreement to move forward.

Publish updates.
Not only does the occasional press release and newsletter provide information to the public, it helps keep people aware of the progress of a project. Deadlines to produce these updates also work to keep a project on schedule. During construction of Warren's wastewater project, for example, printed and e-mail newsletters were sent regularly to everyone interested in the project to keep them informed.

Giving regular updates at selectboard meetings and writing articles for local newsletters are good ways to keep people informed about wastewater planning.

Address the nay-sayers.
Not everyone in your community is going to agree with the solution for wastewater, or even that a solution is needed. While some struggle is necessary to come to a solution, you will need an equitable way to address concerns and move forward.

Engage local officials.
Your community elects leaders to address complex issues. While a group of volunteers may build the expertise to identify the solutions that will help solve wastewater problems, those volunteers may not have the political credibility to gain general support. Working with or communicating regularly with your Selectboard or other elected officials can help build the credibility necessary to move your good ideas to action.

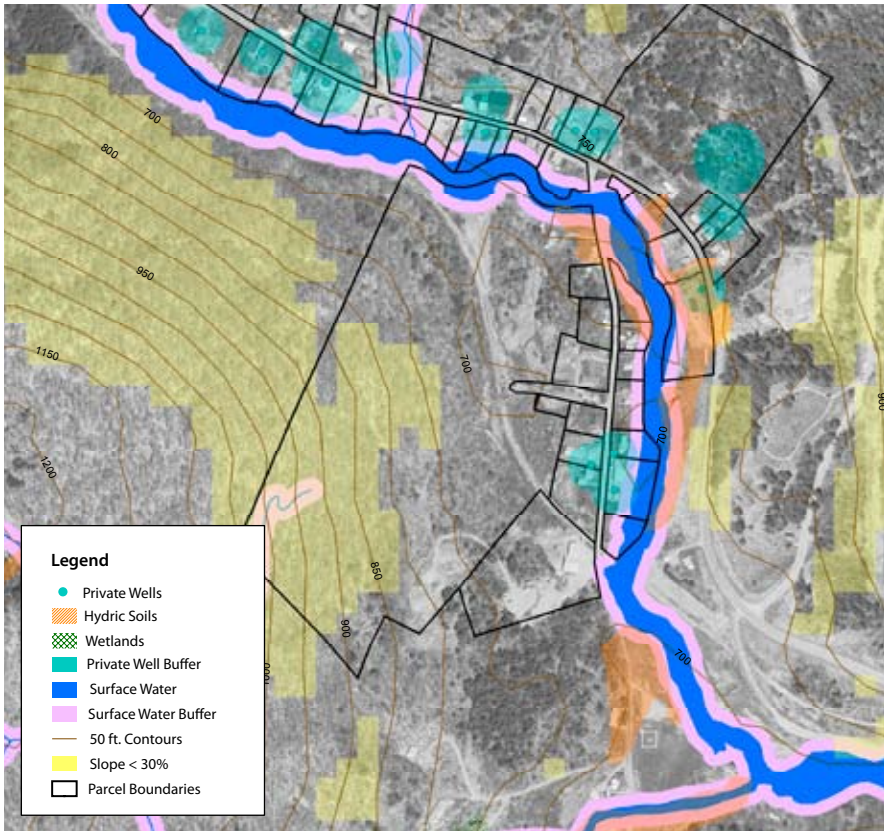
Assess What? And Why?

Assessing the state of wastewater treatment in your community allows you to understand what infrastructure is in the ground and whether that infrastructure complies with modern rules and regulations. The more detail you can get during the assessment, the better informed you will be to make decisions about wastewater treatment options or about hiring professionals to help design a wastewater solution. Your community can benefit from three different kinds of assessment.

Physical assessment

A physical assessment provides information about your current wastewater and water supply infrastructure. Things considered in a physical assessment include soils, the age and condition of existing septic systems, and water resources like wells or surface water at risk from contamination. This assessment builds understanding of the potential for onsite wastewater solutions and the use of cluster systems or alternative technology to address problems in areas with limited land for subsurface soil treatment.

Often, local volunteers or committee members can collect information that is needed for the physical assessment. In Georgia, for example, members of a homeowner's association collected GPS coordinates of drilled wells and springs as part of their assessment. Planning consultants, engineers, wastewater consultants, and Regional Planning Commission staff can provide technical assistance during your physical assessment.



This map shows a range of limitations for on-site wastewater disposal, such as steep slopes and setbacks to rivers, wetlands, and private wells. The map was part of a physical assessment conducted for Wolcott Village.

Understanding the strengths and skills of interested people early in your planning process will help you move your wastewater planning effort forward.

Process assessment

A process assessment reviews your community's capacity for putting together a wastewater solution. This includes understanding who is knowledgeable and/or interested locally on the topic of wastewater, and who may have the group communication skills necessary to coordinate the activities of interested citizens. This assessment may not be a formal process, but it identifies some of the skills that you will need to move the overall project forward.

Political assessment

A political assessment gauges the interest of others in your community to consider wastewater and their willingness to make necessary investments in the solution. Beyond the community, state and even federal politics can influence a wastewater outcome, so it is important to build a strong relationship with regulatory agencies. The political assessment highlights both obstacles that need to be overcome and opportunities for facilitating and financing the solution.

All of the assessments combined build a general understanding of your community's conditions. The more thorough and accurate your assessment is, the better equipped you and your community will be to arrive at the best wastewater solution. Even better, carrying out the assessments will help you communicate with local citizens about wastewater issues and start to build your public process.

WARREN'S STORY

In Warren, active public involvement in the assessment process was essential for collection of better information regarding on-site conditions and increased understanding of potential impacts to drinking water supplies and surface waters. The volunteer Wastewater Advisory Committee was an instrumental part of the process.

Committee members led many activities, including helping residents fill out surveys and holding neighborhood potlucks to discuss the physical assessment results. The Committee's efforts led to a high level of voluntary participation in the wastewater solution.

Tools and Tips for Completing Assessments

Sponsor or participate in existing events.
Gathering local citizens together is one way to engage their interest and gather input on community conditions. When people gather, you can accomplish assessment activities with surveys or open discussion.

Work with students.
High school classes can carry out local surveys to build skills in communication and statistics. The added benefit of working with students is that you create another path to engaging their parents.

Build maps.
Provide a map of your community at a scale that allows people to mark where they know of valuable features such as their homes, schools, public wells, or regularly visited swimming holes.

Conduct surveys .
The Green Mountain Institute for Environmental Democracy has developed sample surveys and communication packages for use in rural communities as a part of its Starter's Guide for Community Based Wastewater Solutions.

Apply other tools.
The National Onsite Demonstration Program has several assessment tools available on CD-ROM, including:

- Community Self-Assessment
- Sanitary Situation Survey: Individual Housing Unit Responses Form
- Sanitary Situation Survey: Individual Lot Assessment
- Envisioning Your Community's Future
- Community Readiness Indicator

These are available through the National Small Flows Clearinghouse at www.nesc.wvu.edu/nsfc/NODP_products.htm#9.

Getting from Existing Conditions to the Best Solution

The process of finding technical solutions for your community's existing and future wastewater needs can be broken down into three main steps:

First, understand your community's wastewater dispersal capacity.

Finding cost-effective dispersal alternatives for areas of need is a critical factor in solving your community's wastewater concerns. The first step is usually a general review of soils information—sometimes done as part of your physical assessment—for the area within and near your community that identifies the most suitable areas for soil-based wastewater dispersal systems. Wastewater dispersal alternatives are described on the following pages, and can include standard leachfields, at-grade or mound systems, spray disposal, reuse applications (such as irrigation), and direct discharges to surface water. The dispersal solution for your community will be unique, based on your environmental conditions, current regulations, and your community's ability to obtain rights to fix existing systems or to develop one or more sites for wastewater disposal through the purchase of land or easements. If you find sites that seem promising for a wastewater dispersal solution, you will need the help of an engineer or hydrogeologist to complete field investigations that accurately assess the sites' capacity.

Once you find a site that might work for wastewater disposal, a professional can help you figure out how much wastewater the site can handle.

Alternative technologies, like this media filter, might be among those considered for your treatment solution.

Second, evaluate the treatment options for the selected dispersal alternative(s).

Part of an assessment of wastewater capacity includes an evaluation of various levels of treatment that can be implemented to help meet the needs of the community. The level of treatment ranges from primary treatment (such as a standard septic tank) to highly advanced tertiary treatment processes that reduce nutrients such as nitrogen and phosphorus. Many alternative treatment processes are available, and technical experts should help you to evaluate these based on your community's needs and conditions. Your goal is to match your community's need with the level of treatment required for the dispersal options available.

Third, evaluate the need for infrastructure to connect existing or planned homes and businesses with the chosen treatment and disposal alternatives.

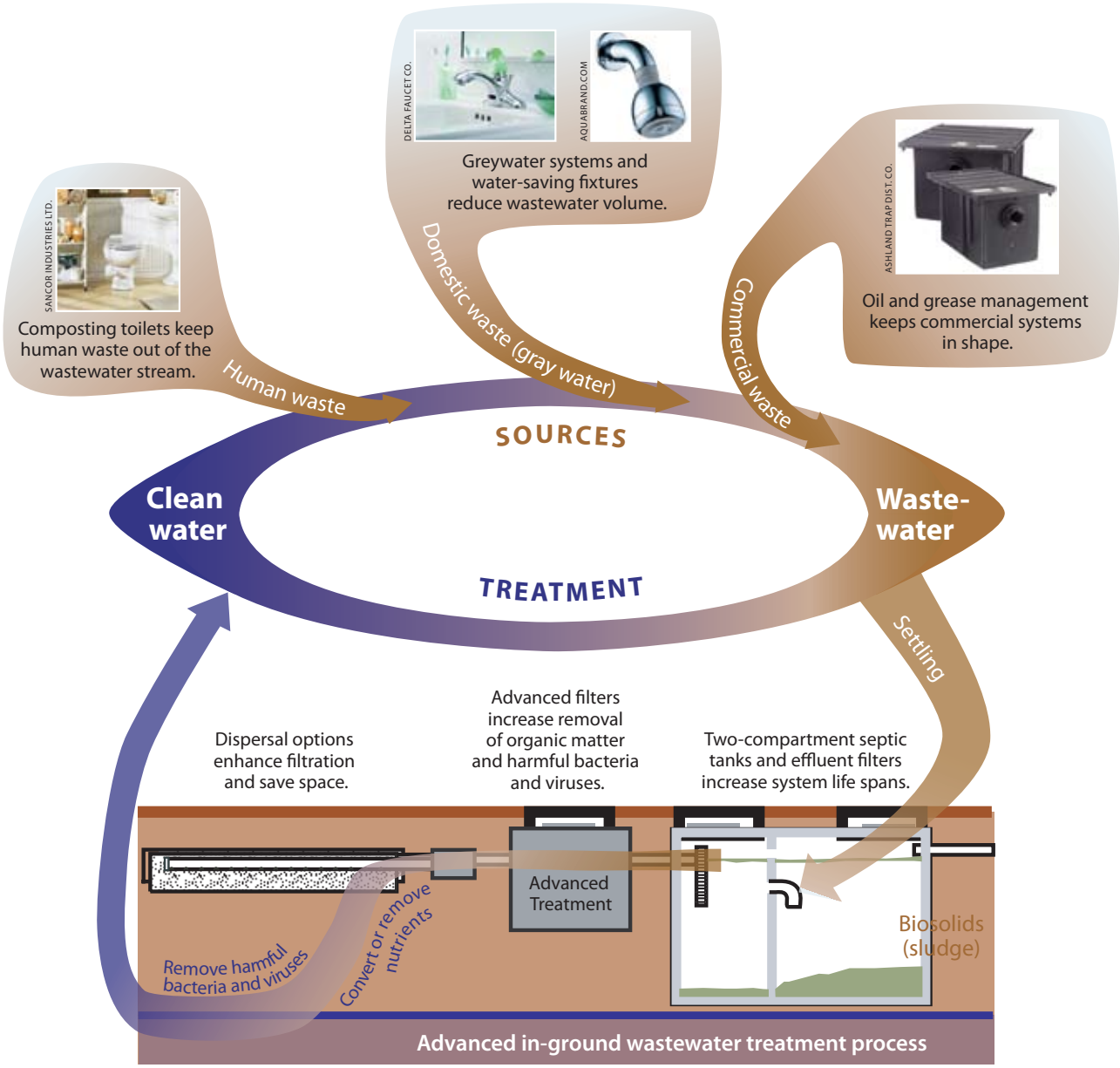
At this stage, your community is "connecting the dots" between areas that need off-site solutions and the treatment and dispersal sites. These may be areas with existing needs or areas where future growth is desired that have limited wastewater disposal capability. The closer your dispersal sites are to your areas of need, the lower your costs will be for sewer lines, pump stations, or force mains. Other factors that can influence your choice for connection options are topography and whether or not your community has areas of shallow bedrock.

In some cases, a new community water supply may be less costly than building a community wastewater system—especially where problem areas are small or widely scattered.

Your issues can point to unique solutions.

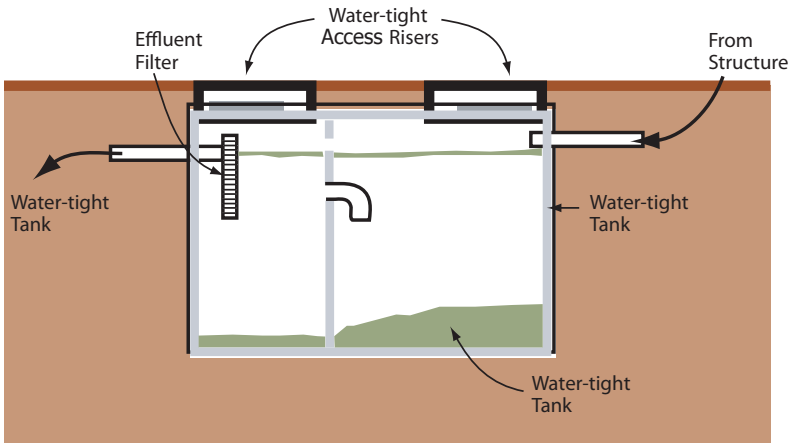
Understanding your community's needs and your current conditions can provide some clues to your optimal wastewater solution. For example, if historically dense development has resulted in septic systems being too close to drinking water supplies, it may be that identifying an alternate water supply is preferred over finding innovative solutions to manage each wastewater treatment system. Similarly, the existence of a significant area of good soils for wastewater dispersal may focus efforts towards developing a cluster system for several households or businesses.

Details of Wastewater Solutions



Understanding Wastewater Treatment Technologies

Some of the small-scale wastewater treatment options described here, like septic tanks, traditional leachfields, and mound systems, have been in use in Vermont for decades. Since 2002, however, several advanced technologies for treating wastewater at the individual site or small community scale, have been approved for use in Vermont. Advanced treatment systems generally are placed between a septic tank and the dispersal system, and they provide a higher level of treatment than a septic tank alone can deliver. This means that the dispersal field can be smaller, or that separation distances to groundwater or bedrock can be reduced. The following pages contain more information about the range of wastewater treatment options now available in Vermont.



Almost every wastewater treatment system requires a septic tank.

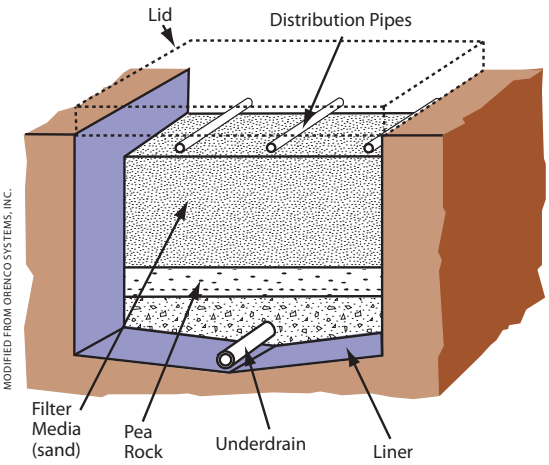
Wastewater Treatment Technology: Conventional

Septic tanks

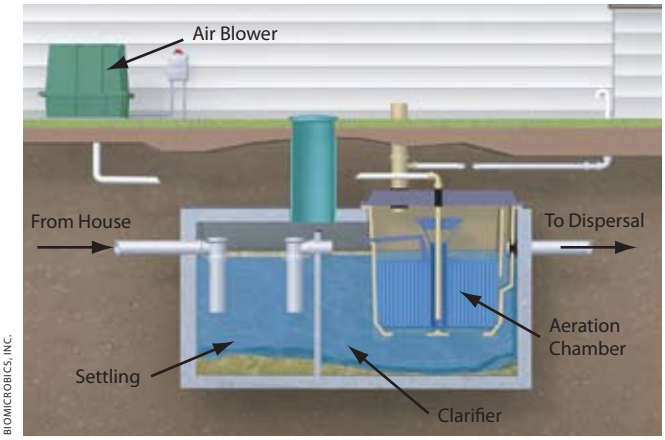
Almost every wastewater treatment system, whether it uses advanced treatment or not, requires a septic tank. This tank is a watertight box, usually made of concrete or fiberglass, with an inlet and outlet pipe. Wastewater flows from the building to the septic tank through the sewer pipe. The septic tank holds wastewater long enough for solids and liquids to separate. The layers of sludge and scum remain in the septic tank, while the layer of clarified liquid flows from the septic tank to the leachfield or to advanced treatment. An effluent filter, installed on the outlet of the septic tank, can keep solids or scum from getting into the leachfield.

The most common application for septic tanks in Vermont is for wastewater treatment at individual houses or businesses. It is not unusual, however, for two or more buildings to share a septic tank—or for buildings to have their own individual septic tanks and then share a leachfield.

For more on septic tanks, visit www.nesc.wvu.edu/nsfc/nsfc_septicnews.htm.



Sand filters have been used in Vermont for many years, but several other kinds of media filters have been approved recently.



A BioMicrobics FAST aerobic treatment system, shown here, is essentially a small wastewater treatment plant intended for residential use.

Treatment Technologies: Advanced (or Innovative/Alternative)

If wastewater is treated to a relatively high quality using any of the advanced technologies described here, Vermont's wastewater treatment rules allow dispersal systems to be used that are smaller than traditional leachfields. Since the wastewater has been partially treated already, separation distances required from the bottom of the leachfield to bedrock and the groundwater can also be reduced. The smaller size of these dispersal systems may be particularly useful in Vermont's historic villages and in new town centers or other dense developments, where homes are often close together on small lots.

Media filters

Systems for filtering wastewater have been used for wastewater treatment since sand filter systems were introduced in the late 1800s. They are often used to supplement wastewater treatment when soil conditions, like shallow groundwater or bedrock, limit the usefulness of conventional in-ground septic tank/leachfield systems. A schematic of a sand filter is shown here, but the basic principles are similar for all the different media filter systems.

Wastewater from the septic tank or a pump tank is applied in intermittent doses evenly to the top of a bed of sand or other suitable media. As the wastewater passes through the filter, it is treated by physical filtering and by microorganisms attached to the filter media. The treated wastewater is collected at the bottom of the filter for further treatment or dispersal.

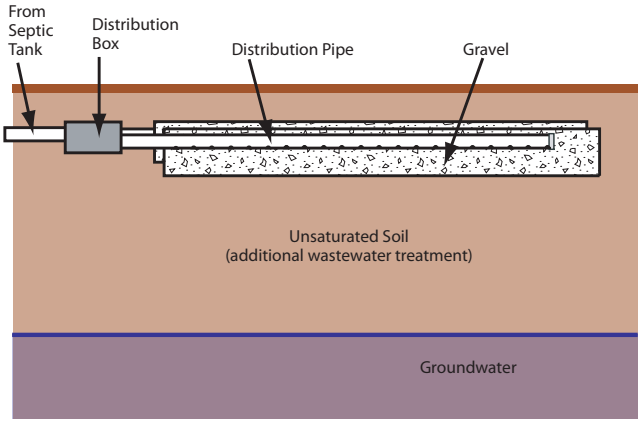
Sand filters have been allowed in Vermont for many years, but several other kinds of media filters have been approved for use since 2002, including peat biofilters and textile filters. Many of the new media filters have a modular design, which makes them easy to install, especially on small lots or in places with limited access—conditions that are common in Vermont communities. These modular filters are also easy to expand if wastewater flows increase in the future.

More information about media filters can be found at www.inspect-ny.com/septic/altmedia.htm.

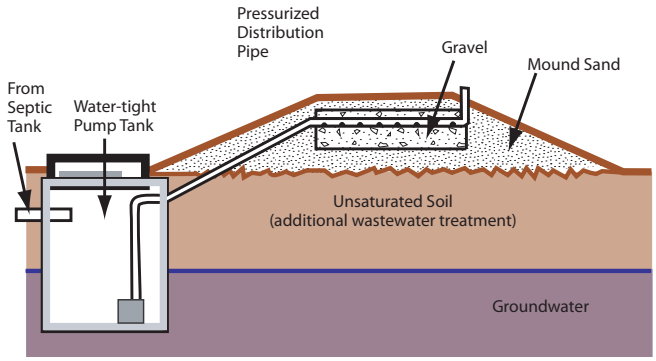
Aerobic treatment systems

Aerobic treatment systems are essentially small wastewater treatment plants intended for residential use. These systems use an air pump or blower to add oxygen to the treatment tank, increasing the level of treatment by the system. Aerobic treatment systems require electrical power and more frequent maintenance than traditional systems or media filters. Like media filters, aerobic treatment systems are useful on sites with limited space or problem soils, and several different types are approved for use in Vermont.

For more information on aerobic treatment systems, see www.inspect-ny.com/septic/altaerobic.htm.



A traditional leachfield treats wastewater by allowing it to slowly trickle out through gravel and soil.



A mound system is used where soil conditions, such as shallow groundwater or bedrock, prevent the use of a traditional leachfield.

Dispersal Options

Considering the potential for wastewater dispersal in and near your community provides the basis for considering the location and scale of your wastewater solution. The "dispersal" step for any treatment system is often the most critical—this is where the wastewater is released to re-enter the water cycle. Centralized systems usually treat wastewater to a high quality, including disinfection using chlorine or ultraviolet light, before releasing that water to rivers or lakes. Most decentralized wastewater systems rely on the soil to remove harmful pathogens and to filter other contaminants, or to convert those contaminants to nutrients. When native soils are not sufficient to provide necessary treatment before water re-enters the hydrologic cycle, a variety of raised dispersal systems or other new technologies can be used to help accomplish the treatment and dispersal functions.

A number of different soil-based dispersal options are described below. Each of these dispersal technologies can scaled up or down as needed to serve nearly any property use—from an individual house to a whole community.

Traditional leachfields

A leachfield (also known as a drainfield, disposal field, or a soil absorption system) is a series of trenches or a bed lined with gravel and buried at least 6-12 inches below the ground surface. Perforated pipes run through the trenches to distribute the wastewater. The leachfield treats the wastewater by allowing it to slowly trickle out into the gravel and down through the soil. A leachfield can be dosed either by gravity or by using a pump to deliver small amounts of wastewater.

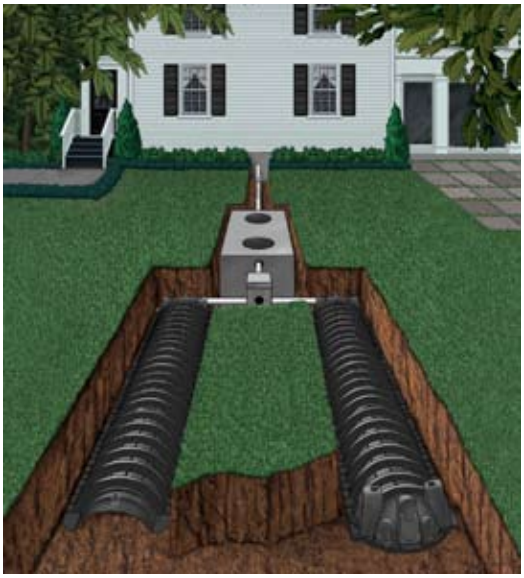
Many applications of this simple technology at the community scale have been constructed in Vermont. Warren Village, for example, has a large pressure-dosed leachfield that covers about 1.5 acres, while Rochester's downtown area is served by three different leachfields.

More information about leachfields can be found at www.nesc.wvu.edu/nsfc/nsfc_septicnews.htm.

At-grade and mound systems

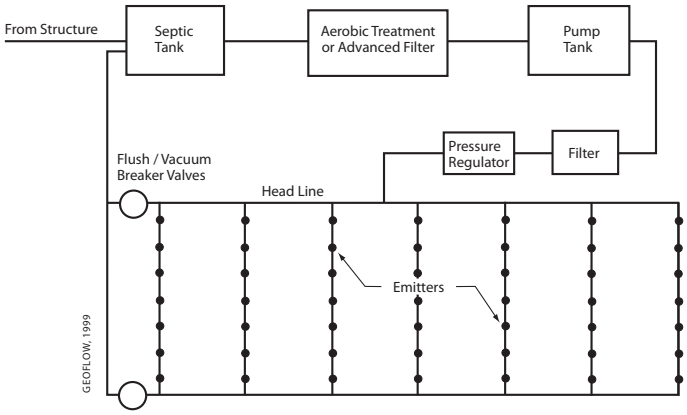
At-grade and mound dispersal systems are used in Vermont where soil conditions, such as shallow groundwater or bedrock, prevent the use of a traditional leachfield. These systems work in basically the same way as a conventional leachfield, except that the perforated pipe and gravel is placed at the ground surface for at-grade systems, and in a bed of sand trucked to the site for mound systems. These dispersal technologies are usually dosed by a pump.

For more on mounds, visit www.nesc.wvu.edu/nsfc/pdf/eti/mounds_gen.pdf.



INFILTRATOR SYSTEMS, INC.

One of several approved new gravel-less dispersal alternatives. These work in the same way as a traditional leachfield but can be easier to install, especially in tight spaces.



Subsurface drip distribution was recently approved for use in Vermont. It must be used with aerobic treatment units or media filters.

Source Reduction

Less wastewater to treat

Reducing the volume of wastewater—or reducing the loading of pollutants in that wastewater—is often a cost-effective strategy for meeting community needs. Several different strategies for reducing the amount of wastewater that needs to be treated, all of which are currently approved in Vermont, are described below.

Gravel-less dispersal technologies

One of the newer dispersal alternatives allowed in Vermont is the use of plastic or multi-media infiltration systems instead of the traditional pipe-and-gravel system. These alternatives work in the same way as a regular leachfield, but are often lighter, more flexible, and easier to install. The gravel-less technologies are often more efficient than conventional pipe-and-stone leachfields, so they can be loaded at higher rates, resulting in smaller leachfield sizes. They can be used right after the septic tank or with any of the pretreatment options described earlier. Only one of the approved options is shown here.

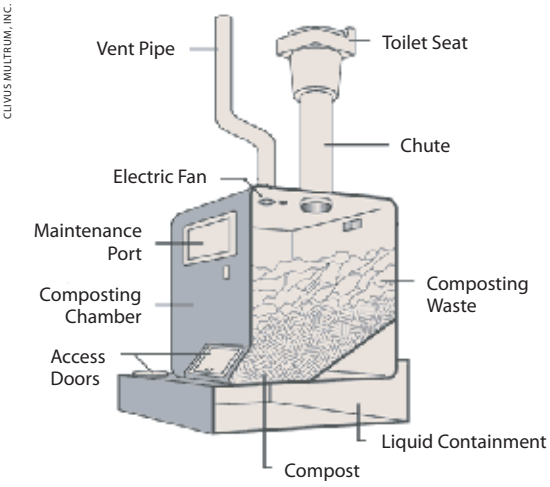
To find out more about gravel-less dispersal options, visit www.inspect-ny.com/septic/gravelless.htm

Dispersal using subsurface drip distribution

Subsurface drip distribution was approved for use in Vermont in 2007. This technology delivers small doses of effluent to shallow soils, usually 6-18 inches below the ground. In Vermont, this technology can be used on sites with as little as 24 inches of soil above seasonal groundwater or bedrock. The "perforated pipe" in drip dispersal is flexible polyethylene tubing (dripline) with small in-line emitters (holes that discharge effluent at slow, controlled rates). The tubing can be trenched by hand or with a trenching machine directly into the soil and backfilled without gravel. Because of the narrow diameter of the tubing and the small size of the emitters, drip irrigation requires highly treated effluent and must be used with aerobic treatment units or media filters.

To learn more about subsurface drip distribution, try http://onsite.tennessee.edu/Drip Dispersal Text.pdf

CLIVUS MULTRUM, INC.



A composting toilet (such as the Clivus Multrum, shown here) produces no effluent, reducing the amount of wastewater that leaves a structure.

DELTA FAUCET COMPANY

A low-flow faucet with an aerator reduces water flow without affecting water velocity.

Composting toilets

A composting toilet system contains and processes human waste, toilet paper, and usually a carbon source such as kitchen waste, and uses no water for flushing. Unlike a septic system, a composting toilet relies on aerobic, or air-requiring, bacteria and fungi to break down wastes, just as they do in a yard waste composter. A composting toilet usually breaks down waste to between 10 and 30% of its original volume and, and as long as the resulting compost is disposed of properly, will produce no wastewater.

Composting toilets reduce water use, and using a composting toilet means that for new construction, a smaller leachfield can be installed for greywater treatment only. However, these toilets do require more maintenance than conventional flush toilets.

Composting systems are now successfully used not only in homes but also at businesses and institutions such as the Vermont Law School.

For more on composting toilets, visit www.nesc.wvu.edu/nsfc/pdf/eti/comp_toil_gen.pdf

Water-conserving fixtures

Water-conserving toilets and fixtures reduce water consumption, thus reducing the amount of wastewater that needs to be treated. Many different options are available today, including:

- Dual-flush toilets that provide the option for either a half or full flush.
- Low-flow shower heads
- Faucets with aerators that reduce water flow without affecting water velocity
- Sensors or other "portion control" devices on faucets

Any of these fixtures will help reduce water use, and that reduces wastewater volume. Since you'll use less hot water with these fixtures, they can also save you a significant amount of money on your energy bills.

You can find out more about household water conservation at www.nesc.wvu.edu/nsfc/pdf/eti/WaterEff_gen.pdf.

Greywater systems

Any water that has been used in the home, except water from toilets, is called greywater. Dishwashing, shower, sink, and laundry water comprise 50-80% of residential water use. In Vermont, greywater systems need to have a storage tank and a dispersal field, but the dispersal field can be 25% smaller than it would be if it was receiving toilet waste.

More information about greywater, and greywater systems, can be found at www.barnstablecountyhealth.org/AlternativeWebpage/Greywater/Greywater.htm

Wastewater Regulations

Your wastewater solution will need to comply not only with your community's vision, planning requirements, and zoning rules, but also with state and sometimes federal regulations. By the time you are thinking seriously about regulations, you will be getting some technical assistance from the people in state offices who administer those rules, or you will be working with a consultant or engineer who understands the rules.

Below are some of the permits that may be needed for your community's wastewater solution, with links to more information about each permit.

Less than 6,500 gallons per day

If part of your solution is made up of wastewater systems with daily flows that are smaller than 6,500 gallons per day, each system will need a state ***Wastewater System and Potable Water Supply*** permit.

www.anr.state.vt.us/dec/ww/EngServ.htm#wwsapwsr

More than 6,500 gallons per day

If your solution has larger wastewater systems with daily flows that are more than 6,500 gallons per day, the large systems will need a state ***Indirect Discharge*** permit.

www.anr.state.vt.us/dec/ww/indirect.htm

More than an acre of land

Any solution that disturbs more than an acre of land will need a state ***Construction General or Individual*** permit, and may need a site-specific plan to control storm runoff during construction.

www.vtwaterquality.org/stormwater/htm/sw_cgp.htm

More than 10 acres of land

If your community solution is going to disturb more than 10 acres of land or meets one of several other conditions, it will need an ***Act 250*** permit. Contact your District Commission Coordinator to find out whether you will need this permit.

www.nrb.state.vt.us/lup/publications/act250brochure.pdf

Near a wetland

A solution that is within 50 feet of a wetland will probably need a state ***Wetlands*** permit.

www.anr.state.vt.us/dec//waterq/wetlands/docs/wl_factsheet1.pdf

It may also need a federal permit from the Army Corps of Engineers.

Crosses a river or stream

If pipes from your project cross rivers or streams, you will need a ***Stream Alteration*** permit.

www.anr.state.vt.us/dec/waterq/permits/htm/pm_streamalt.htm

Federal funding

If your project receives any federal funding, you will also need to prepare an *Environmental Assessment* to comply with the National Environmental Policy Act (NEPA).

PLANNING GRANTS

You can use a planning grant to complete an assessment of current conditions and needs related to wastewater in your community, even if you do not move forward with a wastewater construction project.

This approach, using a wastewater planning award from the Vermont Department of Environmental Conservation, was recently employed by Westford's Wastewater Committee to gain a better understanding of the capacity of their growth center to support future development.

Funding

Three are three types of funding that you may need for your wastewater planning and for your eventual wastewater solution:

- Funding for preliminary planning
- Funding for construction of your chosen alternative
- Funding for perpetual management, including debt service and management, operation, and maintenance of your solution

Money for wastewater planning

Planning a community wastewater project can be a large undertaking. Depending on the extent of your areas of need, and your community's unique conditions, initial planning and feasibility studies can sometimes be as much as 10-20% of the total project costs. After the initial assessment and feasibility evaluations are complete, if you move forward with a wastewater solution there are preliminary and final design phases as well as a detailed permitting process to be completed before construction. Fortunately, there are several options available to obtain grants or no-interest loans that allow your community to plan without making significant up-front cash investments.

The Financial Management Section of the Vermont Department of Environmental Conservation can award up to $25,000 for assessment-related or feasibility-level wastewater planning. More information is available by calling Donald Robisky, the Section Chief, at (802) 241-3734—or at www.anr.state.vt.us/dec/fed/fms.htm. In addition, the ***Facilities Engineering Division*** extends low-interest loans to communities for the more detailed planning phases. These loans are usually combined with the long-term debt service and are not repayable until after the project is complete.

The Department of Housing and Community Affairs administers a ***Municipal Planning Grant Program*** that provides up to $15,000 in grant funding to support town planning efforts including community wastewater planning. The deadline for this competitive funding is in the fall of each year. For more information, call Wendy Tudor at (802) 828-5249 or visit www.dhca.state.vt.us/Planning/MPG.htm.

The Department of Housing and Community Affairs also administers ***Community Development Planning Grants*** of up to $30,000 that municipalities can apply for. Wastewater planning to benefit housing or economic development with the potential to benefit primarily persons of low-to-moderate income is eligible for funding. For more information, call Josh Hanford at (802) 828-5201 or visit www.dhca.state.vt.us/VCDP/index.htm.

Funding construction of your wastewater solutions

Once you decide to move forward with a wastewater construction project, your community will work with a variety of professionals, including engineers, state regulators, and finance specialists, to secure a financial package that will allow your solution to be sustainable. Federal and state funding sources are usually awarded on a prioritized basis, so the sooner the state financial specialists know about your need, the better. Before construction of your solution begins, funding commitments for grants and loans will be agreed to by your community and the funding agencies. Most funding agencies are likely to require some amount of local match, often in the form of a bond vote to secure long-term loans. Once construction is finished, your community will close on a long-term construction loan.

The most common federal and state funding sources for wastewater projects are:

- US Department of Agriculture, Rural Development loans and grants (for municipalities with less than 10,000 residents)
- Vermont Department of Housing and Community Affairs, Community Development Block Grant Program (very competitive grants for wastewater projects in low- to moderate-income eligible communities)
- Vermont Department of Environmental Conservation, Dry Weather Pollution Abatement Grants (up to 35% for planning and construction of facilities that fix dry-weather pollution problems)
- Vermont Department of Environmental Conservation, State Revolving

Fund Loans (interest-free planning loans, 2% construction loans; often used to help finance the local share of a project)

As the level of available grant funding for wastewater projects has declined, innovative financing solutions like public/private partnerships are being considered more often in some Vermont communities. The community can enter any reasonable and fair agreement with private owners to enable a project which neither party could afford on its own. A recent example of local partnership occurred in Warren, where the owners of the Pitcher Inn installed sewers, a pump station, and force main that were later incorporated into a larger Town-owned system.

UVM CENTER FOR LANDSCAPE CHANGE

When THE TOWN OF CABOT implemented its wastewater solution in the late 1990s, it used several different funding sources to finance the project, including:

- **State of Vermont Dry Weather Flow Grant**
- **US EPA State and Tribal Assistance Grant**
- **USDA Rural Development Grant**
- **USDA Rural Development Loan**
- **Local bond to support loan funding**

Supporting your solution after construction

After your solution is constructed, your community assumes responsibility for managing the wastewater system or systems and generating enough revenue to pay annual expenses. Whether you have a centralized or decentralized solution, typical expenses include:

- Payment on the long-term construction loan
- Costs associated with operation and maintenance of facilities associated with the system
- Costs associated with administration and management of the system

While there may be limitations from some funding sources, it is generally up to your community to determine how to pay annual expenses. The annual expenses for community wastewater solutions are usually paid by the users of the system—those receiving the direct benefit of the wastewater service. The most common ways of generating revenue to keep your community wastewater system operating are:

User Fees—Home and business owners need to pay for the wastewater services that they receive. Just as individual land owners pay for the installation and maintenance of their septic systems, users of a community system need to provide funds for installation, operation, maintenance, and management of that system.

Connection Fees—In addition to annual user fees, communities generally charge a one-time "connection fee" in order to connect to the system. This fee may be used to pay a portion of initial construction costs or used to create a reserve fund for future maintenance.

Tax Revenues—For some communities, the solution to wastewater problems opens doors for the growth of important local services. For example, a restaurant, school, or senior care facility may be possible with sufficient wastewater capacity. In those cases, the benefits of wastewater infrastructure may accrue to others not receiving the direct benefits of wastewater treatment, and a tax may be an appropriate mechanism to support the local benefit. In most cases, tax revenues are only used to offset the cost of capital improvements, and not to subsidize operation or management.

HEATKERNEL 6/2005

THE TOWN OF ROCHESTER understands its community sewer system is instrumental in maintaining its downtown's viability. When a recent major upgrade was needed, the debt service for construction costs was assumed by the entire grand list.

THE TOWN OF SHOREHAM recently completed a community sewer project for the village, using a modest grand list tax to offset a portion of the debt service costs. Residents outside the service area have benefited through the opening of several commercial establishments, modest residential growth, and a hot lunch program for the school.

Getting Outside Help

As your community works through understanding your current conditions, wastewater needs, and potential options for wastewater treatment and management, you will probably need to consult and work with many different people and groups. The table below shows some examples of the different kinds of technical assistance your community may need at different steps in your wastewater planning process.

Everyone involved in your wastewater planning effort is likely to bring some sort of bias to the table. Residents may not want their taxes to increase as the result of a new wastewater solution, for example, while local officials or realtors may want to encourage new investments. Outside professionals may have their own biases, too, toward particular technologies or solutions.

Wastewater Planning Stage	Type of Professional	How the Professional Helps
Vision and problem definition	Land-use planner	Develops long-range plans for the development of local infrastructure and government services
	Strategic planning consultant	Leads strategic planning processes, like developing mission and vision statements
Assessment	Land-use planner	Produces maps of current conditions
	Engineer/Scientist	Provides information about soils, regulations, water resources, and existing systems
Evaluating wastewater treatment alternatives	Scientist	Completes preliminary evaluations of potential wastewater disposal sites
	Engineer	Evaluates possible solutions against criteria specified by the community or committee; develops initial cost estimates
Designing and permitting a wastewater solution	Engineer	Completes designs; obtains necessary permits; assists with obtaining financing
	Scientist	Conducts evaluations of wastewater disposal sites; completes background environmental monitoring for larger disposal sites
	Licensed surveyor	Prepares legally enforceable maps of real property
	Attorney	Interprets laws, rules, and regulations; helps clients with contract development and administration
Construction	Engineer	Supervises construction
	Construction contractor	Completes system installations
	Project manager	Keeps the project on track; coordinates contractors; monitors expenses; reports to town officials; keeps residents informed
Operating, maintaining, and managing the solution	Engineer	Performs system inspections; reports to town officials on needed repairs; helps with permit renewals
	Maintenance provider	Performs routine maintenance activities

Skills You Need to Integrate the Pieces

Bringing together all the disparate pieces that will make up your wastewater solution—your assessment process, making decisions as a community, investigating funding possibilities, understanding the rules and regulations—takes time and some important skills. Here are some tools and resources to consider as you prepare to move forward.

Leadership

The basis of leadership is taking responsibility (not credit) for progress. When things are not moving, a leader will take the steps necessary to kick-start the process.

The first book here is a guide that describes the premise, principles, and leadership characteristics of successful collaboration. The *Fieldbook* then presents tools for applying lessons learned, powerful approaches that get results, and guidance for solving complex community problems.

Collaborative Leadership: How Citizens and Civic Leaders Can Make a Difference, by David Chrislip and Carl E. Larson (San Francisco: Jossey-Bass Publishers, 1994).

The Collaborative Leadership Fieldbook, by David Chrislip (San Francisco: Jossey-Bass Publishers, 2002).

Communication

How many times have you heard about efforts that fail because of a "simple lack of communication"? Indeed, some are more skilled at delivering messages with the right mix of flash and substance, but all of us can communicate by making a quick phone call or e-mailing to let others know that a project has taken certain steps. That's all it takes.

The Community Development Academy at the University of Missouri offers a 5-day course on Building Communities from the Grassroots; more information can be found at http://extension.missouri.edu/cd/cda/course_1.html.

Coordination

Coordination is the next step after communication. After notifying others of the actions that are taking place, a follow up can determine if others are taking actions that may influence your objectives. A key to coordination is the development of a clear strategy that becomes the basis of communication. Every action leads to a project outcome, and the coordinated activities of others fit within the framework of your objectives.

A good book on coordination is *Making Collaboration Work* by Julia Wondolleck and Steven L. Yaffee (Washington, DC: Island Press, 2000).

Building a project road map

A visual representation of steps and outcomes is a tool that helps with communication and coordination. The development of this map with the input of as many others as possible can be a good start in developing the leadership for a project, as well.

To develop a project road map, see a list of activities at http://www.naccho.org/ topics/environmental/ CEHA/ documents/ PACE_Guidebook.pdf

A community dinner can bring people together to talk about wastewater solutions.

Additional Resources

The US Environmental Protection Agency's *Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems* describes a step-by-step approach for the development of a community management program for decentralized wastewater systems. It includes specific community examples, gives an overview of the elements essential for sound management of these systems, and provides links to extensive resources. Find it online at www.epa.gov/owm/septic/pubs/onsite_handbook.pdf.

The National Small Flows Clearinghouse (NSFC) offers a variety of technical assistance and free or low-cost information and materials about wastewater technologies for small communities. Services include a toll-free technical assistance hotline, an Internet-based discussion group, computer databases, newsletters, and other publications. Visit them on the internet at www.nsfc.wvu.edu, or use the contact information below:

National Small Flows Clearinghouse
P.O. Box 6064
West Virginia University
Morgantown, WV 26506-6064
Phone: 800-624-8301 or
304-293-4191
Fax: 304-293-3161

The Green Mountain Institute for Environmental Democracy created a good general guide to community wastewater planning called *A Starter's Guide for Community-Based Wastewater Solutions.* This guide is available online at www.scdhec.net/environment/ocrm/plan_tech/docs/gmi_guide.pdf.

The Rensselaerville Institute publishes *The Self-Help Handbook for Small Town Water and Wastewater Projects.* This book describes the Small Towns Environment Program (STEP), which provides rural communities a method to find reasonable, low-cost solutions to solving wastewater problems. Communities use their own resources (people, materials, and financing) to reduce costs for wastewater projects. Information about STEP is also available at www.rinstitute.org/STEP/STEP.htm. The book can be ordered from:

Small Towns Environment Program
The Rensselaerville Institute
P.O. Box 128, 63 Huyck Road
Rensselaerville, NY 12147
Phone: 518-797-3783

Stone Environmental, Inc.'s website contains presentations, handouts, and reports on a variety of topics related to community wastewater planning and wastewater needs assessments. Find out more at www.stone-env.com/water/wwres.html.

Barnstable County, Massachusetts and its Wastewater Implementation Committee (WIC) funded an analysis of planning, administrative, and legal tools to improve wastewater management on Cape Cod. A report on this effort, titled *Enhancing Wastewater Management on Cape Cod: Planning, Administrative, and Legal Tools,* is available at www.capecodcommission.org/water/WastewaterToolsReport/.

The Onsite Wastewater Resource Center at the University of Rhode Island offers a wide range of information related to individual and small community wastewater treatment. For more, visit www.uri.edu/ce/wq/RESOURCES/wastewater/index.htm.

Fact sheets that explain different wastewater technologies in greater detail can be found in several different places online. The US Environmental Protection Agency publishes fact sheets on centralized and decentralized technologies at www.epa.gov/OW-OWM.html/mtb/mtbfact.htm.

The National Small Flows Clearinghouse publishes both general and technical fact sheets on a range of innovative and alternative wastewater technologies, and these are available at www.nesc.wvu.edu/nsfc/nsfc_etifactsheets.htm.

Wastewater is not the only factor that influences development patterns. Local organizations such as Smart Growth Vermont (www.smartgrowthvermont.org) and larger groups like the Lincoln Institute for Land Policy (www.lincolninst.edu) provide helpful guidance on addressing the challenges of traffic management, high land costs, and local zoning ordinances that are also important for maintaining compact development.

A book titled *Selecting Your Engineer: How to Find the Best Consultant for Small Town Water and Wastewater Project,* by Jane W. Schautz and Christopher M. Conway, is also available from the National Small Flows Clearinghouse. Call (800) 624-8301 or e-mail info@mail.nesc.wvu.edu and reference publication number FMBKGN16.

The University of Minnesota's Extension Service publishes a guidebook titled *Small Community Wastewater Solutions: A Guide to Making Treatment, Management, and Financing Decisions,* which contains a chapter on selecting and working with professionals. The guide can be ordered at www.extension.umn.edu/distribution/naturalresources/DD7734.html.