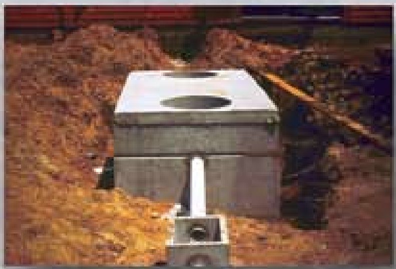
Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems

An Introduction to Management Tools and Information for Implementing EPA's Management Guidelines



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EPA thanks the many organizations, public agency officials, and others who assisted in the development of this guide. Participating organizations include:

National Environmental Health Association (NEHA)
National Onsite Wastewater Recycling Association (NOWRA)
National Environmental Services Center (NESC)
National Association of City and County Health Officials (NACCHO)
Rural Community Assistance Partnership (RCAP)
Water Environment Federation (WEF)
Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT)
National Association of Wastewater Transporters (NAWT)
National Association of Towns and Townships (NATaT)
National Association of Counties (NACO)

For more information visit www.epa.gov/owm/onsite

Visit U.S. EPA's Onsite Wastewater Systems web site for more information on onsite and cluster systems or how to start a management program. The web site also provides design information for onsite and cluster system technologies, information on management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Electronic copies of this Handbook can be downloaded from the U.S. EPA Onsite Wastewater Systems web site at: www.epa.gov/owm/onsite

Printed copies can be obtained from:
U.S. EPA National Service Center for Environmental Publications
PO Box 42419
Cincinnati, OH 45242
Telephone: (800) 490-9198

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Office of Water

U.S. Environmental Protection Agency

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contents

Why do I need this handbook?

One in every four households in the United States relies on an individual onsite or small cluster system to treat wastewater. In far too many cases, these systems are installed and largely forgotten – until problems arise. On the other hand, EPA concluded in its 1997 Report to Congress that "adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals, particularly in less densely populated areas."

"This handbook is a great resource for communities looking for creative and affordable ways to address their wastewater management needs. It serves as a gateway to a wealth of practical tools and resources. Those who will benefit from this handbook include sanitarians, regulators, other wastewater professionals, community leaders, planners, and utility managers."

Benjamin H. Grumbles
U.S. EPA Assistant Administrator for Water

The difference between failure and success is the implementation of an effective wastewater management program. Such a program, if properly executed, can protect public health, preserve valuable water resources, and maintain economic vitality in a community. To facilitate proper management, EPA published *Voluntary National Guidelines for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems*. This handbook assists with implementing the guidelines and is intended as a guide for communities that have evaluated a full range of wastewater options and determined that decentralized wastewater treatment is the most cost-effective and appropriate long-term option.

The handbook will help you to address some of the many challenges faced by communitites. Here are some common scenarios:

- Waterfront seasonal recreational communities have transformed into year-round bedroom communities whose residents find their onsite systems overwhelmed and their water quality threatened.
- Growing numbers of retirees are creating a demand for development in relatively remote rural areas, which lack significant wastewater infrastructure or management capacity.
- Scattered rural populations, often with limited incomes, suffer nuisances and public health hazards due to poorly-built, inadequately maintained, aging septic systems.
- Increasing growth pressure is occurring in the fringe areas just outside established metropolitan areas, where it is not feasible to extend sewer lines from existing treatment plants.

If you are facing similar wastewater challenges and are interested in finding solutions for your community, this handbook is for you. It provides:

- A basic overview of the elements essential for the sound management of decentralized wastewater systems.
- A step-by-step process for developing a management program specifically suited to your community.
- Links to extensive resources (articles, publications, web sites, databases, software, government programs) for more thorough investigation of particular topics or management program elements.

Coming soon—expanded online version

An expanded version of this handbook is being developed, and will include links to more specific information on topics of interest. A series of case studies is also being published to provide examples of successful management programs. Please visit the EPA Web site **www.epa.gov/owm/onsite** *for more information.*

What's inside

This handbook provides an overview of key considerations for developing or enhancing management programs for decentralized wastewater treatment systems. Here's an overview of what you'll find inside...

Look for this icon throughout the handbook to reference additional sources of useful information.

Introduction. What is management and why is it needed? Provides information on what a decentralized management program entails. A flow chart details the management development process.

Chapter 1. How do we get started? Outlines some of the driving forces behind a decentralized wastewater treatment management program. Information-gathering and public outreach are reviewed as critical factors in this phase to help communities identify management options that are technically feasible, cost-effective, and protective of public health and the environment.

Chapter 2. Where are we going? Discusses the important role of formal leadership in the program development process. During this phase, key stakeholders are identified, convened, and tasked with setting program goals. Various leadership options are reviewed.

Chapter 3. What is our current situation? Reviews necessary risk assessment and analytical work that must be undertaken to characterize the current situation and identify existing gaps in wastewater system management.

Chapter 4. What program is best for our community? Considers the authority needed to implement various program elements, such as operation and maintenance, enforcement, and permitting.

Chapter 5. How do we make our plan a reality? Offers options for implementing a management program, including the adoption of the model programs developed by EPA. Integrated wastewater planning, linkages between wastewater management activities, and compliance with state, tribal, and federal water resource protection programs are also reviewed.

Appendix A. EPA decentralized wastewater treatment fact sheets. Informative Fact Sheets summarizing each of the 13 program elements that make up an onsite management program. These one-page fact sheets describe various levels of management based on community needs along with real life examples to help guide decision-makers.

Appendix B. References and resources. Offers readers additional sources of information to further develop and enhance an onsite management program. These resources include links to information and offer many examples of onsite management programs across the country.

Appendix C. Glossary of terms. Provides common definitions used in the decentralized wastewater field.

What is management and why is it needed?

Decentralized systems can provide appropriate treatment if they are managed properly.

Onsite and clustered wastewater systems (commonly called "septic systems) serve nearly 25 percent of U.S. households and up to 33 percent of new development. More than half of these systems are over 30 years old and surveys indicate at least 10 percent might not be functioning properly.

Malfunctioning septic systems can cause bacterial contamination of groundwater and recreational waters as well as algae growth and other problems in lakes, rivers, streams, wetlands, and coastal waters. The high cost of sewers and centralized wastewater treatment plants have greatly limited communities in their efforts to address their wastewater treatment needs. State and local governments are now looking to innovative treatment systems and management options to help reduce or eliminate problem systems. Some communities have built advanced sewage treatment systems and created management entities as a long-term, reliable solution for unsewered areas. Others are focusing on enhancing existing programs to help homeowners better manage their septic systems.

The key to achieving effective performance of decentralized sewage treatment systems—from the simplest "box and rocks" septic tank and drainfield system to the most complex treatment and dispersal unit—is an effective management strategy. This strategy must consider a number of critical elements such as planning, site conditions, risk factors, system design, and operation and maintenance, all of which comprise a management program.

What is a decentralized wastewater system?

Decentralized wastewater systems include a wide range of onsite and cluster treatment systems that process household and commercial sewage. Most discharge treated septic tank wastewater to the soil, but some discharge to ditches, streams, lakes ,and other waterbodies and need special federal or state permits. Some systems in arid regions promote evaporation or wastewater uptake by plants. Onsite and clustered wastewater treatment systems are known by many names, such as

- **Septic systems**
- **Onsite sewage systems**
- **On-lot sewage systems**
- **Private sewage systems**
- **Individual sewage systems**
- **Cluster, neighborhood or community systems**

This handbook refers to all of these as decentralized wastewater treatment systems.

Benefits of managed decentralized systems

An estimated 60 million people in the United States rely on decentralized systems to treat their wastewater. These systems will play an even greater role in the future because they are often more affordable than conventional centralized sewage treatment plants and can be designed to perform under a variety of specific site conditions. A decentralized approach to wastewater treatment offers other benefits, including:

- **Protection of property values.** Well-managed, properly designed onsite or cluster systems can provide sewage treatment equivalent to a centralized plant, often at a lower cost.

- **Water conservation.** Decentralized systems can help recharge groundwater aquifers and maintain dry season flow in streams.
- **Preservation of the tax base.** Decentralized systems can be installed on an as-needed basis, thus avoiding the large up-front capital costs of centralized sewage treatment plants.
- **Life-cycle cost savings.** Proper management can result in lower replacement and repair costs, increased property values, enhanced economic development, and improved quality of life.
- **Effective planning.** Decentralized systems provide flexible wastewater options and help achieve land use objectives.

Although decentralized systems offer many benefits, they are not without problems and critics. Each communitiy must carefully evaluate its situation and management needs to develop a program that is supported by residents, protects public health and the environment, and allows the community to grow and prosper in a sustainable manner consistent with land use plans and needs.

Underground leaching chamber installation on an onsite wastewater system. *Photo: State Conservation Service Kansas*

Barnstable County, Massachusetts Department of Health and the Environment Alternative Septic System Information Center. *This Web site contains information on alternative onsite technologies.* *See page 52, reference 36.*

Building effective management programs

It's important to better understand why management programs have not been effective in the past. A review of current state and local onsite regulatory and management approaches reveals that many programs rely on homeowners to assume full responsibility for the operation and maintenance of individual treatment systems. Many of these programs, however, do not provide the information and trained service providers that homeowners need to accomplish this job. Local regulators often lack the legal authority to hold homeowners accountable for properly maintaining their systems. This is compounded by the fact that few homeowners are trained to check their systems. Without proper training, they can actually risk injury or death from exposure to hydrogen sulfide and other gases generated in the tank. As communities grow, many new rural and suburban residents move to unsewered areas unaware of their system location and the need for periodic maintenance. In this "unmanaged" condition, septic systems will not perform adequately and many will ultimately have problems.

Benefits of effective decentralized wastewater management include...

- **Reduced costs for repairs, operation, maintenance and replacement**
- **Longer system life**
- **Improved system performance**
- **Increased reliability and overall satisfaction**
- **Higher property values**

In order to enhance management of decentralized wastewater treatment systems, state and local governments should develop a well-thought-out strategy that considers a number of factors, including design options, site conditions, operation and maintenance requirements, periodic inspections, monitoring, and financial support. Central to this strategy is ensuring that the legal authority is in place to carry out program requirements. Legal authority can be granted at the state or local level. For example, some local health departments are authorized by state statute to adopt regulatory powers as necessary to carry out program functions such as issuing operating permits, requiring maintenance contracts, setting system pumping/repair/replace-

What is decentralized wastewater management?

Decentralized wastewater management is not just about septic systems. It is about how much your community will grow, what your community will look like, how clean your local stream or estuary will be, and even the layout of your streets and subdivision. Finding answers to these questions means understanding:

- **Community wastewater needs and their effects on public health and the environment**
- **Your local setting and technical options and solutions**
- **The relationship between the technical solution and the shape and form of your community**

ment schedules, and promoting compliance through inspections and fines. Other communities have adopted local ordinances to provide the necessary legal powers to support management efforts and to take appropriate action when public health or water resources are threatened.

In some cases, communities have elected to give legal authority to a public and/or private responsible management entity (RME). Depending on state, tribal, and local codes, revised enabling legislation or special ordinances or agreements might be needed for a third-party entity to assume responsibility for certain services, such as system operation, inspection, monitoring, and ownership. Oversight of the management entity by the state or local regulatory authority is usally needed, regardless of the management approach selected.

Integrating decentralized wastewater treatment considerations into other programs also offers opportunities to manage systems more effectively. For example, planning agencies typically develop land use plans and zoning designations for various tracts of residential, commercial, and industrial land. However, they rarely consider clustering wastewater treatment facilities in unsewered areas or consult with water resource professionals on ways to accommodate soil-based or other treatment in rapidly developing locations. Integrating wastewater treatment into other programs can spur the development of creative and cost-saving approaches to wastewater management.

EPA's Voluntary National Guidelines for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems *provides information on the impacts of decentralized wastewater systems, the need for management, and five management program models that can be used by states and communities.* *See page 49, reference #4.*

How to use this handbook

The process of finding solutions to wastewater problems must be driven by local needs consistent with community sentiment and state and federal requirements. This handbook offers guidance on ways to tailor a management approach to the specific needs of a community. It recommends the basic format for developing an effective onsite sewage management program based on the principles in EPA's *Voluntary National Guidelines for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems*. This handbook is not a regulation, and readers remain free to use approaches other than those suggested here.

Management involves technology, engineering, and regulatory issues. Planners, health environmentalists, installers, elected officials, and citizens also play important roles.

Figure 1 summarizes the five major steps outlined in this handbook for developing or enhancing a decentralized wastewater management program. You can find additional resources in the appendices of this handbook. Fact sheets describing the 13 program elements of a decentralized wastewater management program appear in Appendix A. The management program elements provide a good basis for reviewing and evaluating existing programs and developing new ones. Resources and references are listed in Appendix B, and a glossary of terms used in this handbook appears in Appendix C.

Figure 1. *Process for developing a decentralized wastewater management program*

STEPS	KEY ACTIVITIES
1 **Conduct initial scoping and outreach.**	***Chapter 1*** ■ Conduct informal surveys of existing system performance. ■ Review potential problems. ■ Identify organizations involved in system planning, permitting, operation, and maintenance. ■ Conduct initial outreach and education and convene interested parties to define problems and how to address them.
2 **Convene interested stakeholders to investigate system performance and set goals.**	***Chapter 2*** ■ Identify key stakeholders (community leaders, regulators) and other potential partners (planning departments, developers, service providers, existing management entities, and watershed groups). ■ Develop a formal or informal group of key stakeholders to evaluate current activities, assess existing information, define problems, determine the feasibility of establishing or enhancing a management program, and develop goals.
3 **Analyze existing information to assess the community and evaluate current and future risks.**	***Chapter 3*** ■ Develop a community profile to assess socioeconomic and other community factors. ■ Review existing statutory and regulatory authority. ■ Determine the current management approach of the existing regulatory authorities. ■ Inventory or otherwise collect information on existing systems and impacts, analyze risks posed by existing systems, and assign potential of risk to systems and groups of systems. ■ Assess growth and development trends and create risk scenarios under various management approaches to determine wastewater planning and management needs for newly served areas.
4 **Enhance existing management program or develop new management entities.**	***Chapter 4*** ■ Synthesize information to identify and prioritize risks and management gaps. ■ Select program management approach. ■ Partner with stakeholder organizations (planning/zoning, water resource, service providers, and other entities) to determine implementation feasibility. ■ Conduct a reality check to determine the availability of management, technical, financial, and other resources.
5 **Implement selected elements of the management program, monitor and adapt as necessary.**	***Chapter 5*** ■ Investigate resources needed to implement the program. ■ Establish management requirements for existing and new treatment systems based on health and water resource risks. ■ Evaluate approaches and powers needed for implementing management programs. ■ Coordinate with other wastewater and water programs. ■ Solicit support and resources from stakeholders. ■ Develop indicators to determine progress. ■ Implement and adapt management program as necessary.

How do we get started?

Initial scoping and outreach

Developing an effective decentralized wastewater management program is complex and often challenging, but it is essential to the future environmental and economic health of a community. The process can be broken down into several manageable tasks. This chapter offers some general guidelines for getting started.

Scoping is a relatively quick process of gathering information, discussing its importance, and deciding how to proceed. Detailed analysis is usually undertaken at a later stage (see Chapter 3).

Assessing the situation

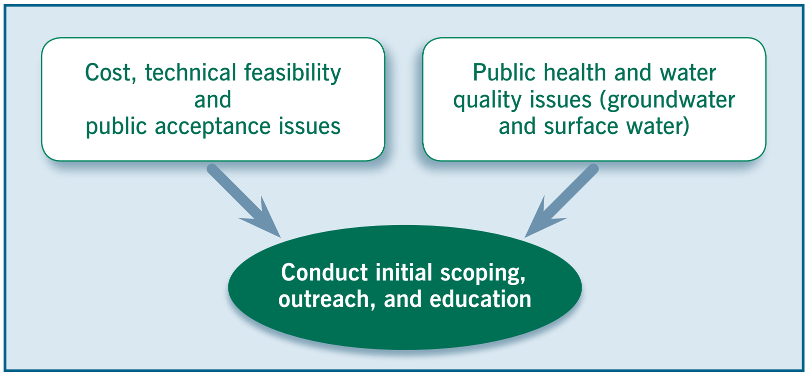
Communities across the nation—big and small, rural and urban—will all face wastewater management issues at some point. One of the greatest challenges facing many small or rural communities today is the set of problems associated with poorly operating small-scale wastewater treatment systems. These problems include:

- Threats to public health from malfunctioning septic systems, resulting in bacterial contamination of well water and swimming areas, or sewage surfacing on the ground
- Inadequate treatment that contributes to nutrient-induced algae growth or other problems in recreational and coastal waters
- Aesthetic concerns including odors, noises from aerators or other system components, or inadequately treated discharges of sewage to neighborhood ditches or streams
- High costs, lowered water tables, and construction-related disruptions associated with replacing onsite systems with sewer lines that transport wastewater to a distant centralized sewage treatment plant

These concerns often prompt residents and public officials to demand action from state and local officials. The question community officials most often face is “Do we stay with onsite systems and try to fix the problems, or do we move in another direction to a community-based or centralized system?”

During this early stage of decision-making, it is important to fully investigate wastewater issues and needs and review potential solutions. Key to a successful scoping process is ensuring that it is done in an open manner—one that supports education and outreach to the community. Figure 2 shows the actions that occur during the scoping process. Adequate scoping and initial outreach is critical in setting the stage for an open, honest process that focuses on the needs of the community.

Figure 2. *Initial scoping and outreach*



Getting the ball rolling

Public awareness of wastewater issues brought about by news stories or complaints can provide a real opportunity to involve a number of stakeholders in the decision-making process and begin a community-wide dialogue regarding wastewater treatment needs. Local agencies can capitalize on the energy and resources of various interested parties, which can lead to innovative and effective management programs. It's not unusual for a developer, neighborhood association, citizen group, or sanitation district to kick off the effort to develop a decentralized wastewater management program. But local decision-makers and regulators must be actively involved and help to drive the process at the earliest opportunity.

Choices for Communities: Wastewater Management Options for Rural Areas. *This document helps communities explore their wastewater treatment options.* *See page 51, reference #17.*

The scoping process typically involves:

- Collecting data and information on water quality
- Identifying the number and types of onsite systems in an area
- Reviewing complaints and system malfunctions
- Assessing the types of system problems that have been reported to pumpers and other service providers
- Considering where new systems are likely to be needed

The use of a data management system and innovative mapping tools can greatly assist in reviewing this information.

Maryland partnership develops septic system impact study

The Department of Environmental Resources and Health Department in Maryland's Prince George's County worked together to develop geographic information system (GIS) tools to quantify and mitigate nonpoint source nutrient loadings to the lower Patuxent River, which empties into the Chesapeake Bay. The agencies developed a database of information on existing onsite systems, including system age, type, and location, with additional data layers for depth to ground water and soils. The resulting GIS framework allows users to quantify nitrogen loadings and visualize likely impacts under a range of management scenarios. Information from GIS outputs is provided to decision makers for use in planning development and devising management strategies. For more information see page 51, reference #25.

Scoping is an informal activity to...

- **Identify driving forces such as system malfunctions and health and water risks**
- **Gather information from regulatory authorities, water resource agencies, planning departments, and other interested parties**
- **Contact system installers and service providers to see what sorts of problems they have encountered in the field**
- **See if a discussion of identified issues can be "piggybacked" onto an existing activity or program (health board, planning commission, water quality meeting)**
- **Convene an informal discussion of interested parties at a time and place convenient for them**

Where are we going?

Setting goals and objectives

Stakeholders need to be involved at every stage of the program development process. If scoping indicates that problems exist and management solutions are needed, a formal (steering committee) or informal (advisory committee) stakeholder group can be formed to assess the situation and recommend options. The problems, goals, and strategies that the stakeholder group generates will help to define what is desirable and ultimately what is achievable. This effort will require a committed group of people who can work together to assess the problems uncovered during the scoping phase outlined in Chapter 1.

Identifying stakeholders and their roles

Figure 3. *Establishing a stakeholder group*

Selecting members of a stakeholder group requires carefully considering a wide range of participants. For example, people with technical understanding, community outreach skills, fiscal/financial training, legal backgrounds, and community organization experience should be strongly considered. Elected officials and senior staff from regulatory agencies such as local and state health and environmental agencies, are almost always key stakeholders and should be involved in the program development process. Figure 3 provides some examples of key stakeholders. An effective stakeholder group will:

- Understand the problems clearly before seeking solutions
- Take responsibility for and ownership of the problems
- Exercise strong leadership, coordination, and communication
- Help to develop a clearly defined vision, mission, and goals
- Gather information from as many sources as possible
- Take the time to identify and examine all options before making decisions
- Identify and use appropriate decision-making processes
- Keep all affected parties informed and involved
- Develop criteria for hiring and working with consultants

Establishing goals and objectives

As the process unfolds, it's likely that some organization—usually one of the stakeholder entities—will assume leadership for the process. This organization could be a local health department, sanitation district, private or public corporation, or homeowner association. The sponsoring organization and several of the stakeholder groups might have their own perceived outcomes and objectives. It is important, however, to go through a process to identify the group's common objectives and interests, such as:

- Characterizing and addressing existing problems such as health or water quality threats
- Identifying and minimizing impacts from future commercial or residential development
- Protecting public health, economic vitality, and important recreational or water resources
- Generating public awareness and interest in resolving problems
- Building trust between the sponsoring organization and partners
- Creating support for funding and implementing selected management actions

Remember that these objectives are only a subset of those which will be pursued during the program development process. Stakeholders will bring to the table their own goals and objectives, which need to be considered when developing the management program.

Convening a stakeholder group

The members of the stakeholder group must clearly understand their roles and responsibilities (see the *Public Education and Participation Fact Sheet* on page 36). Will the group develop an issues and needs assessment, or will it be charged with actually designing the program? Will it have decision-making authority or play an advisory role? It is important that the framework of the group be clearly defined to avoid any confusion. Establishing ground rules and time frames will also be necessary to keep the group on task. If you choose to hire a wastewater planning consultant, look for someone who is knowledgeable about both centralized and decentralized treatment options. Staged development of wastewater facilities through both centralized and decentralized systems, selected through an objective process, should be the focus of a wastewater planning consultant.

Involving key stakeholders in the management program helps to build trust, communication, and support for whatever options appear to best address community needs. Stakeholders often bring additional resources to the table for assessment and program development.

When developing a stakeholder group answer these questions:

- **How will the group be structured—will it be a fully empowered decision-making entity, steering committee, advisory body, or ad hoc group?**
- **How will decisions be made—by majority vote, consensus, input received but decisions made by a responsible party?**
- **What is the membership of the group—is there one representative from each locality or interest group, or a cross-section of stakeholder groups?**
- **What are the roles and responsibilities of the stakeholders—will they include outreach, analysis and assessment, selection of management options, preparation of reports?**

Key questions to consider

The following questions might help to guide the stakeholder group as they begin the program development process.

1. **Where are we now, and where do we want to go?** Asking this question will help the group to focus on problems and desired outcomes. It is also helpful for stakeholders to consider the consequences of not taking some kind of action.

2. **How do we get there?** Identifying common goals and preliminary objectives during initial meetings helps to keep the group focused. Goals are generally broad expressions of a future vision of the group. For example, a goal might be to "improve the operation and maintenance of existing onsite systems." Objectives are then linked to the goals and provide a yardstick against which progress can be measured. For example, the group might identify a specific objective such as: "within 2 years, all systems having electrical or mechanical parts will be inspected annually, and those that discharge to ditches or the ground surface will be replaced with soil infiltration systems."

Stakeholder involvement tasks

- **Summarize and review the driving forces for better system management**
- **Determine the level of stakeholder involvement expected**
- **Decide which stakeholders are needed and invite them to participate**
- **Provide background information and general goals to the stakeholder group**
- **Convene the stakeholders to discuss their interest and desire to participate**
- **Develop a framework for stakeholder meetings, decision-making, and actions**
- **Conduct outreach to build awareness and interest.**

Gaining public support for wastewater management in Idaho

Because of accelerated development in the Idaho panhandle and a rapid rise in nitrate concentrations in the Rathdrum Prairie Aquifer, the Panhandle Health District (PHD), which covers the state's five northernmost counties, developed a plan to implement an interim moratorium on new development served by conventional septic tank soil-absorption systems. The high nitrate problem had been traced through groundwater monitoring to wastewater systems in densely developed subdivisions. To gain support for the plan, the PHD made presentations that documented the problem and proposed solutions to school, civic, and professional groups. The agency also used radio and television ads. In all cases, the PHD attempted to craft the presentation contents and supporting materials specifically for the audience being addressed. All public presentations were conducted in a cooperative, rather than confrontational manner.

The PHD then formed an ad hoc citizens' committee to develop and present suggested changes to the preliminary policy developed by the PHD. This committee included representatives from the home builders, the U.S. Department of Agriculture's Natural Resources Conservation Service, and two other affected federal agencies, farmers, planning boards, the state legislature, the League of Women Voters, and conservation/environmental organizations. The committee members not only reached out to their respective constituencies but also solicited feedback from other interested parties. For more information see the *Public Education Fact Sheet* on page 36.

3. **Do we always need consensus? Who has decision-making authority?** Stakeholder consensus is not needed for every decision. In some cases, it might be more appropriate to simply gather information from the stakeholders. The factors to consider when selecting a decision-making protocol include the time frame, the importance of the decision, the information needed to make the decision, and the capability and authority of the group to make the decision. For a decision to be generally accepted by the public, people must be informed of an impending decision or action, be heard before the decision is made, and have the opportunity to influence the decision.

What is our current situation?

Assessing and analyzing existing conditions

During this step, stakeholders will continue to build on their knowledge of community and resource conditions. This chapter focuses on developing a community profile, reviewing legal authorities, assessing current management practices, preparing a risk assessment, and considering future community growth and development (Figure 4).

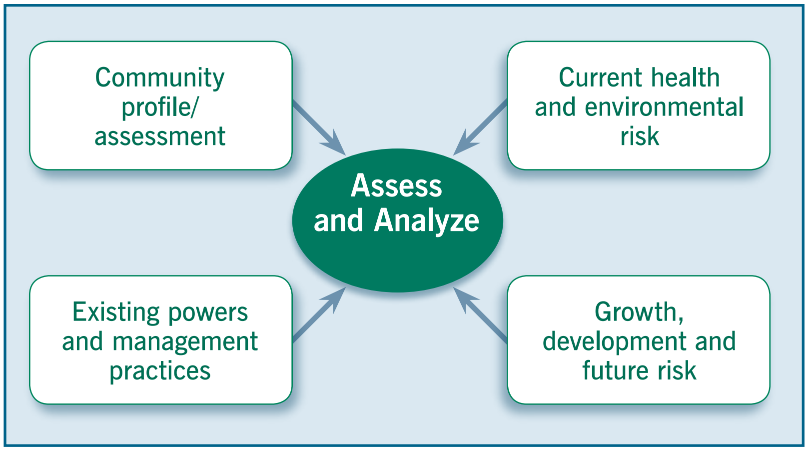


Figure 4. *Assessing and analyzing existing conditions*

Developing a community profile

A sense of community conditions is needed to provide context for stakeholder discussions. Therfore, it is beneficial for the stakeholder group to create a profile of their community which has three parts:

1. **Socioeconomic conditions**. A review of social and economic conditions provides perspective on the types of management actions that are likely to be acceptable and affordable for a community. For example, dealing with system malfunctions in densely populated low-income areas with small lots served by inadequate older treatment units might require cost-share assistance as opposed to stepped-up enforcement.

2. **Land and water resource conditions.** Information on a wide range of land and water resources that can assist in developing a community profile is readily available from a number of sources including:
   - Aerial photographs from property valuation and tax agencies, the Natural Resource Conservation Service, and local utilities
   - Population and housing census data (www.census.gov)
   - Wastewater, drinking water, and other data from local utilities
   - Soil data from the Natural Resource Conservation Service (www.soils.usda.gov/)
   - Topographic data from the U.S. Geological Survey (www.usgs.gov/)
   - Land-use and mapping data from planning agencies.
   - Water quality and watershed data from state water agencies and EPA websites (see page 45, reference #1 and #2)

Information and planning

Collecting information should not become burdensome. Focus on collecting information that is needed and available. For example, if the objective is to improve wastewater treatment systems in a specific area, target data collection efforts to assess the status of the existing systems, groundwater and surface water quality, and where infill development might occur. Denote potential areas where cluster systems might replace malfunctioning systems to capitalize on performance and cost efficiencies.

A geographic information system (GIS) can be used to store information and generate maps. These maps can familiarize stakeholders and the public with community conditions. Stakeholder groups are strongly encouraged to partner with planning agencies or data managers to develop or share GIS capabilities.

3. Onsite and cluster system inventories. An important step in developing a community profile is to estimate the number and types of onsite/cluster systems, along with their location and where they disperse treated wastewater. Information can be accessed by contacting a number of agencies including:

- County or city health departments
- Planning/zoning agencies
- Regional wastewater treatment plants
- Economic development offices, county/city housing, and property valuation agencies

Inventories and assessments of system performance provide vital information for risk analyses. These can begin as broad screening characterizations of service or geographical areas, with more refined analysis conducted in potential problem areas.

Water quality information sources include:

- Source water assessment and protection plans from local drinking water utilities
- Watershed studies from local water/wastewater utilities and state water quality agencies
- Data from local or regional water quality monitoring organizations or volunteer groups

Service providers are also a good source of information, and include:

- Onsite service providers such as septic tank pumpers, designers, and installers
- Well drillers and other water-related professionals

Wastewater professionals can be a valuable source of information regarding the types of systems being installed, malfunctioning systems, and homeowner compliance with recommended service schedules.

Using GIS maps to assign risks

GIS maps can assist with developing a framework for assigning risk tiers to groups of systems. Several tools exist to aid in this process. One such tool is the "susceptibility determinations" that drinking water utilities make as part of their source water assessments. These assessments determine which potential sources of pollution, including onsite wastewater systems, pose the greatest threats to potable water systems.

An assessment of resource conditions can be used to…

- **Identify and prioritize problem systems**
- **Identify the causes for inadequate performance of existing systems**
- **Collect soil data and other information needed for system design**
- **Evaluate the trends and likely impacts of future residential and commercial growth**
- **Examine technologies and system configurations that might accommodate growth**
- **Estimate costs and environmental and public health impacts of alternative solutions**
- **Define the desired character of the community**

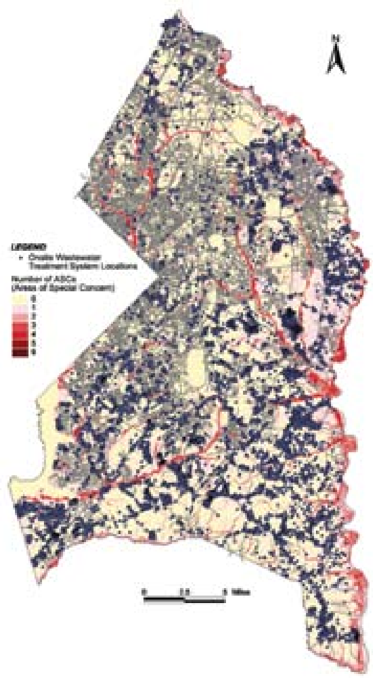
Using GIS tools to characterize water quality threats in Colorado

Summit County, Colorado, in partnership with the Colorado School of Mines and other organizations, developed a GIS to identify the adverse effects of nitrate from septic systems on water quality in the upper Blue River watershed. The GIS database included geologic maps, soil survey maps, topographic features, land parcel maps, domestic well sampling data, onsite system permitting data, well logs, and tax assessor data. The database can be updated with new water quality information, system maintenance records, property records, and onsite system construction permit and repair information. The database is linked to the DRASTIC groundwater vulnerability rating model and is being used to identify areas that have a potential for excessive contamination by nitrate-nitrogen, which helps in prioritizing water quality improvement projects. See page 54, reference #56 for more information.

Reviewing current regulatory powers and management

As part of the assessment and analysis phase, a review of the statutory and regulatory authority in place to carry out a decentralized wastewater treatment management program should be conducted, including:

- Authority to enter private property for inspection or health nuisance abatement
- Authority to require repair or replacement of malfunctioning systems
- Authority that allows private entities to manage systems, charge fees, or apply for funding



Onsite wastewater treatment systems in Prince George's County. *Source: Prince George's County OSDS Database*

Existing management practices should also be reviewed, including:

- Site evaluation procedures
- Educational, training, or other requirements for service providers
- The permitting process
- Design requirements
- Installation/construction requirements
- Operational and maintenance requirements
- Inspection, complaint, and compliance assurance procedures
- Program funding, including fees for permitting, inspection, or other management activities, and whether they cover costs

A review of existing statutory, regulatory, and management approaches will help to identify program gaps, barriers to new technology, and other shortcomings that might need to be addressed to enhance existing activities or develop a new management program.

Assessing public health and environmental risks

One of the most important goals of the management program should be to target actions in direct proportion to the risks posed by malfunctioning treatment systems. The importance of this concept cannot be overstated. In practice, this means that some systems need only minimal management, while others must be managed much more intensively.

Developing integrated risk assessments for wastewater systems is a demanding task, but the benefits can be significant. Examples of parameters to consider in assessing public health and environmental risks for existing systems are soil permeability, depth to groundwater, aquifer type, groundwater and surface water use, proximity to sensitive surface waters, topography, geology, density of development, and system types. In developing risk assessments, the objective is not to produce an expensive, time-consuming, lengthy and complicated study, but rather to quickly assimilate available data and identify classes or groups of systems posing similar risks so they can be managed in a similar manner. For example, widely scattered older systems sited in deep, well-drained soils far away from surface waters need not be managed as intensively as newer, electromechanical treatment units serving beach-front properties. Densely packed systems installed during the 1950s near a downtown area bisected by a trout stream might be targeted for replacement with a new clustered facility featuring neighborhood collection lines, a biofiltration unit, and pressure distribution to soils.

The development of a database and GIS mapping capabilities, or even hand-drawn maps, can help to inform risk assignment decisions. Inspections of individual systems in areas targeted for more intensive management can confirm risk decisions and bolster homeowners' confidence in the process and its outcomes. Table 1 summarizes some of the risk factors that indicate more intensive system management might be needed.

Potential problem indicators

Untreated or partially treated sewage pooling on ground surfaces and in ditches, sewage backup in household plumbing fixtures, and sewage breakouts on slopes

High nitrate or bacteria levels in downgradient drinking water wells, presence of toxic substances in well water, and taste or odor problems in well water caused by untreated or poorly treated wastewater

Shellfish bed and recreational beach closures due to bacterial or viral contamination

Algae blooms and low dissolved oxygen concentrations in nearby surface waters

General approach for conducting risk assessments

Many researchers have used the following general approach to identify onsite and cluster systems that might be impairing or threatening water resources:

Identify pollutants such as pathogens, nitrogen, or phosphorus that are impairing or threatening waterways.

List likely sources of the pollutants of concern.

Estimate the total load of pollutants to the receiving water from each source. Estimating the total load of pollutants from onsite/cluster systems requires modeling system flows, pollutant output, transport and rate, and assimilation by the receiving waters. An alternative approach is to conduct lot-level analysis of system type, age, proximity to receiving water, repair and service records, and site conditions.

Create a matrix that ranks lot-level system risk by assigning ratings or risk level values and applying them to each lot or parcel. This approach is useful for areas where onsite/cluster systems are collectively judged to be a significant source of the pollutant or pollutants of concern.

Analyzing growth, development, and future risk

Analyzing growth, development, and future risk is similar to the process of assessing risks posed by existing systems. Projecting residential and commercial build-out and estimating likely system numbers and types can be challenging if there is no comprehensive land use plan or wastewater management plan. Consultation with the local planning agency and developers can yield significant information regarding planned build-out. The assessment can also be used to project risks posed by systems that might be installed in the future. Getting "ahead of the curve" by forecasting future risk is useful in developing design requirements (performance targets) and management needs for wastewater systems that will serve new subdivisions and commercial areas. **Combining or coordinating treatment service planning for both centralized and decentralized wastewater treatment facilities is highly recommended.** Developing a seamless approach to treatment planning by integrating individual, cluster, and sewage plant services builds efficiency, promotes effectiveness, and contributes to a sense that all wastewater treatment services are community assets that should be managed appropriately for public benefit.

Table 1. *Onsite system risk factors*

Risk category	Risk factors
Environmental sensitivity	◆ Impermeable soils such as heavy clay ◆ Shallow depths to groundwater ◆ Rock layers near the surface ◆ Hilly terrain with thin soils and steep slopes ◆ High densities of system installations ◆ Sensitive waterbodies nearby
Public health	◆ Drinking water wells nearby ◆ Recreational waters nearby ◆ Effluent surfacing or plumbing backups ◆ Potential for rapid groundwater movement ◆ Systems more than 25 years old not maintained ◆ Illegal system discharges
Treatment complexity	◆ Electrical and mechanical system components ◆ Heavy sewage loads (high-strength wastewaters) ◆ High fat, oil, and grease content in wastewater ◆ Industrial and certain commercial wastewaters

In practice, this means that local communities should examine future goals for growth, development, resource protection, and community character prior to evaluating wastewater treatment options, because the type of treatment selected – centralized, decentralized, or a combination of the two – can have a significant impact on these goals. For example, appropriately designed individual systems and cluster systems serving targeted areas can promote a "pay as you go" approach and ensure that extension of centralized sewer service does not promote unwanted growth or overload treatment plants already at capacity or experiencing overflow problems. Information from consultants or engineers familiar with the full range of treatment options, the planning guides cited in this chapter, and EPA's *Onsite Wastewater Treatment Systems Manual* (see page 52, reference #34) are all useful in analyzing the range of options available. This handbook is intended to aid in developing appropriate management programs for areas that select individual or clustered decentralized systems.

Watershed planning

Local government land use planning programs should be integrated with the selected wastewater management program. Planning can include performance targets for wastewater treatment and promote integration of wastewater/stormwater/watershed management programs and policies. For more information on integrated wastewater planning, see page 51, reference #25 and page 52, reference #35.

Assessing onsite system risks in Malibu

Malibu, California, relies on residential onsite wastewater treatment systems to protect valuable inland and coastal waters. A team of consultants and city staff conducted a three-year risk management study to develop recommendations to protect these resources and to meet state water quality standards. Many stakeholders, including regulators and environmental advocacy groups, were involved throughout and were essential to the study's success. The study area was defined by groundwater recharge zones in the alluvial aquifers around Malibu Creek and Lagoon, Winter Canyon and the surf zone of the Pacific Ocean near Surfrider Beach. The groundwater aquifer was the focus of the study because it receives the treated effluent from onsite systems and transmits groundwater to local surface waters.

The study integrated data from a network of new and existing monitoring wells into a centralized, web-based information management system. Using this information, a three-dimensional groundwater model was developed to evaluate impacts of onsite systems on groundwater quality and to determine the directions and rates of groundwater flow. The risk assessment approach used six steps:

1. Define receiving waters and objectives for key water quality constituents
2. Identify, locate, and quantify contamination contributed by onsite systems.
3. Evaluate hydrological conditions to determine groundwater flow directions and travel times
4. Estimate the assimilative capacity of unsaturated and saturated zones to account for the reduction or assimilation of pathogens and nitrogen during groundwater transport
5. Delineate specific areas that might pose pathogen and nitrogen risks to the receiving waters
6. Identify and evaluate alternative strategies to reduce risks to acceptable levels

The results indicated that portions of the study area might be contributing pathogens or nitrogen to either Malibu Creek and Lagoon or the surf zone. The recommendations focused on the desired water quality outcomes—specifically, meeting Total Maximum Daily Loads (TMDLs) for pathogens and nitrogen. Suggested actions included initiating a point-of-sale onsite system inspection program, requiring inspections for systems within the six-month pollutant travel time zones, evaluating a proposed clustered wastewater collection/treatment/dispersal system, and requiring disinfection or nitrogen removal for systems in the contributing areas. The City of Malibu is incorporating the action items into its Wastewater Management Plan. For more information see page 54, reference #49 and #50.

All management programs should...

- **Have sufficient local support and legal authority**
- **Be flexible in adapting to changing demands**
- **Ensure reasonable homeowner costs**
- **Be able to achieve public health and environmental objectives**

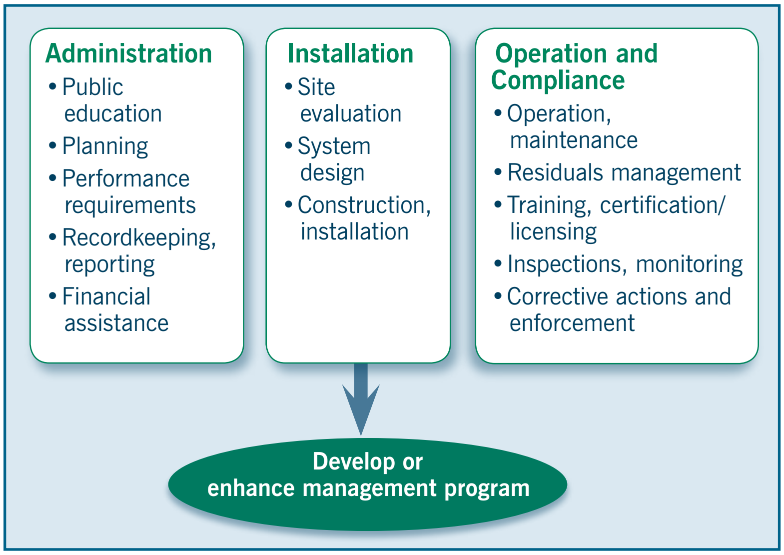
chapter 4

What is best for our community?

Developing or enhancing your program

This chapter discusses the development or enhancement of your decentralized wastewater management program based on 13 principal program elements (Figure 5 and Table 3; also see Appendix A for fact sheets on each of these elements.) Management programs typically support the twin goals of protecting human health and environmental resources. They might also influence future growth and community character, promote water recycling and reuse, protect and enhance private property values, and protect against water resource diversions. Developing management approaches for specific groups of onsite systems—which can be classified as having high, moderate, or low risk—will constitute much of the work in devising the overall management program.

Figure 5. *Decentralized wastewater management program elements*



Selecting a management approach

The EPA *Voluntary Management Guidelines* (see page 49, reference #4) detail five management approaches that respond to varying levels of risk posed by decentralized wastewater treatment systems (see Table 2 and www.epa.gov/owm/onsite). These conceptual models represent a range of possible programmatic responses to water quality and public health concerns or local wastewater infrastructure needs (Figure 6). Management models 2 through 5 are recommended for electromechanical systems and moderate- to high-risk site conditions. Each management approach consists of a "package" of management activities. The mix of institutions, procedures, and arrangements involved in a management program varies depending on enabling legislation, environmental conditions, resources, and other factors. Because of this diversity, the outcomes of management efforts will be different across the country depending on local conditions and needs.

Figure 6. *Using risk inputs to select a management model*

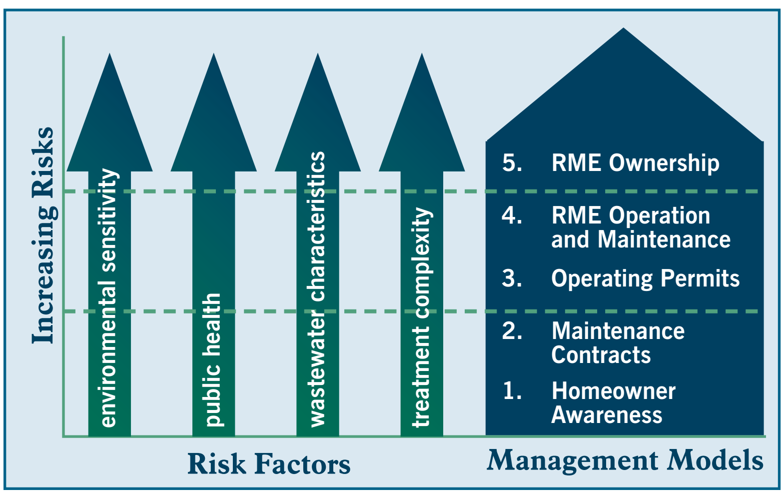


Table 2. *EPA management models for decentralized wastewater treatment systems*

Typical applications	Program description	Benefits	Limitations
1. Homeowner Awareness Model			
◆ Areas of low environmental sensitivity where sites are suitable for conventional onsite systems	◆ Systems sited and constructed based on prescribed criteria ◆ Maintenance reminders ◆ Inventory of all systems	◆ Code-compliant system ◆ Ease of implementation ◆ Inventory of systems that is useful for tracking and areawide planning	◆ No compliance ID mechanism ◆ Sites must meet siting requirements ◆ Cost to maintain database
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 cluster systems	◆ Systems properly sited and constructed ◆ More complex treatment options (mechanical, clusters of homes) ◆ Service contracts must be maintained ◆ Inventory of all systems ◆ Contract tracking system	◆ Lower risk of treatment system malfunctions ◆ Homeowner's investment protected	◆ Difficulty tracking and enforcing compliance due to reliance on the owner or contractor to report a lapse in services ◆ No mechanism provided to assess the effectiveness of the maintenance program
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 areas ◆ Systems treating high-strength wastes, or large-capacity systems	◆ Performance and monitoring requirements ◆ Engineered designs allowed but may provide prescriptive designs for specific sites ◆ Regulatory oversight by issuing renewable operating permits that may be revoked for noncompliance ◆ Inventory of all systems ◆ Tracking of operating permit and compliance monitoring ◆ Minimum for large-capacity systems	◆ Systems can be located in more environmentally sensitive areas ◆ Regular compliance monitoring reports ◆ Noncompliant systems identified and corrective actions required ◆ Less need for regulation of large systems	◆ Higher level of expertise and resources for regulatory authority to implement ◆ Requires permit tracking system ◆ Regulatory authority needs enforcement powers
4. Responsible Management Entity (RME) Operation			
◆ Areas of moderate to high environmental sensitivity where reliable and sustainable system operation and maintenance is required (sole-source aquifers, wellhead or source water protection zones, critical aquatic habitats, and outstanding value resource waters) ◆ Cluster systems	◆ System performance and monitoring requirements ◆ Professional O&M services through RME (public or private) ◆ Regulatory oversight by issuing operating or NPDES permits directly to RME (system ownership remains with 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 holds the operating permit ◆ Problems identified before malfunctions occur ◆ Onsite treatment in more environmentally sensitive areas or for treatment of high-strength wastes ◆ One permit for a group of systems	◆ Enabling legislation might be necessary to allow RME to hold the operating permit for an individual system owner ◆ RME must have owner's approval for repairs; might be conflict if performance problems are identified and not corrected ◆ Need for easement/right of entry ◆ Need for oversight of RME by the regulatory authority
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, and outstanding value resource waters ◆ Preferred management program for cluster systems serving multiple properties under different ownership	◆ Establishes system performance and monitoring requirements ◆ Professional management of all aspects of decentralized systems ◆ RMEs own or manage individual systems ◆ Trained and licensed professional owners/operators ◆ Regulatory oversight through NPDES or other permit ◆ Inventory of all systems ◆ Tracking of operating permit and compliance monitoring	◆ High level of oversight if system problems occur ◆ Model of central sewerage that reduces the risk of noncompliance ◆ Onsite treatment in environmentally sensitive areas ◆ Effective planning and watershed management ◆ Potential conflicts between the user and RME removed ◆ Greatest protection of environmental resources and homeowner investment	◆ Enabling legislation or formation of special district might be required ◆ Might require significant financial investment by RME for installation or purchase of existing systems or components ◆ Need for oversight of RME by the regulatory authority; might limit competition ◆ Homeowner associations may not have adequate authority

Table 3. *Decentralized wastewater management program elements*

Elements	Purpose	Basic activities	Advanced activities
Administration			
Performance requirements	Link treatment standards and relative risk to health and water resource goals.	Prescribe acceptable site characteristics and system types allowed.	Stipulate that system performance must meet defined standards that consider water resource values, vulnerabilities and risks.
Planning	Consider site and regional conditions and effects on long-term watershed and public health.	Identify minimum lot sizes, surface water/groundwater separation distances, and critical areas requiring protection.	Monitor and model regional pollutant loads; tailor development patterns based on environmental and physical limitations; require clustering for large developments.
Record-keeping, inventory and reporting	Create inventory of systems and O&M logs, planning and reporting to oversight agencies.	Provide inventory information on all systems; submit performance reports to health agency.	Provide GIS-based comprehensive inventories, including web-based monitoring and O&M data input for administrative reporting and watershed assessment studies.
Financial assistance and funding	Provide financial and legal support for management program.	Implement basic powers, revenue-generation fees, and legal backup for a sustainable program.	Initiate monthly or quarterly service fees; cost-share or other repair/replacement program; full financial and legal support for management program; equitable revenue base and assistance programs; regular reviews and modifications.
Public education and participation	Maximize public involvement while developing a management program.	Sponsor public meetings, forums, updates and education programs.	Maintain public advisory groups, review groups, and other involvement opportunities in the program; distribute educational and other materials.
Installation			
Site evaluation	Assess system site and relationship to other features (groundwater and surface water).	Characterize landscape, soils, ground and surface water location, lot size, and other conditions.	Assess site and cumulative watershed impacts, groundwater mounding potential, long-term specific pollutant trends, and cluster system needs.
System design	Ensure that system is appropriate for site, watershed and wastewater characteristics.	Prescribe a limited number of acceptable designs for specific site conditions.	Implement codes for developing designs that meet performance requirements for each site; address wastewater, reuse and dispersal options.
Construction	Ensure installation as designed; record as-built drawings.	Inspect installation prior to covering with soil and enter as-built information into the file record.	Provide supplemental training, certification and licensing programs; provide more comprehensive inspection of installations; verify and enter as-built information into the record.

Table 3. (continued) *Decentralized wastewater management program elements*

Elements	Purpose	Basic activities	Advanced activities
Operation and Compliance			
Operation and maintenance	Ensure that systems perform as designed.	Initiate homeowner education and reminder programs that promote O&M.	Require service contracts or renewable, revocable operating permits with periodic reporting; log service reports in database; ensure responsibility for O&M activities.
Inspections and monitoring	Document provider performance, functioning of systems, and impacts.	Perform inspection prior to cover-up and property title transfer; provide complaint response.	Conduct regional surface water and groundwater monitoring; web-based inspection reporting and system operational monitoring; require installation and periodic operational inspections.
Residuals management	Remove and treat residuals; minimize health or environmental risks from residuals handling, use, and dispersal.	Ensure compliance with federal and state codes for residuals dispersal.	Conduct analysis and oversight of residuals program; web-based reporting and inspection of pumping and dispersal facility activities; assistance in locating or developing residuals handling facilities.
Training and certification/ licensing	Promote excellence in site evaluation, design, installation, O&M, and other service provider areas.	Recommend use of only state-licensed/certified service providers.	Provide supplemental training and certification/licensing programs; offer continuing education opportunities; monitor performance through inspections; sponsor mentoring programs.
Corrective actions and enforcement	Ensure timely compliance with applicable codes and performance requirements.	Provide for complaint reporting under nuisance laws; inspection and prompt response procedures and penalties.	Deny or revoke operating permit until compliance measures are satisfied; set violation response protocol and legal response actions, including correction and liens against property by RME.

A management framework to address gaps

The management program elements summarized in Table 3 and detailed in the *Decentralized Management Program Elements Fact Sheets* (see Appendix A) provide a useful framework for identifying and addressing potential gaps in the current management approach. It should be noted that Table 3 covers only broad programmatic management activities. The level or intensity of management activities applied to specific systems or groups of systems should be commensurate with the relative risks identified.

For example, implementing only the basic management activities for each program element might be appropriate for systems posing a low risk to public health or water resources, such as new gravity-flow soil infiltration systems installed at low densities on sites with suitable soils. However, advanced management activities would be more appropriate for higher-risk systems such as older systems or those installed at high densities on sites with poor soils, greater slopes and proximity to groundwater or surface waters. The intent is to manage groups of similar systems under a fairly uniform approach. For example, dozens of septic tank and leach field systems installed over two to three years

Training of service providers

Service providers should be professionally trained, licensed, or certified in system design, installation, inspection, operation, and maintenance. The use of certified professionals is endorsed by most wastewater industry organizations, such as the National Onsite Wastewater Recycling Association, the National Environmental Health Association and the National Association of Wastewater Transporters. For more information see the *Training and Certification/Licensing Fact Sheet on page 46 and reference #53 on page 54.*

Addressing water pollution

Managing water pollution risks posed by onsite systems is a process that includes:

- **Identifying pollutants of concern in the drainage area surface waters or aquifer**
- **Identifying pollutant sources and estimating relative contributions from each source**
- **Determining methods and costs of reducing pollutant contributions**
- **Sharing information and involving the public**
- **Defining what's economically feasible and technically achievable**
- **Determining the pollutant reductions necessary from each identified source or area**
- **Establishing authority to regulate the target sources**
- **Implementing a pollutant reduction strategy**

Use of NPDES permits for onsite systems

National Pollutant Discharge Elimination System (NPDES) permits have been used by some states to regulate onsite sewage discharges, and are required for all systems that discharge to ditches or surface waters. The Clean Water Act authorizes NPDES permits for individual or group dischargers. A state may implement a general NPDES permit program to cover the general class of individual or clustered wastewater systems that discharge to surface waters.

in a residential development would be managed in the same manner if site conditions warrant. This concept allows management programs to be tailored to the setting, whether it is a small rural town or a large jurisdiction such as a township or county. The key is to characterize systems according to their similarities, so that management approaches can be tailored to address the systems specific needs (see the *System Design Fact Sheet* on page 42). Grouping systems by the risks they pose based on location, technology type, and other attributes will help create a useful framework for screening out low-risk systems and focusing on those needing more intensive management.

Implementing the management program

The mix of institutions, procedures, and arrangements involved in a management program varies depending on a host of factors, including enabling legislation, environmental conditions and resources available. Because of this diversity, the outcomes of management efforts are likely to be different across the country. Table 4 provides a framework you can use to explore management issues.

Management programs can range from an informal network of private service providers, public agency staffs, and other partners operating under a coordinated framework, to a highly structured RME (responsible management entity) that owns or maintains a set of treatment systems. The key objective in developing the program is to ensure that it reflects the community's best effort to deal with public health and water resource threats. Developing a viable management program is a case-specific process, highly dependent on the commitment, creativity, and cooperation of the community and the stakeholders.

Many management programs are developed and overseen by local health departments. These programs may include performance-based requirements for design, construction, and operation and maintenance performed by outside contractors or other entities. State and local codes, memoranda of agreement, conditional permits, and maintenance contract requirements should clearly identify how the management program will be executed.

The most intensive management programs are those which rely on RMEs to manage designated systems. An RME is defined as a legal organization with the technical, managerial, and financial capacity to operate and maintain viable decentralized wastewater systems within the RME's jurisdiction. Sanitation and water districts, public/private corporations, public agencies or authorities, and special districts can all function as RMEs. Homeowner associations have proven to be less effective as RMEs because of their large scope of interests, lack of

Consideration of residuals management

Community decentralized wastewater management programs will need an ordinance to specify the frequency of residuals removal, approved service providers, and reporting requirements. The ordinance can require a specific frequency for pumping or inspection to determine if pumping is necessary. Existing management programs use both techniques. For more information see the *Residuals Management Fact Sheet on page 45.*

technical expertise, and lack of managerial/staffing support for providing wastewater services. Oversight by the local regulatory authority is needed to ensure that the RME complies with federal, state, and local rules regarding system permitting, operation, and maintenance requirements.

U.S. Environmental Protection Agency Onsite Wastewater Treatment Systems Manual. *This comprehensive reference manual is designed to provide engineers and regulators with guidance on the planning, design, and operation of onsite systems.* *See page 52, reference #34.*

In addition to the necessary legal authority, RMEs should have the technical, managerial and financial expertise needed to ensure system performance over the long term. RMEs can be formed in a variety of ways, which include modifying the missions of existing sanitation districts, public agencies, other public/private service providers, and profit or nonprofit corporations or by creating special districts. The early planning efforts should sort out what type of management entity can be created under specific state laws and determine whether additional enabling ordinances or legislation is necessary.

Table 4. *A framework for exploring management issues*

Issue	Questions to be addressed
Time frame	◆ At what point will the planned management program structure be sustainable? ◆ If the program is sequentially implemented, when will each sequence be completed? ◆ When will the management program be fully operational?
Service area	◆ What areas or which systems will the management program serve? ◆ Are these areas compatible with a local public jurisdiction that would have the necessary powers to make the program effective and sustainable? ◆ Do specific subareas need different management approaches (system designs, staffing, regulatory controls)?
Purpose	◆ What public health and water resource problems will be addressed? ◆ What measurements should be made (monitoring) to verify success?
Structure	◆ Can existing entities be modified or be included in a partnership to provide management services or will a new entity be needed? ◆ Should the management program be limited to decentralized wastewater treatment, or should other water, stormwater, or wastewater infrastructure be included? ◆ How will the program elements of the management program be staffed and administered? ◆ Will formal agreements, ordinances, or other legal mechanisms (articles of incorporation, public charter) be needed to create the structural elements of the program?
Authority and liability	◆ Which systems will be under the jurisdiction of the management program? ◆ Will the onsite treatment systems be privately or publicly owned? ◆ How will future wastewater systems be planned, designed, installed, operated, maintained, inspected, and repaired or replaced? ◆ What is the relationship between the management program and the regulatory authority? ◆ What formal agreements, ordinances or other legal mechanisms (e.g., with system or property owners) are necessary to implement each element of the program? ◆ How will the program be funded (planning, construction and operational phases)?

Regulatory considerations for onsite programs

All treatment systems that discharge effluent to surface waters through a pipe, swale, drain, tile, or other man-made conveyance must comply with National Pollutant Discharge Elimination System permits and the antidegradation provisions of the federal Clean Water Act.

Treatment systems that discharge effluent below the ground surface and serve 20 or more persons per day – or those that receive commercial or industrial wastes – are regulated as Class V injection wells under the Underground Injection Control Program of the Safe Drinking Water Act. Class V injection wells are authorized by rule, i.e., a permit is not required as long as the system is constructed and operated in a manner that protects underground sources of drinking water and the owner or operator submits basic information about the system to EPA or the state groundwater agency. States can be more stringent and may require additional information or a permit in order to ensure that groundwater is adequately protected.

Treatment systems that cause or contribute to a violation of state or federal water quality standards may be subject to the Total Maximum Daily Load (TMDL) program under section 303 of the Clean Water Act. State or local implementation of TMDLs may require the use of better-performing treatment technologies or more stringent system management to ensure long-term protection of the designated uses of surface waters.

Integrating wastewater system management

Integrating wastewater planning and management for individual onsite, cluster, and centralized sewage treatment is highly recommended (see the *Planning Fact Sheet* on page 37). The federal Clean Water Act requires areawide wastewater management plans for many urban areas and other areas with water quality problems. It further requires that states conduct an ongoing planning process to ensure that wastewater treatment plans and other water quality control efforts are integrated and updated. Some states have adopted this approach to ensure that centralized and decentralized wastewater services are provided in the most effective manner possible.

Partnerships are helpful to promote wastewater management in your community. Have the stakeholder group explore opportunities to partner with other organizations and agencies. Cooperation and communication can often lead to wastewater improvements. For example, working cooperatively with neighboring communities to address residuals can help the community identify land application sites, wastewater treatment facilities, or other alternatives that can help manage wastewater treatment by-products. Because of environmental impacts linked to onsite and cluster system malfunctions, federal, state and local water resource protection agencies are often interested in partnering with decentralized wastewater programs to ensure that management efforts are locally and regionally coordinated. Consider partnering with:

- Planning/zoning and economic development agencies
- Local water, wastewater, and other public utilities
- State surface water and groundwater bureaus
- State wastewater discharge permitting agencies
- Volunteer water quality monitoring groups
- Onsite system service provider groups

Likewise, you can integrate other programs into your decentralized wastewater management program such as the following:

- Watershed Management
- The National Pollutant Discharge Elimination System
- Biosolids and Residuals Management
- Stormwater Management, Water Quality Management (including Total Maximum Daily Loads, or TMDLs)
- Water Quality Standards
- Source Water Assessment and Protection
- Underground Injection Control
- Coastal Zone Management
- Nonpoint Source Control
- Technology Transfer

Conducting a reality check

Specifying wastewater system management requirements can be challenging, particularly for existing systems. In general, acceptance of new management activities like inspections, operating permits, and maintenance contracts is greater if:

- Negative health or environmental impacts have been demonstrated
- The impacts have been linked to onsite systems
- The management program will address the impacts

Before launching new program requirements, it helps to conduct a reality check by reviewing data collected during the assessment/analysis phase and sharing it with system owners. Involving the management program stakeholder group is also vital during this phase because the stakeholders' constituencies can help to provide information, explain technical and socioeconomic issues, and tap into community and other organizations that can build support for program implementation. If stakeholders have been directly involved in assessing current conditions, analyzing risk and developing the management program and if they have communicated with their constituents during this process, it is likely that program requirements will be known and generally understood.

Dealing with opposition to management

Some resistance to a new or enhanced management program might emerge because of citizens' reluctance to pay for a service that previously was "free." Past experience indicates that most residents will begin to comply once they recognize that the program is needed to address real community problems. In some cases, delaying (or phasing in) necessary technological upgrades and management services until after a substantial portion of the service population has accepted the program rules can help to create momentum and support.

Working through the underlying concerns such as maintenance costs or private property inspections can be addressed through a number of options, such as providing access to cost-share funds or notifying homeowners in advance of inspections. The best approach in most cases is to proceed with program implementation if there is general public support for the program. Remember to keep communication lines open and honest and express the desire to work with residents to address their concerns. Balancing mandatory compliance with persistent persuasion requires a person-to-person approach and patience, and provides the best guarantee of eventual success.

Prescriptive versus performance onsite system requirements

Most state and local health departments rely on prescriptive codes when issuing permits for onsite systems.

These prescriptive codes typically establish minimum setback distances between treatment system components and property lines, structures, and water resources; establish minimum square footage requirements for infiltration fields; and restrict the type of onsite systems that can be used.

Performance-based codes focus on treatment outcomes rather than system components or their location. The codes do not specify the type of system permitted but rather allow the design of a treatment system to meet the standards.

Performance-based codes are related to environmental sensitivity and are often created in concert with state environmental agencies. A performance-based code might specify pollutant concentration standards for the effluent at some specific point in the treatment process.

RME management is typically needed to ensure compliance with performance-based codes.

*For more information see the **System Design Fact Sheet** on page 42.*

How do we make our plan a reality?

Inspecting a septic system.
Photo: Kentucky Department of Health

Program implementation

Decentralized wastewater management programs will be as varied as the communities they serve. Each community has different issues and needs, but by targeting planning, design, performance, installation, operation, and maintenance requirements to those areas or system types that pose the most significant threats, the program should achieve its goals (see Figure 5).

Consideration of program authority

Legal authority is necessary to carry out an effective management program. In most cases broad legal mandates for onsite programs are vested under state law (see the *Corrective Actions and Enforcement Fact Sheet* on page 48). But when it comes to who can actually manage a wastewater program and under what circumstances special districts or private management entities may be formed, state laws are typically much more specific. For example, West Virginia law specifies three entities that can manage onsite systems, while California statutes authorize more than a dozen entities with the power to manage community wastewater systems.

The authority to carry out an onsite management program can be granted to local entity such as a township or county by local ordinance. Table 5 and Table 6 review the levels of authority required to carry out a management program based on the jurisdiction of the agency.

Figure 7. *Key outcomes of a management plan and implementation strategy*

Address current and future health and water resource risks
Plans for treatment options in new developments
Integrates and coordinates with other wastewater planning efforts
Is sustainable through adequate funding sources and local support
Coordinates with water resource programs, including source water protection, total maximum daily loads, stormwater management, areawide planning
Is continuously monitored and evaluated in order to adapt or improve as necessary

Onsite management authorities in Missouri

In Missouri the Department of Health regulates all single-family-residence wastewater systems and other sources of domestic sewage with flows less than 3,000 gallons per day that discharge to soil or holding tanks. The Department of Natural Resources (DNR) regulates systems with flows of 3,000 or more gallons per day, systems treating industrial facilities, and systems that discharge to surface waters except single-family systems discharging to lagoons. This “split” responsibility is typical for most states.

The DNR permits clustered systems. The agency requires the designation of a “continuing authority” defined by state rules before an operating permit is issued. The continuing authority is a permanent organization responsible for the operation, maintenance, and upgrading of the cluster system. The hierarchy of acceptable continuing authorities is listed in preferential order in the Missouri regulation. In recent years the legislature created an option of forming a nonprofit sewer company and establishing management guidelines on a watershed basis. For more information see page 49, reference #7 for a link to the Missouri law.

Table 5. *Public institutions as onsite management entities*

Program considerations	State agency	County	Municipality	Sanitation or special district	Improvement district	Public authority
Authority	Enforcement of state laws and regulations.	Enforcement of state codes, county ordinances.	Enforcement of municipal ordinances and state/ county codes.	Powers defined; may include code enforcement.	State statutes define extent of authority.	Duties specified in enabling instrument.
Financing capabilities	Usually funded through appropriations and grants.	Able to charge fees, assess property, levy taxes, issue bonds, appropriate general funds.	Able to charge fees, assess property taxes, issue bonds, appropriate general funds.	Able to charge fees, assess property taxes, issue bonds.	Can apply special property assessments, user charges, other fees; can sell bonds.	Can issue revenue bonds, charge user and other fees.
Advantages	Authority level and code enforceability high; programs can be standardized; scale efficiencies.	Authority level and code enforceability are high; programs can be tailored to local conditions.	Authority level and code enforceability are high; programs can be tailored to local conditions.	Flexible, renders equitable service (only those receiving services pay); simple and independent approach.	Can extend public services without major expenditures; service recipients usually supportive.	Can provide service when government is unable to do so; autonomous, flexible.
Disadvantages	Sometimes not sensitive to local needs and issues; often leaves enforcement up to local entities.	Sometimes unable to provide service, conduct enforcement; debt limits could be restrictive.	Might lack legal, financial, or other resources, thus needing special ordinances.	Could promote duplication/ fragmentation of public services.	Could contribute to fragmentation of government services; can result in initial administrative delays.	Financing ability limted to revenue bonds; local government must cover debt.

Funding management activities

Funding Decentralized Wastewater Systems Using the Clean Water State Revolving Fund. *A fact sheet that explains the Clean Water State Revolving Fund and activities that can be funded. See page 50, reference #8.*

Financial support for management programs is available through grant programs, low-interest loans, or service contracts (see the *Financial Assistance/Funding Fact Sheet* on page 38). A review of funding options reveals that user fees or service charges typically cover operational expenses for management programs (see Tables 7 and 8). If construction is required to install cluster systems or replace significant numbers of existing septic systems, loans, grants or both will likely be needed. Public-private partnerships are also a good source of funding support. Private partners include commercial wastewater sources, because these generators have the most to gain from a successful wastewater management program. The federal government is another source of funding. For example, a public or privately owned/operated RME is eligible under federal guidelines to receive EPA Clean Water State Revolving Fund (SRF) loans. However, many states have not yet implemented the rules needed to authorize these loans for decentralized wastewater programs.

Table 6. *Public/private corporations as management entities*

Management considerations	Public nonprofit corporation	Private nonprofit corporation	Private nonprofit corporation
Authority	Powers are specified in articles of incorporation.	Powers specified in articles of incorporation (homeowner association).	Powers specified in articles of incorporation.
Financing capabilities	Can charge fees; sell stock; issue bonds; accept grants and loans.	Can charge user fees; accept grants and loans.	Can charge fees; sell stock; accept some grants and loans.
Advantages	Can provide service when government is unable to do so; autonomous, flexible.	Can provide service when government is unable to do so; autonomous, flexible.	Can provide service when government is unable to do so; autonomous, flexible.
Disadvantages	Building support for this concept may be challenging.	Range of powers and services likely limited; must partner with empowered entity.	Company might not be fiscally viable; not eligible for some major grant or loan programs.

The following entities have provided support for decentralized programs and facilities in the past. Use the information links below to contact these agencies regarding your program needs:

U.S. Environmental Protection Agency

- The Clean Water State Revolving Fund (CWSRF) is a low- or no-interest loan program that has financed sewage treatment plants across the nation.
  Web site: ***www.epa.gov/owm/cwfinance/cwsrf*** *Phone:* ***202-564-0752***
- The Catalog of Federal Funding Sources for Watershed Protection is a searchable database of financial assistance sources (grants, loans, cost-sharing) available to fund watershed protection projects.
  Web site: ***http://cfpub.epa.gov/fedfund/***
- The Environmental Finance Program provides financial technical assistance to the regulated community and advice and recommendations on issues, trends and options.
  Web site: ***www.epa.gov/efinpage/*** *Phone:* ***(202) 564-4994***
- The Nonpoint Source Pollution Program can support a wide range of nonpoint pollution abatement projects including onsite wastewater system projects.
  Web site: ***www.epa.gov/owow/nps/319hfunds.html*** *Phone:* ***(202) 566-1163***

Financing onsite systems in Pennsylvania

State financing programs for onsite systems often merge various funding streams to provide an accessible, easy-to-use support mechanism for individual system owners. The Pennsylvania Infrastructure Investment Authority (PENNVEST) provides low-cost financing for systems on individual lots or within entire communities. Teaming with the Housing Finance Agency and the Department of Environmental Protection, PENNVEST created a low-interest loan program for low- to moderate-income homeowners. The $65 application fee is refundable if the project is approved. The program can save system owners $3,000 to $6,000 in interest payments on a 15-year loan of $10,000. Since 1999 PENNVEST has approved 230 loans totaling $3.5 million. The program is financed by revenue bonds, special statewide referenda, the state general fund, and the State Revolving Fund. For more information see page 50, reference #12.

U.S. Department of Agriculture

Funding onsite systems and management in Massachusetts

Massachusetts has developed three onsite management funding programs. The first program provides low-interest loans to homeowners to address onsite system problems. Another program provides tax credits of up to $6,000 ($1,500 per year) to defray the cost of system repairs for a primary residence. Finally, the Comprehensive Community Septic Management Program, sponsored by environmental, finance and housing agencies, provides low-interest loans for long-term community, regional, or watershed-based solutions to system malfunctions in sensitive environmental areas. Loans of up to $200,000 (and more, in some cases) are available and are repaid by the communities and homeowners that participate in the program. Funds for these programs include the State Revolving Fund loan program, state general funds, and loans from area banks. For more information see page 50, reference #13 and #14.

- The Rural Housing Service makes funding available to low- and moderate-income rural Americans to acquire homes through several loan and grant guarantee programs.
  Web site: ***http://www.rurdev.usda.gov/in/loansandgrants.htm***
- The Home Repair Loan and Grant Program is for low-income families that own homes in need of repair and offers loans and grants for renovation. Loans are for up to 20 years at one percent interest.
  Web site: ***http://www.rurdev.usda.gov/rhs/sfh/brief_repairloan.htm***
- The Rural Utilities Service loans assist public or nonprofit entities developing water and waste dispersal systems in rural areas and towns with populations of no more than 10,000.
  Web site: ***www.usda.gov/rus/water/programs.htm***
- The Rural Business-Cooperative Service provides guaranteed loans to help create jobs and stimulate rural economies. This program provides guarantees for up to 90 percent of a loan made by a commercial lender.
  Web site: ***www.rurdev.usda.gov/rbs/busp/b&i_gar.htm***

U.S. Department of Housing and Urban Development

- Community Development Block Grants provide annual grants for community development to smaller cities and counties for rehabilitating residential and nonresidential structures, constructing public facilities, and improving water and sewer facilities, including onsite systems.
  Web site: ***www.hud.gov/cpd/cdbg.html*** *Phone:* ***(202) 708-1112***
- The Appalachian Regional Commission helps communities to fund the development of onsite programs.
  Web site: ***www.arc.gov*** *Phone:* ***(202) 884-7799***

Tribal Sources

- The EPA Clean Water Indian Set-Aside Program administers grants in cooperation with the Indian Health Service to address tribal sanitation needs.
  Website: http://www.epa.gov/owm/mab/indian/cwisa.htm Phone: (202) 564-0621
- The Indian Health Service–Sanitation Facilities Construction Program administers the Sanitation Facilities Construction Program to deliver environmental engineering and sanitation facilities to Native Americans.
  Web site: ***www.dsfc.ihs.gov*** *Phone:* ***(301) 443-1046***
- RCAP Native American Program services include onsite technical assistance to address drinking water supply and wastewater treatment needs, including decentralized wastewater training, construction and repair, operator certification, income, and rate surveys.
  Web site: ***www.rcap.org*** *Phone:* ***(202) 408-1273***

Table 7. *Advantages and disadvantages of various funding sources*

Source	Description	Advantages	Disadvantages
Loans	Money lent with interest; can be obtained from federal, state and commercial lending institutions.	State and federal agencies can often issue low-interest loans with a long repayment period. Loans can be used for short-term financing while waiting for grants or bonds.	Loans must be repaid with interest. Lending agency might require certain provisions to ensure repayment of the debt. Commercial loans typically are available at high interest rates and might be difficult to obtain without adequate collateral.
Grants	Funds awarded to pay for some or all of a community project.	Funds do not need to be repaid. Small communities might be eligible for many different grants to build or upgrade their wastewater facilities.	Requires time and money to manage. Wage standards may apply increasing project expense. Might require use of material/ design requirements that exceed local standards resulting in higher costs.
General obligation bonds	Bonds backed by the full faith and credit of the issuing entity. Secured by the taxing powers of the issuing entity. Used by local governments.	Interest rates are usually lower than those of other bonds. Offers considerable flexibility to local governments.	Community debt limitations might restrict use. Voters often must approve of using these bonds. Usually used for facilities that do not generate revenues.
Revenue bonds	Bonds repaid by the revenue of the facility.	Can be used to circumvent local debt limitation.	Do not have full faith and credit of the local government. Interest rates may be higher than those of general obligation bonds.
Special assessment bonds	Bonds payable only from collection of special assessments.	Removes financial burden from local government. Useful when direct benefits can be identified.	Might be costly to some landowners and inappropriate in areas with nonuniform lot sizes. Interest rate may be high.
Bondbank monies	States use taxing power to secure a large-issue bond that can be divided among communities.	States can secure bond at a lower interest rate. The state may issue the bond in anticipation of community need.	Many communities compete for limited amount of bond bank funds.
Certificates of partici-pation (COPs)	Certificate that may be issued by a community to several lenders that participate in the same loan.	Costs and risks spread out over several lenders. In some cases COPs may beissued when bonds would exceed debt limitations.	Involve complicated agreements among participating lenders.
Note	A written promise to pay a debt.	Method of short-term financing while a community is waiting for a grant or bond.	Community must be certain of receipt of the grant money. Notes are risky because voters must approve general obligation bonds before they are issued.
Property Assessment	Direct fees or taxes on property. May include grant and bond anticipation notes. Sometimes referred to as an improvement fee.	Useful when benefits from capital improvements are identifiable. May be used to reduce local-share debt requirements for financing. May be used to establish a fund for future capital investments.	Initial lump sum payment of assessment might be a significant burden on individual property owners. Some states and localities restrict the allowable burden on individuals.
Connection fees	Charges assessed for connection to existing system.	Connection funded by beneficiary. All connection costs might be paid.	Might discourage development. Can be restricted by state and local laws.
Impact fees	Fees charged to developers.	Paid for by only those who profit. Funds may be used to offset costs.	Might reduce potential for development. Can be restricted by state and local laws.

Table 8. *Fee-for-service management agency examples*

Services provided	Service providers	Typical costs to owner
Maintenance reminders. Complaint response.	County health department staff. Owner pays for maintenance services needed.	Negligible
Inspection upon title transfer.	County health department staff. Contracted licensed inspector.	~ $75 to $150 at the time of sale
Inspection every 2 to 5 years. Tank pumped out at time of inspection. Effluent screen cleaned or replaced annually.	County health department staff. Contracted operation and maintenance service providers.	~ $25 quarterly
Inspection of system every year. Effluent screen cleaned or replaced annually. Tank pumped out every 5 years.	County health department staff. Contracted operation and maintenance service providers.	~ $30 to $40 quarterly
Inspection of system every six months. Effluent screen cleaned & replaced annually. Tank pumped out every 5 years.	County health department staff. Contracted operation and maintenance service providers.	~ $15 per month
System inspections as needed. On-call service for problems. Repair of faulty system components. Replacement of system if needed.	Responsible management entity. Contracted service providers.	~ $30 to $35 per month; other charges for repairs or replacement

A Responsible Management Entity (RME) may...

- **Purchase, lease and rent real and personal property**
- **Access and inspect the systems it manages by covenant ordinance or other instrument**
- **Apply for and receive loans and grants for construction of facilities**
- **Enter into contracts, undertake debt obligations, borrow funds, and issue stock or bonds**
- **Establish and collect charges for system usage or oversight**
- **Make rules and regulations regarding the use of systems**
- **Ensure the repair or replacement of malfunctioning systems**

Selecting a management entity

In some cases a community might choose to adopt a basic management approach by selecting management actions to target problem systems, track compliance, and respond to noncompliant owners through a stepwise approach such as (1) notification and persuasion, (2) technical/financial assistance, and (3) enforcement action. In other cases, a community might opt for a more advanced management approach through a Responsible Management Entity (RME). RME management has been the preferred option for areas with very intensive management needs, and it is best suited to areas that include cluster systems (see the *Operation and Maintenance Fact Sheet* on page 44). The common ownership of collection lines and larger treatment and dispersal systems typical of cluster facilities make a "single manager" RME approach preferable. These management entities can also handle individual onsite systems within their jurisdiction and seek to maximize the number of dwellings served in order to be financially sustainable.

Creating a centralized management entity will be a new undertaking for many localities. States and communities can consider several options. In some cases, a management partnership—coordinated by the regulatory authority and supported by local planning agen-

A Guide to the Public Management of Private Septic Systems.
Communities can use this handbook to examine their wastewater treatment options and design a unique program that meets their needs. *See page 51, reference #20.*

cies, service providers, and public agencies—might provide the best option to oversee and implement a program. Another option is to enlist an existing sanitation or other special district to provide a solid base of support for management functions like planning, installation, operation and maintenance, inspection, enforcement, and financing. For example, a sanitation district could be responsible for regional planning, inspecting systems, and ensuring system maintenance such as tank pumping and residuals reuse/dispersal, while the health department would retain authority over approving system designs, issuing permits, and overseeing construction.

Enforcement Authority and Tools

Enforcement authority can be granted through

- **State enabling legislation**
- **Municipal ordinances/ codes**
- **Local health board powers to abate nuisances and provide public health services.**

Onsite management programs use a variety of enforcement tools to compel compliance, from citations and property liens to turning off water service.

Public service providers such as utility districts can also serve as a management entity. Private or public RMEs have been created to manage the full range of decentralized system management activities—from regional planning and system permitting to inspection and enforcement. RMEs can relieve the strain on the regulatory authority by engaging in fee-for-service activities with only occasional compliance support from or intervention by the regulatory authority. The approach selected will be unique and based on each community's situation.

System inspections are a key component of management programs, Clogged septic tank effluent filters (above) can trigger calls for needed service, but regular inspections tailored to system type, setting, and use profile provide a better approach for ensuring long-term system performance.

Septic System Checkup: The Rhode Island Handbook for Inspection. *A Handbook with instructions for gathering septic system records, locating components, diagnosing minor in-home plumbing problems, conducting flow trials, dye tracing, and maintenance scheduling.* *See page 54, reference #56.*

Creation of an onsite management district in Colorado

In 1969 the Crystal Lakes Development Company began building a residential community 40 miles northwest of Fort Collins, Colorado. Three years later the company sponsored the creation of the Crystal Lakes Water and Sewer Association to provide drinking water and sewage treatment services to the growing community. Membership in the Association is required of all lot owners, who must also obtain an onsite system permit from the Larimer County Health Department. The Association enforces county health covenants, assists in system design and installation, monitors surface water and groundwater, and has developed guidelines for inspections, which are conducted at the time of property transfer. The Association conducts preliminary site evaluations for proposed treatment systems.

The county health department has also authorized the Association to design systems. The Association manages wastewater treatment for more than 100 permanent dwellings and 600 seasonal residences. Management services are provided for all systems in the development, including 300 holding tanks, seven community vault toilets, recreational vehicle dump stations, a lodge, offices, a restaurant, and a cluster system that serves 25 homes on small lots. The Association is financed by annual property owner dues of $90 to $180, and a $25 property transfer fee, which covers inspections. For more information see page 53, reference #38.

A formal program evaluation includes:

- An evaluation team composed of stakeholders
- A review of goals, objectives, and operational components of the various management program elements using a checklist to identify which program elements already exist and evaluate whether they are meeting their objectives
- A review of the program elements and feedback collected from staff and stakeholders to determine the level of progress toward goals and objectives and to assess current status, trends, administrative processes, and cooperative arrangements with other entities.
- Identifying program elements in need of improvement, as well as actions or amounts and types of resources needed to address deficient program areas
- Identifying sources of additional support or assistance to improve program performance
- Communicating suggested improvements to program managers for consideration in program structure and function

Evaluating the program

Septic System Checkup: The Rhode Island Handbook for Inspection. *A Handbook with instructions for gathering septic system records, locating components, diagnosing minor in-home plumbing problems, conducting flow trials, dye tracing, and maintenance scheduling. See page 54, reference #56.*

Monitoring of program performance is key to effective decentralized wastewater management. The management authority should regularly review inspection reports, water quality monitoring data, customer complaints, and fee structures to track the progress of the management program in achieving goals and objectives. Although an annual management program review is recommended, the management program should be able to make interim adjustments in response to unanticipated problems that arise during the course of normal operations.

The 13 program elements listed in Appendix A provide a framework for reviewing and adapting management approaches. The evaluation method you choose for each program, like the program itself, will depend on local circumstances, the types and number of stakeholders involved, and the level of support by management agencies.

Additional information and resources

This handbook should be used in tandem with the EPA *National Voluntary Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems* (see reference #4) as a starting point for developing and implementing an effective decentralized wastewater treatment management program. EPA has also developed information on decentralized wastewater treatment management to supplement this handbook. The information is available on the EPA web site at www.epa.gov/owm/onsite. Information is also available from the EPA cooperating partners listed on page 55.

There is no "cookie-cutter" approach for improving decentralized wastewater system management. By following the steps outlined in this handbook and using the resources listed in appendices A and B along with supplemental materials on EPA's web site, you can develop the program that best fits the needs and resources of your community.

EPA FACT SHEETS

Decentralized Wastewater Management Program Elements

Program Management Elements

Administration

1. Public education
2. Planning
3. Performance requirements
4. Recordkeeping and reporting
5. Financial assistance

Installation

6. Site Evaluation
7. System design
8. Construction and installation

Operation and Compliance

9. Operation and maintenance
10. Residuals management
11. Training and certification/ licensing
12. Inspections and monitoring
13. Corrective actions and enforcement

Develop or enhance decentralized wastewater treatment management program

FACT SHEET 1

Public Education and Participation

Decentralized wastewater management programs require public support. The success of these programs will depend on how well homeowners, system service providers, and other stakeholders are involved in the development process. Unless people understand the need for a management program, there is little chance it will be adopted. Once in operation, the program must keep the community involved and informed to perform at its best.

Relationship to Other Program Elements

Involving and educating homeowners, service providers, and the public will set the groundwork for how well a management program is received and ultimately how well it performs. Public awareness is particularly crucial when it comes to initiating several management program elements including planning, inspections/monitoring, operation/maintenance, corrective actions, and financial assistance.

Options

Public education and participation can be implemented by regulatory agencies or through cooperative actions supported by program partners. The figure below shows the varying approaches to public education and participation.

Public Education and Participation Approaches	
Basic	➤ Promote public awareness of management program development and rule revisions. ➤ Distribute multimedia materials on basic system operation and maintenance needs. ➤ Reminders sent to owners when operation and maintenance should be scheduled.
Intermediate	➤ Public involvement in program development and annual program reviews. ➤ Develop locally specific educational materials including information on watershed impacts. ➤ Provide users with lists of approved service providers. ➤ Provide information through workshops, fairs, schools, and other events to educate system owners on them on operation and maintenance, health and environmental impacts, causes of malfunction, and program procedures.
Advanced	➤ Involve public in program development, annual program reviews, and public education and outreach efforts. ➤ Educate homeowners about management program advisory boards, variance and complaint review panels. ➤ Work with homeowners in system design phase and during inspections to optimize management program performance and acceptability. ➤ Conduct outreach programs at civic, school, and other events to answer questions and obtain feedback from citizens.

Examples

In south Deschutes County, Oregon, a decentralized wastewater project determined that education was the key to public support of the maintenance program. The project team involved and educated homeowners, real estate professionals, and building contractors through a one-hour training session that provided continuing education unit credits for real estate professionals.

Key Evaluation Questions

- What are your outreach objectives, messages, target audiences, and communication venues?
- Which activities would benefit from public or partner involvement, and how can we implement them?

FACT SHEET 2

Planning

Planning can be used to integrate management strategies for areas served by both centralized and decentralized wastewater treatment facilities. Integrating wastewater planning functions provides better long-term management of facilities and can help local officials deal with a number of needs such as sewer overflows, NPDES effluent limitations, Total Maximum Daily Loads, and antidegradation requirements. Variables to consider during the planning process include wastewater flows, proximity and uses of nearby water resources, landscape topography, hydrology, hydrogeology, soils, environmentally sensitive areas, system options and locations, population densities, and need/potential for clustering treatment/reuse facilities.

Relationship to Other Program Elements

Planning is the foundation for many program elements including the establishment of local performance requirements and criteria used for site evaluation, system design, construction, inspections, operation and maintenance, and residuals management .

Options

Planning can be implemented by enhancing existing planning and zoning programs or through integrated wastewater facility planning. The figure below shows the varying approaches to planning.

Planning Approaches	
Basic	➤ Work with local and regional planning agencies to access and utilize information such as soils data and planning requirements.
Intermediate	➤ Assess vulnerabilities of receiving waters. ➤ Identify treatment standards based on health and water resource risks.
Advanced	➤ Establish overlay treatment zones based on environmental sensitivity and potential health impacts. ➤ Identify cluster system opportunities for existing and new developments.

Example

In Prince George's County, Maryland, the Department of Environmental Resources and the Health Department worked together to develop geographic information system (GIS) tools to quantify and mitigate nonpoint source nutrient loadings to the lower Patuxent River, which empties into the Chesapeake Bay. The agencies developed a database of information on existing onsite systems, including system age, type, and location, with additional data layers for depth to ground water and soils. The resulting GIS framework allows users to quantify nitrogen loadings and visualize likely impacts under a range of management scenarios to be used to manage wastewater in new developments.

Key Evaluation Questions

- Do current land use planning and zoning approaches consider the full range of wastewater treatment options?
- Are centralized and decentralized wastewater planning and management approaches integrated?

FACT SHEET 3

Performance Requirements

Performance requirements for systems are derived by characterizing the risks they pose to health and water resources and by setting pollutant loading limits based on limiting those risks to specific levels. Performance requirements specify objectives for each wastewater management system, which may include physical, chemical, and biological process components. Performance compliance is based on cumulative, extrapolated pollutant removals for the various system components (e.g., septic tank, suspended growth or fixed film reactors, lagoons, wetlands, soil, disinfection). Performance can be measured via numeric or narrative criteria. Numeric criteria reflect time-based mass loadings or pollutant concentration limits designed to protect sensitive water resources. Pollutants commonly targeted in performance requirements include nutrients, bacteria, oxygen demand, and solids.

Relationship to Other Program Elements

Performance requirements are derived from planning goals and projected system impacts, site evaluations, system design, inspections/monitoring, and operation/maintenance.

Options

Performance requirements can be implemented through regional analysis, planning, statutes, ordinances, and actions by the regulatory authority. The figure below shows the varying approaches to performance requirements.

Performance Requirements Approaches	
Basic	➤ Prevent direct and indirect contact with wastewater through prescribed site requirements, hydraulic loading restrictions, and separation distances. ➤ Designate specific and acceptable system designs.
Intermediate	➤ Specify alternative technologies for certain sites or conditions that do not meet prescribed requirements. ➤ Establish inspection and maintenance reporting requirements based on system type and performance desired.
Advanced	➤ Identify water resource uses and characterize surface and groundwater quality. ➤ Evaluate cumulative impacts/allotments for all sources of critical pollutants. ➤ Establish numeric and narrative performance requirements for onsite/decentralized systems based on water quality criteria and assimilative capacity of land and water resource(s). ➤ Develop protocols and frequencies for measuring (monitoring/ inspections) compliance.

Examples

Massachusetts' onsite regulations designate several specific areas as "nitrogen-sensitive." Onsite systems in those areas must remove at least 40 percent of the influent nitrogen loading. Restrictive maximum discharge flows are specified per acre/day unless the treatment systems can meet certain specific requirements for nitrogen reduction.

Key Evaluation Questions

- Which water resources receive treated effluent and what are their uses and protection criteria?
- What loading limits should apply to which systems, given the cumulative and mass pollutant loads expected?
- How can we implement or apply these loading or concentration limits to treatment systems (e.g., through permits)?

FACT SHEET 4

Recordkeeping, Inventories, and Reporting

System inventories provide the nuts and bolts for onsite management. Basic system information—GIS location, type, design capacity, owner, installation, and servicing dates—is essential to an effective program. The best recordkeeping programs feature integrated electronic databases with field unit data entry (i.e. using a hand-held PDA), save-to-file CAD drawings, and user-specified reporting formats.

Relationship to Other Program Elements

Data collection and inventories provide information for planning and support establishment of performance requirements for critical areas. All program elements rely on system inventories, reports, and similar data—particularly planning, inspections/monitoring, operation/maintenance, and compliance/enforcement.

Options

Recordkeeping, inventories, and reporting are implemented by management agencies and RMEs. The figure below shows the varying approaches to recordkeeping, inventory and reporting.

Recordkeeping, Inventories, and Reporting Approaches	
Basic	➤ Maintain system inventory, site evaluation, construction permit, and inspection files. ➤ Conduct maintenance reminder and public education programs.
Intermediate	➤ Develop reporting approaches to collect operation and maintenance information from service providers and from inspections, in addition to system inventory. ➤ Institute electronic reporting and database system for operating permit program actions.
Advanced	➤ Provide system inventory and tracking system as an intermediate approach with watershed characterization information and data to assist staff and state agency. ➤ Develop interactive, real-time information tracking programs to maximize productivity. ➤ Track watershed and groundwater trends. ➤ Facilitate reporting to oversight agencies and maximize public education/involvement.

Examples

Cuyahoga County, Ohio developed a Microsoft Access Database to enter, access, and track permits, system drawings, evaluation results, and other information on each onsite system. The database allows the county to respond to homeowner and service provider questions and send out tank pumping reminders as needed.

Key Evaluation Questions

- Does our tracking system for new permits contain GIS location, system size and type, installation date, design capacity, and other key data (system components, site evaluation report, facility type)?
- How do we report, track, and manage data on inspections, repairs, pumpouts, and other services?
- Can our data be used for new development planning and generating service reminders?
- Are we coordinating our inventory and reporting systems with those of our partners (e.g., planning office)?
- Can we use our data to track service provider performance, training needs, and identify other management needs?

FACT SHEET 5

Financial Assistance and Funding

Financial assistance is needed to:

1) Develop or enhance a management program.
2) Provide support for the construction and modification of wastewater facilities.
3) Support operation of the program.

Funding for program development and operation is often available from public and private loan or grant sources, supplemented by local matching funds. It can also be derived from some form of resource sharing among management program partner organizations such as planning departments or health and water resource agencies. Developing a responsible management entity (RME) and financing for the construction and operation of facilities require larger investments which might come from grants and loans. Long-term operating costs are usually borne by system users through payment of fees and tax assessments.

Relationship to Other Program Elements

Program funding and other financial support is essential to develop, implement, and maintain a management program. All program elements depend on cash or in-kind support.

Options

Funding support can be acquired through grants, loans, user fees, and other assessments. The figure below shows the varying levels of financial assistance approaches.

Financial Assistance and Funding Approaches	
Basic	➤ State/local governments provide necessary legal and administrative support to conduct all aspects of the management program.
Intermediate	➤ State/local funds support basic administrative and other costs. ➤ Work with state, tribal, or local governments and local lending institutions to develop low interest loan programs. ➤ Provide guidance to help owners seek funding for system upgrades or replacement.
Advanced	➤ State/local funds support basic administrative and other costs. ➤ Grants, cost-share funds, low-interest loans, or other programs help low income owners pay for system repairs or replacement. ➤ User fees cover inspections, repair, replacement, operation and maintenance costs, and a sinking fund to cover future infrastructure needs.

Examples

The Commonwealth of Massachusetts has developed three programs that help finance onsite systems and management programs. The loan program provides loans at below-market rates. Another program provides a tax credit of up to $4,500 over three years to defray the cost of system repairs for a primary residence. Finally, the Comprehensive Community Septic Management Program provides funding for long term community, regional, or watershed-based solutions to system malfunctions in sensitive environmental areas. Low interest management program loans of up to $100,000 are available.

Key Evaluation Questions

- What management activities and infrastructure needs require funding, financing, or other support?
- Are some essential management activities or infrastructure needs underfunded? By how much?
- Where can funding for these activities or facility components come from?

FACT SHEET 6

Site Evaluation

Evaluating a proposed site in terms of its environmental conditions, physical features, and characteristics provides the information needed to size, select, and locate the appropriate wastewater treatment system. Regulatory authorities issue installation permits based on the information collected and analyses performed during the site evaluation. Prescriptive site evaluation, design, and construction requirements are based on experience with conventional septic tank/soil absorption systems and empirical relationships that have evolved over the years. A soil analysis using core sampling to a depth of 4-6 feet or a backhoe pit, rather than a simple percolation test, provides the best approach for assessing soils, seasonal water table fluctuations, and other subsurface site features. Performance-based approaches require a more comprehensive site evaluation. Site evaluation protocols may include presently employed empirical tests, specific soil properties tests and soil pits to characterize soil horizons, mottling, and a variety of other properties.

Relationship to Other Program Elements

Site evaluations that consider soils, slopes, water tables, surface hydrology, overall system densities, and other features provide the basis for system design and help to focus on planning and the establishment of performance requirements.

Options

Site evaluation protocols are adopted by the regulatory authority and implemented through training, outreach, and certification/licensing programs. The figure below shows the varying approaches to site evaluation.

Site Evaluation Approaches	
Basic	➤ Require assessment of site hydraulic acceptance and other physical features, including slope and vertical and horizontal setbacks for soil-based systems to determine compliance with prescriptive rules. ➤ Require licensed/certified site evaluators.
Intermediate	➤ Prescribe a broader set of site conditions to permit prescribed alternative technologies. ➤ Require third-party licensed/ certified site evaluators. ➤ Designate alternative systems for sites not meeting conditions prescribed for conventional systems.
Advanced	➤ Provide supplemental protocols for assessing site assimilative and treatment capacity keyed to local hydrogeology and critical pollutants. ➤ Characterize critical design and performance requirements and system boundaries. ➤ Provide supplemental certification/licensing training for site evaluators to meet local needs.

Examples

In 1997, Texas eliminated percolation test requirements for onsite systems and instituted new performance requirements for alternative systems such as drip systems, intermittent sand filters, and leaching chambers. Site evaluations in Texas are now based on soil and site analyses. Service providers must also be certified. State officials took these actions after onsite system installations nearly tripled between 1990 and 1997.

Key Evaluation Questions

- What are the current site evaluation procedures and how are they linked to various system design options?
- Who is authorized to conduct site evaluations and what are the education, training, or certification requirements?

FACT SHEET 7

System Design

Decentralized wastewater treatment system design requirements focus on protection of public health and water resources. However, systems should also be affordable and aesthetically acceptable. Prescriptive codes that specify standard designs for sites meeting minimum criteria simplify design reviews but limit development options and the potential for meeting performance requirements. Where management programs rely on the state code for design, there may not be any need for special design protocols. However, in sensitive environments where performance codes are employed, there is a need to include a design protocol even if it only expands the number of prescriptive system choices and site parameters for sites that do not meet the conditions for conventional systems. Design protocols should address the potential implications of water conservation fixtures, impacts of different pretreatment levels on hydraulic and treatment performance of soil-based systems, and the operation and maintenance requirements of different pretreatment and soil dispersal technologies.

Relationship to Other Program Elements

System designs are based on the program elements of performance requirements, site evaluations, and planning-level considerations. System design will also affect the inspection/monitoring elements of a management program as well as operation/maintenance requirements.

Options

System designs are developed by certified professionals or the regulatory authority. The figure below shows the varying approaches to system design.

System Design Approaches	
Basic	➤ Design only conventional septic tank/gravity-flow soil treatment systems on sites meeting code-described prescriptive criteria. ➤ Require state certified/ licensed designers.
Intermediate	➤ Allow limited number of alternative designs on certain code-specified non-compliant sites. ➤ Require state certified designers; provide potential for engineered alternative designs for larger and cluster systems.
Advanced	➤ Institute protocols for use of risk-based designs based on site evaluation results, specific wastewater sources, planning considerations, and receiving water uses ➤ Provide supplemental training and licensing/certification for designers based on specific needs of local water resources.

Examples

The New England Interstate Water Pollution Control Commission adopted a regional, interstate process for reviewing proposed wastewater treatment technologies. A technical review committee evaluates innovative and alternative technologies as well as system components that replace part of a conventional system, modify conventional operation or performance, or provide a higher level of treatment than conventional onsite systems.

Key Evaluation Questions

- What sort of system designs are allowed on which type of sites and who develops the system design?
- Is there a need to adopt a performance design approach or to expand the type of systems and sites allowed?
- If more complex designs are permitted, how can we assure that they are competently reviewed?

FACT SHEET 8

Construction/Installation

Poor installation can adversely affect performance of both conventional and advanced systems that rely on soil dispersion and treatment. Most jurisdictions allow installation or construction to begin after issuance of a construction permit, which occurs after the design and site evaluation reports have been reviewed and approved. Performance problems linked to installation/construction are typically related to soil moisture conditions during construction, operation of heavy equipment on soil infiltration areas, use of unapproved construction materials (e.g. unwashed aggregate containing clay or other fines), and overall construction practices (e.g. altering trench depth, slope, length, location). The impacts of improper installation of soil-based systems generally occur within the first year of operation in the form of wastewater backups. Some improper construction practices may not be as evident, and may take years to manifest themselves in the form of degraded groundwater or surface water. Inspections by the regulatory authority or other approved professional should be conducted at several stages during the system installation process to ensure compliance with design and regulatory requirements.

Relationship to Other Program Elements

The primary program element linked to installation of the system is training, certification and licensing of installers.

Options

Construction and installation of systems is typically coordinated by the regulatory authority through the permitting, inspection, and oversight process. The figure below shows the varying approaches to construction/installation.

Construction/Installation Approaches	
Basic	➤ Construction permit based on code-compliant site evaluation and system design. ➤ Installation by trained professionals. ➤ Inspection of system prior to backfilling to confirm installation complies with design.
Intermediate	➤ Use of more proactive measures such as pre-construction meeting at site with owner, installer during all phases of construction. ➤ Maintain certification/licensing and training requirements for installers.
Advanced	➤ Provide extensive construction oversight for all critical steps such as field verification and staking of system components; inspections after backfilling and installation are complete. ➤ Supplemental training for installers on difficult sites and new technologies. ➤ Verification and database entry of as-built drawings and other installation information.

Examples

The Responsible Management Entity (RME) for Shannon City, Iowa uses its trained and certified staff or USDA Rural Development staff to provide construction oversight. Final pre-cover inspection and permitting are also performed by the Union County Sanitarian.

Key Evaluation Questions

- Are installers trained and certified/licensed to build or install the type of systems they are working with?
- Do inspectors visit the site before, during, and after installation to verify that design directives were followed?
- Are records of system design, location, installer, owner, and as-built drawings kept in permanent files?
- Is advanced training available for installers who work with new technologies, difficult sites, and other challenges?

FACT SHEET 9

Operation and Maintenance

O&M for most systems includes some user awareness of inputs that might impact treatment processes, such as strong cleaners, lye, acids, biocides, paint wastes, oil and grease, etc. Gravity flow soil-infiltration systems require little O&M beyond limiting inputs to normal residential wastes, cleaning effluent screens/filters, and periodic (e.g. every 3–7 years) tank pumping. Systems employing advanced treatment technologies and electromechanical components require more intensive O&M attention, e.g., checking switches and pumps, measuring and managing sludge levels, monitoring and adjusting treatment process and system timers, checking effluent filters, monitoring effluent quality, and maintaining disinfection equipment. Operators and service technicians should be trained and certified for the types of systems they will be servicing; services should be logged and reported to the management program so that long-term performance can be tracked. The use of a dial-up modem or Internet-based monitoring equipment can improve operator efficiency and performance tracking when large numbers of systems are involved.

Relationship to Other Program Elements

O&M is linked most closely to system design, inspection and monitoring, residuals management, performance requirements, and recordkeeping and reporting. O&M also relates to training and certification for service providers.

Options

O&M can be implemented through homeowner education (for simple gravity-driven, soil-based systems), trained service providers (for more complex systems), or RMEs (for systems owned/operated by a responsible management entity). The table below summarizes basic, intermediate, and advanced approaches.

Operation and Maintenance Approaches	
Basic	➤ O&M educational materials and service reminders circulated to system owners ➤ Complaint response protocols published ➤ Only certified/licensed O&M providers can be used
Intermediate	➤ Maintenance contracts and reporting required for electro-mechanical systems ➤ Operating permits renewable upon reported completion of required O&M tasks and inspections ➤ Prescriptive requirements for surface risers and inspection ports
Advanced	➤ Trained, certified service providers handle O&M tasks for all systems in accordance with established protocols ➤ Supplemental training and certification programs provided or supported by RME through training centers or other means ➤ Electronic access to O&M records by field personnel ➤ O&M provider performance reviews frequently updated and local approval list disseminated

Examples

Fairfax County, Virginia requires septic tank pumping every five years. System owners must provide the county health department with a written notification within 10 days of the pump-out. A receipt from the pump-out contractor, who must be licensed to handle septic tank residuals, must supplement the notification.

Key Evaluation Questions

- Do we have clearly defined O&M requirements based on system type and performance requirements or risk factors?
- Are operators and service personnel trained and certified before servicing systems?
- How are O&M services reported to the management program? Is the data easily entered and retrieved?
- Are system owners aware of waste restrictions, their system type, and how to access O&M services?

FACT SHEET 10

Residuals Management

The primary objective for septage management is to establish procedures for handling and dispersing the material in a manner that protects public health and water resources and complies with applicable laws. Approximately 67 percent of the estimated 12.4 billion gallons of septage produced annually in the U.S. is hauled to POTWs or other facilities for treatment, while the remaining 33 percent is land applied. Federal regulations (under 40 CFR Part 503) and state/local codes strive to minimize exposure of humans, animals, and the environment to chemical contaminants and pathogens that may be present in septage. Residuals management programs include tracking or manifest systems that identify sources, pumpers, transport equipment, final destination, and treatment or management techniques.

Relationship to Other Program Elements

Residuals management is closely linked to planning, operation/maintenance, inspection/monitoring, and training/certification of service providers. Public education is also a key factor when new residual facilities are proposed.

Options

Residuals can be land-applied after proper treatment, discharged to a septage or wastewater treatment plant, or delivered to an approved dispersal site. The figure below shows the varying approaches to residual management.

Residuals Management Approaches	
Basic	➤ Assure that residuals are being reused or managed in compliance with applicable federal, state, and local requirements ➤ Educate and remind owners of the need to inspect and/or pump tanks. ➤ Require only state-certified/ licensed O/M residuals handlers using approved sites and management practices.
Intermediate	➤ Require homeowners and licensed/certified service providers to report when tanks are inspected, residuals are removed, and how the residuals are managed in order to renew operating permit. ➤ Maintain and disseminate list of acceptable O&M service providers.
Advanced	➤ Create and administer tracking, inspection, and monitoring plan for all aspects of tank inspections, residuals removal, hauling, treatment, and reuse/disposal. ➤ Provide any necessary supplemental training and registration/licensing programs for local O&M providers or arrange it with training centers and universities. ➤ Develop contingency plans for alternative management practices or disposal sites. ➤ Employ only approved service providers.

Examples

Hollis Warren Incorporated has operated a dedicated land application site for septage in Kent County, Delaware for more than 10 years. The operation processes 4 million gallons of septage annually by screening, grit removal, and lime stabilization. The decanted liquid is then land applied to irrigate reed canary grass, corn, and soybeans. Solids removed during decanting are applied at agronomic rates to farmland for beneficial reuse as a soil amendment.

Key Evaluation Questions

- Where are pumpers currently hauling septage removed from tanks, and how is it treated, used, or dispersed?
- Do we have adequate capacity to handle current and future septage loads?
- What are the barriers to expanding existing land application and septage facilities or establishing new ones?
- Can the management program provide support (e.g., public education, financing) to overcome these barriers?

FACT SHEET 11

Training and Certification/Licensing

A variety of professionals and technicians including planners, regulators, designers, installers, operators, pumpers, and inspectors, are all involved in some aspect of a decentralized wastewater management program. Training, along with certification or registration, provides system owners and users with competent service providers and “raises the bar” in promoting professionalism among the industry. Service providers need to have a solid working knowledge of treatment processes, system components, performance options, operation/maintenance requirements, and laws/regulations. This training can be provided by universities, colleges, technical schools, agency-sponsored training programs, regional/local workshops, or formal/informal apprenticeship programs. Service providers should have extensive and detailed knowledge of their particular service area and a general grasp of other related activities (e.g. planning or site evaluation). Opportunities for cross-training, joint accreditation/certification, and sharing of training resources should be pursued wherever possible.

Relationship to Other Program Elements

Training and certification are linked primarily to site evaluation, design, construction, residuals management, inspections/monitoring, and operation/maintenance.

Options

Training and certification programs can be implemented by the regulatory authority, RME, or other regional/national trade organizations. The figure below shows the varying approaches to training, certification and licensing.

Training and Certification/Licensing Approaches	
Basic	➤ Require homeowners to use only state or tribal certified/licensed service providers. ➤ Track and investigate system owner complaints.
Intermediate	➤ Support more comprehensive state/tribal training requirements for certificate or license. ➤ Create and disseminate lists of acceptable service providers contingent on their accuracy of reporting and service complaint investigations.
Advanced	➤ Develop an inspection program and performance reviews for approval of service providers in district. ➤ Implement supplemental training programs for service providers seeking to perform services based on local protocols, system variations, and other specifications.

Examples

A number of states and national trade groups such as NSF International, the National Association of Wastewater Transporters, National Environmental Health Association, and the National Environmental Service Center have developed training and accreditation programs to verify the proficiency of persons performing system inspections and other services. Training and certification programs include written and field tests and have continuing education requirements. Providers that past tests are often included on vendor lists which help to support quality services.

Key Evaluation Questions

- What state or regional training and certification programs are available, and for which service areas?
- Can we approve joint accreditation or common recognition for regional, state, or multi-state training/certification?
- Are apprenticeships available for providers-in-training opting for experienced-based competency approaches?

FACT SHEET 12

Inspection and Monitoring

Perhaps the most significant shortcoming in existing management programs is the lack of regular inspections and performance monitoring. Area-wide monitoring regimes include testing groundwater and surface waters for indicators of poor treatment, such as the presence of human fecal bacteria and excess nutrients. All systems need to be inspected, at an interval defined by the technological complexity of system components, the receiving environment, and the relative risk posed to public health and valued water resources. The best approach is to establish an inspection regime and schedule based on the consideration of the system's relative reliance on electromechanical components combined with health and environmental risk. Less effective surrogate approaches include, in order of descending effectiveness:

1) Requiring comprehensive inspections at regular intervals.
2) Third party inspections at the time of property transfer.
3) Inspections only as part of complaint investigations.

Relationship to Other Program Elements

Inspection and monitoring are defined by source characterization, site evaluation, and system design, and are influenced by planning objectives and residuals management and performance requirements.

Options

Inspections and monitoring can be implemented by regulatory authority personnel, RME staff, or third-party inspectors. The figure below shows the varying approaches to inspections and monitoring.

Inspection and Monitoring Approaches	
Basic	➤ Educate homeowners on how and when to conduct basic walkover inspections. ➤ Require comprehensive inspections by licensed/certified persons at time of property transfer, change in system use, and complaint investigation. ➤ Require only trained inspectors.
Intermediate	➤ Specify regular operating inspections of all systems as part of operating permits ➤ Develop inspection reporting program with O&M provider/homeowner inputs ➤ Permit only licensed/certified inspectors to perform comprehensive inspections.
Advanced	➤ Conduct aquifer or watershed and pretreatment system effluent monitoring. ➤ Regularly evaluate monitoring data and permit requirements to determine if any program adjustments are needed. ➤ Develop supplemental training programs specific to local needs for approved inspectors. ➤ Formalize comprehensive system construction inspections.

Examples

Wisconsin requires management plans with maintenance or service contracts stipulating inspection/monitoring schedules for certain systems with electromechanical components. Property deeds must note that management plans are in effect. Inspection/monitoring services must be provided by a licensed, certified, or registered provider.

Key Evaluation Questions

- ➤ Are system inspections required?
- ➤ Is the inspection schedule based on system type and relative risk factors?
- ➤ Who is authorized to conduct inspections or monitoring, and how are they trained and certified?
- ➤ How are inspection/monitoring results reported and it is required to be provided to regulators?

FACT SHEET 13

Corrective Actions and Enforcement

A decentralized wastewater management program should be enforceable in order to assure compliance with laws and to protect public health and the environment. Management agencies should have the legal authority to adopt rules and assure compliance by levying fines, fees, assessments, or by requiring service providers to respond to system malfunctions. Emphasis should be placed on those tools that encourage compliance, rather than punishment. It also helps to have the support of the courts to implement an effective enforcement program. In order to assure compliance, management agencies typically need authority to:

- Respond promptly to complaints.
- Provide meaningful performance inspections.
- Issue notices of violation (NOVs).
- Implement consent orders and court orders.
- Hold formal and informal hearings.
- Issue civil and criminal actions or injunctions.
- Condemn systems and/or property.
- Correct system malfunctions.
- Restrict real estate transactions.
- Issue fines and penalties.

Relationship to Other Program Elements

The enforcement program provides backup and support for planning, site evaluation, construction, certification/ licensing, residuals management, inspections/monitoring, and operation/maintenance.

Options

The enforcement component of the management program is typically a function of the powers granted to it. The figure below shows the varying approaches to corrective actions and enforcement.

Corrective Actions and Enforcement Approaches	
Basic	➤ Issue Notice of Violation (NOV) and negotiate compliance schedules for problems. ➤ Administer enforcement program with fines or penalties for malfunctions ➤ Comply with requirements in a timely manner.
Intermediate	➤ Develop revocable operating permit program to assure corrective actions through required inspections and enforcement. ➤ Create electronic reporting system to track corrective measures with real-time input from staff and service providers.
Advanced	➤ Implement public education and involvement programs that promote the economic and health/environmental protection benefits of code compliance. ➤ RME implements corrective actions with power to compel compliance by imposing property liens or other enforcement instruments.

Examples

Cranberry Lake, New Jersey passed an ordinance which requires owners/operators of onsite systems to operate and maintain their systems, pump out tanks as needed, perform repairs, maintain service records and issue reports. Those failing to comply can face fines up to $1,000 per day, up to 90 days of community service, and court proceedings.

Key Evaluation Questions

- Does a complaint response system exist, and do residents know how to use it?
- Are there local ordinances and legal procedures in place to enforce codes and health/environmental rules?
- Do inspectors have the right to enter private property to inspect systems and assess needed repairs?
- Is there a public outreach and involvement program to engage and educate people on the benefits of compliance?

References and resources

These resources are offered to provide additional information on decentralized wastewater treatment management. Many of these sources are referred to in the Handbook and correspond to the reference number below.

Management Resources

Informational Databases and Websites

1. U. S. Environmental Protection Agency Surf Your Watershed
Gathers environmental information available by geographic units by state, watershed (Surf's primary focus), county, metro area, and tribe. Visit Website http://cfpub.epa.gov/surf/locate/index.cfm

2. U.S. Environmental Protection Agency 2002 National Assessment Database.
Summarizes electronic information submitted by the states to EPA in the 2002 water quality reporting cycle. This information should not be used to compare water quality conditions between states or to identify statewide or national trends because of differences in state assessment methods and changes to EPA guidance. This represents the most recent electronically available state water quality information. We are currently assembling information for the 2004 reporting cycle. To access this information visit http://www.epa.gov/waters/305b/index.html

3. U.S. Environmental Protection Agency Site for Onsite and Clustered (Decentralized) Wastewater Treatment Systems.
Website provides tools for communities investigating and implementing decentralized management programs and contains fact sheets, program summaries, case studies, links to design manuals and other materials, and a list of state health department contacts. Visit http://cfpub.epa.gov/owm/septic/index.cfm for more information.

Guidance and Policy Documents

4. U.S. Environmental Protection Agency Voluntary Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems.
This guide provides information on the impacts of decentralized wastewater systems, the need for management, and five management program models that can be used by states and communities. Visit the EPA Website to view this document at http://cfpub.epa.gov/owm/septic/septic.cfm?page_id=268

5. Response to Congress on Use of Decentralized Wastewater Treatment Systems.
This EPA document describes the benefits and barriers to implementing an onsite wastewater management program. It can be downloaded from http://cfpub.epa.gov/owm/septic/index.cfm

6. Model Ordinances to Protect Local Resources.
This web site includes model ordinances to serve as a template for those charged with making decisions concerning growth and environmental protection. For each model ordinance listed, there are several real -life examples of ordinances used by local and state governments around the nation (onsite sewage is included under the illicit discharges category). Visit http://www.epa.gov/owow/nps/ordinance/index.htm

7. Missouri Onsite Regulatory Authority
is specified in: 10 CSR 20-6.010, Construction and Operating Permits, Continuing Authority http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-6a.pdf and Missouri Revised Statutes, Chapter 398.825, http://www.moga.mo.gov/statutesearch/

Financial Assistance/Funding Documents

8. Funding Decentralized Wastewater Systems Using the Clean Water State Revolving Fund.
This fact sheet explains the Clean Water State Revolving Fund and the types of activities that can be funded. It can be downloaded from http://www.epa.gov/owm/cwfinance/cwsrf/factsheets.htm#Decentralized

9. Valuing Decentralized Wastewater Technologies A Catalog of Benefits, Costs, and Economic Analysis Techniques.
Presents a "catalog" of the economic advantages and disadvantages of decentralized wastewater systems relative to larger scale, centralized solutions. It also discusses techniques that can be used to place economic values on positive and negative impacts brought about by a community's choice of a wastewater system. Visit http://www.rmi.org/images/other/Water/W04-21_ValuingDecentralizedWastewater to download the report.

10. National Decentralized Water Resources Capacity Development Project Case Studies of Economic Analysis and Community Decision Making for Decentralized Wastewater Systems.
This report examines how communities consider and value the benefits and costs of different scale wastewater facility options (onsite, cluster, and centralized options) in monetary or other terms, and examines the driving issues, motivations, thought processes, and decision-making methods of stakeholders relative to choices of wastewater system scale. Case study communities are included. Visit http://www.rmi.org/rmi/Library/W04-20_EconomicAnalysisCommunityDecisionMaking to download the report.

11. Rural Empowerment Zone and Economic Community Program.
The road to economic opportunity and community development starts with broad participation by all segments of the community. This Website provides information on how to involve the community and develop a strategic plan. Visit http://www.ezec.gov/index.html

12. PENNVEST Onlot Sewage Disposal Funds
PENNVEST was established in 1988 to help provide more than $2.5 billion for improvements in Pennsylvania's drinking water, sewer and stormwater systems. PENNVEST provides Low-cost financing for wastewater systems across the Commonwealth. See the PENNVEST Website http://www.pennvest.state.pa.us/ or go directly to http://www.pennvest.state.pa.us/portal/server.pt/community/programs/9322

13. Community Onsite System Management Program.
Provides tools to help communities regulate and manage on-site systems. See Website http://www.mass.gov/dep/water/wastewater/onsite.htm

14. Potential Roles for Clean Water State Revolving Fund Programs in Smart Growth Initiatives.
The CWSRF is a widely available financing source used to fund municipal wastewater treatment projects as well as nonpoint source pollution control and estuary protection projects. See Website http://www.epa.gov/owmitnet/cwfinance/cwsrf/smartgro.pdf

15. Onsite Wastewater Management: Cost and Financing
Several approaches are being used to collect the funds necessary to maintain an onsite wastewater management system. Visit http://ohioline.osu.edu/aex-fact/0751.html to view this fact sheet.

Planning/Decision-Making Resources

16. Building Our Future: A Handbook to Community Visioning.
This manual provides community residents with a process for planning for their mutual future. It can be downloaded from http://dnr.wi.gov/org/es/science/landuse/data_wkshp/future.pdf

17. Choices for Communities: Wastewater Management Options for Rural Areas.
This 17-page document helps communities explore their wastewater treatment options. It can be downloaded from http://www.ncswastewater.com/images/Symposium09/01MHooverChoices.pdf

18. City of Vancouver Citizen Handbook on Building Community.
The handbook is meant to encourage more active citizens—people motivated by an interest in public issues and a desire to make a difference. See http://vcn.bc.ca/citizens-handbook/

19. Community Visioning: Planning for the Future in Oregon's Local Communities.
This report describes how new approaches to anticipate and plan for change are needed—approaches that actively engage citizens in thinking about the future at the local level. The report can be downloaded from http://www.design.asu.edu/apa/proceedings97/ames.html

20. A Guide to the Public Management of Private Septic Systems.
Communities can use this handbook to examine their wastewater treatment options and design a unique program that meets their needs. This document can be downloaded from http://devsoc.cals.cornell.edu/cals/devsoc/outreach/cardi/publications/resources/index.cfm

21. The Neighborhood Charrette Handbook: Visioning and Visualizing Your Neighborhood's Future.
The Charrette workshop is designed to stimulate ideas and involve the public in the community planning and design process. This handbook can be downloaded from www.michigantownships.org/downloads/charrette_handbook.pdf

22. National Environmental Services Center (NESC).
NESC's NODP (National Onsite Demonstration Program) has produced two videos and a series of CD ROMs that can be used to communicate wastewater options to citizens. Order from http://www.nesc.wvu.edu/

23. A Quick Handbook to Small Community Wastewater Treatment Decisions.
This document guides communities through choosing an effective and reasonably priced wastewater treatment system. See http://www.extension.umn.edu/distribution/naturalresources/DD7735.html

24. U.S. Environmental Protection Agency Community-Based Environmental Protection.
Community-Based Environmental Protection (CBEP) integrates environmental management with human needs, considers long-term ecosystem health, and highlights the positive correlations between economic prosperity and environmental well-being. For more information, visit http://www.epa.gov/care/library/howto.pdf

25. Wastewater Planning Handbook Mapping Onsite Treatment Needs, Pollution Risks, and Management Options Using GIS.
This handbook is a guide to wastewater management planning for small communities using geographic information systems. See Website http://www.ndwrcdp.org/userfiles/WUHT0117_post.pdf

Homeowner Guides

26. Environmental Protection Agency Homeowner Septic System Checklist.
Worksheet that allows homeowners to keep track of septic system inspections and maintenance. See http://www.epa.gov/owm/septic/pubs/septic_sticker.pdf

27. The Easy Septic Guide.
This handbook describes everything homeowners need to know about their onsite systems. It has chapters on checking, understanding, and maintaining a system. The handbook can be downloaded from http://www.dlg.nsw.gov.au/Files/Information/ssguide.pdf

28. Homeowner's Handbook to On-Site Wastewater Disposal Zone.
The Sea Ranch Association, an onsite management entity, developed this handbook for new homeowners. The handbook explains a septic system and explains a typical inspection. To learn more, call 707-785-2444.

29. The Septic Education Kit.
The Department of Commerce's National Technical Information Service distributes this toolbox that contains everything needed to organize an education program on the care and maintenance of onsite systems. The kit can be ordered from http://www.ntis.gov. Enter AVA20666KK00 into the technical reports search.

30. Septic Yellow Pages.
This Website provides useful information concerning onsite systems for homeowners. To view see http://www.septicyellowpages.com/homeowner.html

Technical Resources

Technical Assistance Resources

31. National Environmental Services Center.
National Environmental Services Center provides technical assistance and information about drinking water, wastewater, environmental training, and solid waste management to communities serving fewer than 10,000 people. Visit http://www.nesc.wvu.edu/

32. National Small Flows Clearinghouse.
The National Environmental Service Center at NSFC has produced a technology overview CD ROM. Visit http://www.nesc.wvu.edu/wastewater.cfm or call 800-624-8301.

33. U.S. Environmental Protection Agency Municipal Technologies Branch Fact Sheets.
These fact sheets cover difference treatment technologies. See http://www.epa.gov/owm/mtb/mtbfact.htm

System Design

34. U.S. Environmental Protection Agency Onsite Wastewater Treatment Systems Manual.
This comprehensive reference manual is designed to provide state and local governments with guidance on the planning, design, and oversight of onsite systems. It can be downloaded from http://www.epa.gov/nrmrl/Pubs/625R00008/html/62500008.htm

35. Creative Community Design and Wastewater Management.
A guidance manual for local officials to demonstrate the use of alternative on-site wastewater treatment technologies to support zoning for compact and sustainable land use patterns. See http://www.ndwrcdp.org/userfiles/WUHT0030_post.pdf

Alternative Systems

36. Barnstable County, Massachusetts Department of Health and the Environment Alternative Septic System Information Center.
This Web site contains information on alternative onsite technologies. View the site at http://www.barnstablecountyhealth.org/AlternativeWebpage/index1.htm

37. City of Austin, Texas Onsite Wastewater Treatment and Disposal Fact Sheets.
The set of fact sheets covers many onsite topics from conventional systems to alternative systems. The fact sheets can be downloaded from http://www.ci.austin.tx.us/wri/fact.htm

38. Are Cluster Treatment Systems the Key to Implementing Effective Decentralized Wastewater Management?

Given a choice of managing hundreds of onsite systems versus systems that serve several hundred homes, management professionals will favor the cluster scale. To access this article see Website http://www.infiltratorsystems.com/word/NOWRA_Cluster_S%C9n8-24-01_1.doc

39. A Simpler, Cheaper Alternative to Sewer Systems.

This handbook describes a wastewater project in Willard, a village in New Mexico, where the sole supply of drinking water is threatened by wastewater. Visit http://72.14.203.104/search?q=cache:4_NHGbJP-SoJ:www.nmenv.state.nm.us/cpb/Jan%252003%2520Willard%2520Case%2520Study.pdf+Willard,+a+village+in+New+Mexico+septic+system&hl=en&gl=us&ct=clnk&cd=1 and http://www.forester.net/ow_0507_large.html

40. Constructed Wetlands for Wastewater Treatment.

This document describes constructed wetlands for wastewater treatment and has numerous case studies. It can be downloaded from http://www.epa.gov/owow/wetlands/pdf/ConstructedWetlands-Complete.pdf

41. Subsurface Flow Constructed Wetlands for Wastewater Treatment: A Technology Assessment.

This report verifies that a subsurface-flow constructed wetland can be a viable and cost-effective wastewater treatment option. This document can be downloaded from http://www.epa.gov/owow/wetlands/pdf/sub.pdf

42. Washington Sea Grant Septic Manuals.

Five homeowner manuals Pressure Distribution, Gravity, Mound, Sand Filter, and Proprietary Device can be viewed at http://www.wsg.washington.edu/mas/ecohealth/waterquality.html

State Onsite Fact Sheets

43. Delaware Department of Natural Resources and Environmental Control.

These fact sheets describe different wastewater disposal systems. Visit http://www.dnrec.state.de.us/dnrec2000/P2/Septic.htm

44. Massachusetts Department of Environmental Protection Publications.

This Web page contains links to many publications concerning septic systems and alternative technologies. For more information, visit http://www.mass.gov/dep/water/wastewater/septicsy.htm

45. Ohio State University Extension Fact Sheets.

This series of fact sheets cover topics from septic system maintenance to costs and financing. They can be downloaded from http://ohioline.osu.edu/aex-fact/

46. Oregon Department of Environmental Quality On-Site Fact Sheets.

These fact sheets provide information on septic system installation and maintenance. They can be downloaded from http://www.deq.state.or.us/wq/onsite/onsite.htm

47. University of Minnesota Fact Sheets.

This set of fact sheets covers topics from homeowner education to alternative technologies and can be downloaded from http://www.extension.umn.edu/topics.html?topic=2&subtopic=110

48. Pennsylvania Department of Environmental Protection Wastewater Management Fact Sheets.
These fact sheets cover topics from sewage planning to sewage disposal systems. The fact sheets can be downloaded from http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqp_wm/Pubs-c.htm

Risk Assessment

49. Risk Assessment of Decentralized Wastewater Management in High Priority Areas of the City of Malibu, California.
Powerpoint presentation can be viewed at http://www.coastalconference.org/h20_2005/pdf/wednesday_2004/1C/Georgeetal-Risk_Assessment_of_Decentralized_Wastewater_Trea.pdf

50. Integrated Risk Assessment for Individual Onsite Wastewater Systems
The primary objective of this project was to develop an approach to risk-based decision making for individual onsite wastewater treatment (OWT) systems. To view this report see http://www.ndwrcdp.org/userfiles/WUHT0118_ORNL_Electronic.pdf

Operation and Maintenance

51. Septic Tank Maintenance
These three publications explain the relationship between septic systems and water quality, and provide recommendations for septic system maintenance (e.g. tank pumping schedules). They can be downloaded from http://www.aces.edu/pubs/speng/sepmaint.pdf, http://www.aces.edu/pubs/docs/C/CRD-0081/, and http://www.epa.gov/owm/septic/pubs/homeowner_guide_long.pdf.

52. U.S. Environmental Protection Agency's Decentralized Onsite Management for Treatment of Domestic Wastes.
This program provides operation and maintenance information for on-site wastewater treatment systems and can be downloaded from http://www.epa.gov/seahome/decent.html

Training

53. Model Decentralized Wastewater Practitioner Curriculum
A model decentralized wastewater field practitioners training curriculum for use throughout North America. Visit http://www.ndwrcdp.org/userfiles/WUHT0105.pdf

Inspection, Monitoring, Compliance

54. University of Rhode Island Fact Sheets.
This set of fact sheets covers topics such as what you should know about inspectors, how to hire a contractor, and how to order and buy a distribution box. The fact sheets can be downloaded from http://www.uri.edu/ce/wq/RESOURCES/wastewater/Onsite_Systems/index.htm

55. Septic System Checkup: The Rhode Island Handbook for Inspection
This handbook includes instructions for gathering septic system records, locating components, diagnosing minor in-home plumbing problems, conducting flow trials, dye tracing, and maintenance scheduling. Website: http://www.dem.ri.gov/pubs/regs/regs/water/isdsbook.pdf

56. Summit County Water Quality: Septic Systems and Potential Nitrate Pollution Analysis
This study demonstrates the use of a geographic information system (GIS) for modeling septic system nitrate impacts to water quality in the upper Blue River watershed, Summit County, Colorado. See Website: http://ehasl.cvmbs.colostate.edu/projects/water.summit.county.html

EPA Cooperating Partners

EPA and eight partner organizations signed a Memorandum of Understanding in 2005 to address environmental problems resulting from failures of decentralized wastewater treatment systems (often called septic systems) when they occur. The agreement formalizes the collaboration between EPA and its partners to help community governments improve their wastewater programs. The agreement focuses on better planning, septic system design, and long-term operation and maintenance of septic systems. To view the Memorandum of Understanding visit the EPA Website: http://cfpub.epa.gov/owm/septic/index.cfm

The partners joining EPA in this effort are:

National Association of Towns and Townships (NATaT). The purpose of NATaT is to strengthen the effectiveness of town and township government. NATaT does this by educating lawmakers and public policy officials about how small town governments operate and by advocating policies on their behalf in Washington, D.C. Website: http://www.natat.org/

National Association of Wastewater Transporters, Inc. (NAWT). NAWT is dedicated to serving the interests of the liquid waste pumping and drain cleaning industries. The association works with EPA to promote training and certification of the pumping industry. Website: http://www.nawt.org/

National Environmental Health Association (NEHA). NEHA fosters more cooperation and understanding between and among environmental health professionals, contributing to the resolution of environmental health issues, and by working with other national professional societies to advance the cause, the image, and the professional standing of the environmental health profession. Website: http://www.neha.org/

National Environmental Services Center (NESC). NESC provides information about drinking water, wastewater, environmental training, and solid waste management in communities serving fewer than 10,000 individuals. Website: http://www.nesc.org/

National Onsite Wastewater Recycling Association, Inc. (NOWRA). NOWRA is the largest organization within the U.S. dedicated solely to educating and representing members within the onsite and decentralized industry. Website: http://www.nowra.org/

Rural Community Assistance Partnership, Inc. (RCAP). RCAP operates as a national service delivery network of six regional partners and a national office in Washington, D.C. Every year, more than 200 RCAP specialists provide technical assistance, training, and financial resources to more than 2,000 small rural communities in all 50 states, Puerto Rico, and the U.S. Virgin Islands. Website: http://www.rcap.org/

Water Environment Federation (WEF). WEF is a not-for-profit technical and educational organization with members from varied disciplines who work toward the preservation and enhancement of the global water environment. Website: http://www.wef.org/

Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT). CIDWT often referred to as "The Onsite Consortium", is a group of Educational Institutions cooperating on decentralized wastewater training and research efforts. The Consortium also includes people from educational institutions, citizens groups, regulatory agencies and private industry. Website: http://www.onsiteconsortium.org/

Glossary of terms

Aerobic Treatment Unit (ATU): A mechanical wastewater treatment unit that provides secondary wastewater treatment for single home, cluster of homes, or commercial establishments by mixing air (oxygen) and aerobic and facultative microbes with the wastewater. ATUs typically use either a suspended growth process (such as activated sludge, extended aeration and batch reactors), fixed film process (similar to a trickling filter), or a combination of the two treatment processes.

Alternative Onsite Treatment System: A wastewater treatment system that includes different components than typically used in a conventional septic tank and subsurface wastewater infiltration system (SWIS). An alternative system is used to achieve acceptable treatment and dispersal of wastewater where conventional systems either may not be capable of protecting public health and water quality, or are inappropriate for properties with shallow soils over groundwater or bedrock or soils with low permeability. Examples of components that may be used in alternative systems include sand filters, aerobic treatment units, disinfection devices, and alternative subsurface infiltration designs such as mounds, gravelless trenches, and pressure and drip distribution.

Centralized Wastewater System: A managed system consisting of collection sewers and a single treatment plant used to collect and treat wastewater from an entire service area. Traditionally, such a system has been called a Publicly Owned Treatment Works (POTW) as defined in 40 CFR 122.2.

Cesspool: A drywell that receives untreated sanitary waste containing human excreta, which sometimes has an open bottom and/or perforated sides (40 CFR 144.3). Cesspools with the capacity to serve 20 or more persons per day were banned in federal regulations promulgated on December 7, 1999. The construction of new cesspools was immediately banned and existing large-capacity cesspools must be replaced with sewer connections or onsite wastewater treatment systems by 2005.

Cluster System: A wastewater collection and treatment system under some form of common ownership which collects wastewater from two or more dwellings or buildings and conveys it to a treatment and dispersal system located on a suitable site near the dwellings or buildings.

Construction Permit: A permit issued by the designated local regulatory authority that allows the installation of a wastewater treatment system in accordance with approved plans and applicable codes.

Conventional Onsite Treatment System: A wastewater treatment system consisting of a septic tank and a typical trench or bed subsurface wastewater infiltration system.

Decentralized System: Managed onsite and/or cluster system(s) used to collect, treat, and disperse or reclaim wastewater from a small community or service area.

Dispersal System: A system which receives pretreated wastewater and releases it into the air, surface or ground water, or onto or under the land surface. A subsurface wastewater infiltration system is an example of a dispersal system.

Engineered Design: An onsite or cluster wastewater system that is designed and certified by a licensed/certified designer to meet specific performance requirements for a particular wastewater on a particular site.

Environmental Sensitivity: The relative susceptibility to adverse impacts of a water resource or other receiving environment from dispersal of wastewater and/or its constituents. The impacts may be low, acute (i.e. immediate and significantly disruptive), or chronic (i.e. long-term, with gradual but serious disruptions).

Large Capacity Septic System: A soil dispersal treatment system having the capacity to serve 20 or more persons-per-day subject to EPA's Underground Injection Control regulations.

Management Model: A program consisting of thirteen elements that is designed to protect and sustain public health and water quality through the use of appropriate policies and administrative procedures that define and integrate the roles and responsibilities of the regulatory authority, system owner, service providers and management entity, to ensure that onsite and cluster wastewater treatment systems are appropriately managed throughout their life cycle. The program elements include public education and participation, planning, performance requirements, training and certification/licensing, site evaluation, design, construction, operation and maintenance, residuals management, compliance inspections/monitoring, corrective actions and enforcement, record keeping, inventory, and reporting, and financial assistance and funding. Management services should be provided by properly trained and certified personnel and tracked via a comprehensive management information system.

National Pollutant Discharge Elimination System (NPDES) Permit: A national program under Section 402 of the Clean Water Act for regulation of discharges of pollutants from point sources to waters of the United States. Discharges are illegal, unless authorized by an NPDES permit.

Onsite Service Provider: A person who provides onsite system services. They include but are not limited to designers, engineers, soil scientists, site evaluators, installers, contractors, operators, managers, maintenance service providers, pumpers, and others who provide services to system owners or other service providers.

Onsite Wastewater Treatment System (OWTS): A system relying on natural processes and/or mechanical components to collect, treat, and disperse or reclaim wastewater from a single dwelling or building.

Operating Permit: A renewable and revocable permit to operate and maintain an onsite or cluster treatment system in compliance with specific operational or performance requirements stipulated by the regulatory authority.

Performance-Based Management Program: A program designed to protect public health and water quality by seeking to ensure sustained achievement of specific, measurable performance requirements based on site and risk assessments.

Performance Requirement: Any requirement established by the regulatory authority to assure future compliance with the public health and water quality goals of the community, the state or tribe, and the federal government. Performance requirements can be expressed as numeric limits (e.g., pollutant concentrations, mass loads, wet weather flow, structural strength) or narrative descriptions of desired conditions or requirements (e.g., no visible scum, sludge, sheen, odors, cracks, or leaks).

Permitting Authority: The state, tribal, or local unit of government with the statutory or delegated authority to issue permits to build and operate onsite wastewater systems.

Prescription-Based Management Program: A program designed to preserve and protect public health and water quality through specification of pre-engineered system designs for specific sets of site conditions, which if sited, designed, and constructed properly, are deemed to meet public health and water quality standards.

Prescriptive Requirements: Specifications for design, installation and other procedures and practices for onsite or cluster wastewater systems on sites that meet stipulated criteria. Proposed deviations from the stipulated criteria, specifications, procedures, and/or practices require formal approval from the regulatory authority.

Regulatory Authority (RA): The unit of government that establishes and enforces codes related to the permitting, design, placement, installation, operation, maintenance, monitoring, and performance of onsite and cluster wastewater systems.

Residuals: The solids generated and/or retained during the treatment of wastewater. They include trash, rags, grit, sediment, sludge, biosolids, septage, scum, grease, as well as those portions of treatment systems that have served their useful life and require disposal such as the sand or peat from a filter. Because of their different characteristics, management requirements can differ as stipulated by the appropriate Federal Regulations.

Responsible Management Entity (RME): A legal entity responsible for providing various management services with the requisite managerial, financial, and technical capacity to ensure the long-term, cost-effective management of decentralized onsite and/or cluster wastewater treatment facilities in accordance with applicable regulations and performance requirements.

Septage: The liquid and solid materials pumped from a septic tank during cleaning operations.

Septic Tank: A buried, watertight tank designed and constructed to receive and partially treat raw wastewater. The tank separates and retains settleable and floatable solids suspended in the wastewater and discharges the settled wastewater for further treatment and dispersal to the environment.

Source Water Assessment: A study and report required by the Source Water Assessment Program (SWAP) of the Safe Drinking Water Act addressing the capability of a given public water system to protect water quality that includes delineation of the source water area, identification of potential sources of contamination in the delineated area, determination of susceptibility to those sources, and public notice of the completed assessment.

Underground Injection Well: A constructed system designed to place waste fluids above, into, or below aquifers classified as underground sources of drinking water. As regulated under the Underground Injection Control (UIC) Program of the Safe Drinking Water Act (40 CFR Parts 144 & 146), injection wells are grouped into five classes. Class 5 includes shallow systems such as cesspools and subsurface wastewater infiltration systems. Subsurface wastewater infiltration systems with the capacity to serve 20 or more people per day, or similar systems receiving non-sanitary wastes, are subject to federal regulation. Class V motor vehicle waste injection wells and large-capacity cesspools are specifically prohibited under the UIC regulations.

United States
Environmental Protection
Agency

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 1. PUBLIC EDUCATION AND OUTREACH

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Public outreach and education is an important component of any wastewater management program, regardless of the types of treatment systems used. The protection of public health and water resources is a community function that requires support from citizens in the form of user fees, state and local rules, and agency oversight. An informed and educated population will likely ensure that leaders from the public and private sectors act in the best interests of the community, and pursue policies and practices that are both effective and efficient. This overview provides readers with various opportunities to engage the public in building an effective wastewater management program. Included in this overview are:

I. Getting Started

- Awareness, Education, and Action
- Basic Steps of Outreach
- Engaging and Involving Stakeholders
- Outreach, Involvement, and Building a Management Program
- Steering and Advisory Committees

II. Options for a Public Education Program

- Basic Public Education Program
- Intermediate Education Program
- Advanced Education Program

III. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to public education and outreach.

I. GETTING STARTED

The need for outreach, education, and involvement in a wastewater management program typically implies a desire for something deeper—support for new rules requiring higher levels of treatment, encouragement to vote "yes" on an upcoming bond issue, or motivation to have an individual onsite system inspected, pumped out, or repaired/replaced. The "driving forces" that prompt interest in an outreach program should be identified up front because they will help shape the direction and approach taken. This section discusses some of the important components of an outreach program and the basic steps involved.

Awareness, Education, and Action

Before attempting to persuade a group of people to support a wastewater management program, take better care of their systems, or take some other desired action, it is extremely helpful to know where they are in the broad spectrum between fuzzy awareness of the issue and strong motivation to do something about it. If people are not aware that a problem or issue exists, or if they know nothing about its importance or how they fit into it (or not), they are not likely to take the desired action(s).

Finding out where people are in terms of their awareness of an issue, their knowledge of key points, and their inclination to act can be done informally, through discussions with homeowners, service providers, and others, or can be the subject of extensive surveys conducted via email or over the phone. Regardless of how the information is collected, knowing whether outreach efforts should focus on awareness-building, educational aspects, or motivational messages will be key to success.

Awareness and education activities are sometimes combined, and often open with "did you know?" and quickly lead into a few educational bullets. For example, a project focused on building support for creation of a wastewater management district might create materials that highlight links between older soil-discharging systems and lake water quality, and then provide information on the benefits of a management district (e.g., spreading costs over time, and among a larger group, oversight controls by local residents, better lake water quality, etc.). The "action" piece of an outreach campaign usually needs to be direct—that is, it needs to clearly tell people what is desired. This portion of the overall effort usually comes after the awareness-building and educational/informational activities.

Basic Steps of Outreach

Making people aware of important public issues, building their background knowledge, providing information about possible options, and prodding them to act in the best interest of the community are part of the foundation of participatory democracy. In addition, motivating people to take specific desired action is also a major private sector endeavor. Marketing has become a huge industry in the U.S. and around the world due to its ability to persuade people to do things—buy certain kinds of computers, shop at certain kinds of stores, or vote for certain candidates. The field of "social" marketing has developed over the past several decades to prompt behaviors believed to be in the best interest of public health or the environment, such as wearing seat belts, stopping the use of tobacco products, not littering, and taking actions to reduce polluted stormwater runoff.

EPA has developed a wide variety of training materials on conducting outreach and social marketing programs. Getting In Step: A Guide for Conducting Watershed Outreach Campaigns outlines the basic steps for outreach, and contains a wealth of case studies, examples, and resources that can be used by wastewater management programs. Below is a summary of the six steps for outreach discussed in the guide:

Define Your Objectives. What, exactly, are you trying to do? Build support for new health or resource protection rules? Encourage homeowners to have their systems inspected or pumped? Recruit volunteers to collect bacteria samples along the lake shore? If you can't define specifically what your objectives are, it will be very difficult to determine if your outreach program has helped to meet them.

Identify the Target Audience. After determining the specific objectives of the outreach effort, it should be possible to figure out who needs to be aware, educated, motivated, or otherwise involved. These people comprise the target audience, and you need to know a lot about them—what they know (or think they know) about the problem or issue, how much they care about it, what they think needs to be done, if anything, where they get their information from, who the important opinion leaders are, and so on. Meeting with members of the target audience and discussing things informally over pizza and soft drinks at focus group meetings is one of many ways to find out about the target audience.

Craft a Message. Defining the objective(s) and identifying the target audience will lead to the development of a message that resonates with the audience and supports the objective. The message should be simple, direct, and help to move the audience toward achieving the objective. For example, a program with an objective of encouraging lakeshore homeowners to have their systems inspected might tell its audience to "Show Your Lake You Care – Get Your Tank Inspected!"

Decide on a Format. How will you package the message so it gets to the target audience? Will it be in the form of a newspaper article, a brochure, video, meeting, web site, door hanger, radio or television spot, or billboard? Message formats vary widely. The important thing to keep in mind is that you're trying to get the message to your target audience. If your audience has an organized group that meets regularly, or if there is a publication widely read by the audience, those formats would be very attractive options.

Distribute the Message. Some formats are already packaged for delivery, such as a newspaper article, radio/television spot, magazine piece, bus placard, billboard, and so on. However, if you're printing brochures or booklets, or if you have produced a DVD, you need to think about how you're going to get them into the hands of your audience and whether or not they will actually read or watch them. Remember that the goal of the outreach effort is to achieve an objective by delivering a specific message to an identified target audience.

Evaluate Your Efforts. After the project has been completed, the sponsors should evaluate it by determining whether or not it advanced achievement of the objective(s), how actual costs compared with the budget, what worked very well, what did not, and what lessons were learned.

Engaging and Involving Stakeholders

Outreach and educational efforts that seek to motivate action or support are almost always part of long-term, multifaceted programs that also include engaging and involving stakeholders, working with public officials, and securing financial assistance. In addition, projects that involve regulatory action or tax/fee increases are likely to spark considerable discussion, interest, and possibly concern. Involving the public, especially key stakeholders that will be affected by a new action, is highly recommended in these instances.

Stakeholder involvement methods work best when they are undertaken early, before any definite proposals are put forward. Ideally, stakeholders would be engaged after a problem or issue was first identified, so that they could be involved in characterizing it, studying its potential impacts, identifying who might be affected, and identifying what sort of solutions/responses might be warranted.

EPA produced a stakeholder involvement guide as part of the agency's nonpoint source pollution control program that contains useful information for those developing stakeholder involvement plans. The guide, called Getting In Step: Engaging and Involving Stakeholders in Your Watershed, explores a wide range of stakeholder involvement approaches and techniques and includes information on how to prepare for and facilitate meetings, deal with conflict, and build a sustainable program.

Outreach, Involvement, and Building a Management Program

Clearly, public education and involvement should be part of any wastewater planning or management program. A report developed by the Barnstable County Wastewater Implementation Committee and the Cape Cod Commission in 2004 highlights the need for education:

"Education of citizens and public officials is a key component of regional planning. If the public knows the sources and extent of contamination problems, is knowledgeable of the options to control them, and is aware of the importance of timely action, then town government will be more apt to deal with the problems promptly and in concert with neighboring towns."

Table 1 provides a general approach for developing wastewater management programs, highlighting the role of education and outreach. This approach, which is similar to watershed assessment, planning, and management protocols used across the nation, can be adapted to meet the wastewater management needs of local communities.

Table 1. Steps for Developing a Wastewater Management Program.

Generalized steps	Examples of typical activities or processes
Convene interested parties and initiate education and outreach activities.	Identify key stakeholders (community and regulators) and other potential partners (planning departments, development companies, service providers, management entities). Develop a steering committee of key stakeholders to be responsible for defining the problems, assessing available information, involving the community, determining the feasibility of establishing a management program, and identifying its goals. Develop and implement education and outreach initiatives to publicize current issues and activities of the steering committee.
Identify and assess existing information to evaluate potential risks.	Inventory or otherwise collect information on existing systems and impacts. Clearly define existing water quality and public health problems and the causative role of existing systems in creating it. Define impacts on property values, the local economy, and other basic concerns of citizens. Analyze trends regarding new or proposed wastewater facilities and projected impacts, based on land-use plans or development proposals. Consider applicable water quality standards, monitoring and assessment information, and available information on relative vulnerability of water resources based on hydrogeologic, modeling, or other existing or new information. Based on trends analysis, estimate likely future impacts of existing wastewater systems on groundwater and/or surface waters.
Develop clear goals and explore options to address identified problems.	Conduct a community profiling and visioning process to identify the positive features about the community that should be preserved under any plan chosen. Ensure that the community is aware of the spatial distribution of wastewater problems identified and the potential social and financial costs of centralized and decentralized options. Review the performance capabilities and costs of the various alternatives. Synthesize vulnerability, monitoring/assessment, and other information to identify and prioritize problem sites or areas. Conduct a reality check to determine the availability of technical, financial, and other resources to abate some or all of those priorities. Investigate and identify resources needed to support remedial action or additional studies. Establish performance requirements based on health and water resource assessment information in concert with regulators. Evaluate powers necessary and approaches for incorporating them into a viable management program. Review management program elements to ensure that all necessary functions are addressed.

Generalized steps	Examples of typical activities or processes
Select management actions; develop and implement a workable plan to achieve goals and objectives.	Identify selected management actions for implementation and methods for incorporation. Solicit support and resources for implementation among stakeholders, regulators, the public, and internal/external funding organizations. Determine what ordinances are necessary to support a sustainable management program as designed. Develop easily understood indicators that can be monitored by the community and management staff to determine trends. Activate or implement management practices/actions, targeting highest priority sites or areas for immediate action. Monitor progress via selected indicators; evaluate progress and adapt as necessary through a regular review process.

One of the first steps in developing or enhancing a wastewater management program is to conduct a community assessment to assess problems and engage the community in seeking solutions. A community assessment typically includes the collection of environmental, socioeconomic, land use, and wastewater information. A community assessment can be adapted to target specific issues and conditions in an area. The National Environmental Services Center has produced a wide range of booklets, articles, videos, and other tools for conducting and analyzing results from community assessments.

Once information has been collected, the community needs to be kept informed about any health or pollution concerns, such pathogen and nitrate contamination. Public outreach may include distributing literature about contaminants and the potential risk to public health. Information about pathogens and other pollutants can be obtained from state or local health departments, county extension offices, EPA, and the National Small Flows Clearinghouse. Articles in local newspapers, television news coverage, or local discussions about wastewater issues can also create an opportunity to further engage the public in assessing the situation to determine if additional management measures are warranted.

Outreach programs can also effectively be conducted by non-governmental agencies. For example, Clean Nova Scotia, a non-profit environmental education organization, launched a no-cost Flush-Less Education Program in 2003 through 2004 to encourage regular septic tank cleaning, reduce water usage, and curtail the use of household chemicals. The program raised awareness of proper septic system and well maintenance practices. Providing water-saving devices and biodegradable cleaners to homeowners gave them a strong incentive to move towards water conservation and to reduce their reliance on toxic chemical cleaners. The information—from general septic system tips to scientific literature—gave project participants background information and resources far beyond what most property buyers usually receive.

Community leaders must also be informed about wastewater management issues. A packet called Protecting Drinking Water Sources in Your Community: Tools for Municipal Officials for community leaders, containing information on wastewater system management issues, can be ordered from the New England Interstate Water Pollution Control Commission.

COMMUNITY OUTREACH – STATE AND LOCAL EXAMPLES

Nags Head, North Carolina, was experiencing a decrease in water quality as a result of malfunctioning individual wastewater treatment systems. Residents did not want to convert to a centralized wastewater system, however, because they feared that the town's character would change as a result of the intense development that often follows introduction of such systems. A group of local citizens formed the Septic Health Committee and spent three years discussing a series of programs designed to improve the performance of individual systems. The committee formed the Septic Health Initiative, a voluntary program to protect the town's water quality. It offers complimentary services to educate citizens, improve documentation and maintenance of systems, and repair malfunctioning systems. The program also includes a component to test water quality. Homeowners receive system owner's manuals, and real estate professionals get education packets to distribute to those owning rental cottages. These packets include door hangers, decals, and brochures explaining what not to flush. The program also is publicized through the town newsletter, the government access channel, and mass mailings twice a year. In a survey of town residents, Nags Head officials discovered that 66 percent of program participants had gained an understanding of the basic functions of their septic systems.

In Warren, Vermont, active public involvement in a needs assessment and planning processes led to the collection of better information regarding onsite conditions and increased public understanding of potential impacts to drinking water supplies and surface waters. In the long run, this involvement led to support for the proposed solutions.

Steering and Advisory Committees

As many stakeholders as needed should be involved in all phases of the wastewater management program to provide meaningful input and support. Individual homeowners, governmental agencies, local homeowner associations, civic and environmental groups, real estate sales representatives and lending institutions, organizations of service providers, local health departments, planning entities, and local industry should be involved in the program early in the process.

A number of communities have established advisory committees to help oversee the community assessment process and the development or enhancement of a wastewater management program. Advisory committees can serve various functions, from reviewing information and offering recommendations to providing oversight of management programs.

Some communities have partnered together to improve the management of wastewater systems. For example, The Northwest Michigan Onsite Wastewater Task Force has distributed a series of educational publications to the 17 counties it serves to help individuals and local communities assess their current wastewater infrastructure, plan for future capacity, and adopt cost-effective solutions and management strategies. These publications will appear as inserts in 14 regional and local newspapers and will also be available at local public libraries and health departments.

STEERING AND ADVISORY COMMITTEES – STATE AND LOCAL EXAMPLES

In 2001, the Colorado Department of Public Health and the Environment formed a steering committee to review the potential impacts of soil-discharging systems in the state and the adequacy of current efforts to address these and other wastewater issues. This effort led to the development of a summary characterization of onsite wastewater system impacts and a number of recommendations including renewable permits and performance standards.

The Panhandle Health District in Idaho (PHD) formed an ad hoc citizens' committee to review data and information collected during a community assessment and develop recommendations. This committee included representatives from the home builders, the U.S. Department of Agriculture Natural Resources Conservation Service, farmers, planning boards, the state legislature, the League of Women Voters, and conservation/environmental organizations. The committee members not only reached out to their respective constituencies but also solicited feedback from other interested parties.

Groundwater quality in the La Pine, Oregon area of southern Deschutes County is at risk due to nitrate contamination believed to be linked to soil-discharging wastewater treatment system discharges to groundwater. An advisory committee developed a set of recommendations to support operation and maintenance of systems using a combination of education, regulatory, and non-regulatory components.

II. Options For A Public Education Program

Wastewater management education programs range from very simple to more formalized measures. These may include the simple distribution of informational brochures to system owners, conducting one-on-one consultations, or holding workshops. These programs vary based on assessed needs and the type and complexity of the issues that need to be addressed. This section outlines some of the basic options for developing an education program.

Basic Public Education Program

A basic public education program includes:

- Ongoing public outreach regarding program development and operation
- Educational materials on system operation and maintenance
- Operation and maintenance reminders (e.g., inspections, pumpouts) for system owners

Management programs typically offer homeowners basic information regarding how their systems work, with space for the owner to make a simple drawing of the system's location, installation date, installer name, permit number, and other information. Many communities provide brochures, flyers, and fact sheets on general maintenance requirements of conventional septic systems.

An effective tool used by many management programs is a homeowner operation/ maintenance checklist. These checklists detail maintenance requirements and timeframes and usually include tips about what not to flush down the drain or toilet and what to look for in conducting a walkover inspection of the system, and provide blank space for owners to note their system location through a drawing and/or description. EPA has developed a Homeowner Guide and Checklist, which are available to communities to use at no cost except for printing. The guide can also be customized to meet local needs.

The New Hampshire Estuaries Project offers homeowners a free septic system maintenance folder and an informational video. The video was the culmination of an educational campaign designed to teach residents in New Hampshire's coastal watershed that maintaining their wastewater system protects their environment. The winning video, entitled "Your Septic System, Your Friend," includes an original septic system music video, an animated SCUBA diver touring a septic system tank, and a news report parody exposing a septic system abuser.

State and community Web sites also are a useful tool to distribute information concerning wastewater management programs. Community gatherings such as local fairs can provide opportunities to distribute information and promote public awareness.

BASIC EDUCATION PROGRAMS – STATE AND LOCAL EXAMPLES

Kitsap County Health Department in the State of Washington developed brochures and fact sheets to educate homeowners and promote proper operation and maintenance of septic systems.

In Lake McConaughy, Nebraska, the community initiated an "Education to Action" project to address problems and issues related to onsite wastewater treatment systems. A key outcome of this program is an easy-to-use education kit, designed to inform septic owners about the proper care and maintenance of their system.

The Trinidad, California, Web site includes an overview of the onsite wastewater program, grant program schedule, information specific to public involvement, frequently asked questions, and technical documents.

Intermediate Education Program

A more sophisticated approach to a public education may include:

- Public involvement in management program development and evaluation

- More specific educational materials and targeted distribution
- Listings of approved service providers
- Formal and informal meetings and workshops
- Basic and specialized training for service providers

Community workshops can be an effective tool to promote public awareness. The Groundwater Foundation's newest community education project, Pathogenic Contamination Workshop, Reference Tools and Methods, was unveiled in February 2006 and is designed to educate communities on how to prevent pathogens from entering drinking water sources. Working with local agencies, this group holds workshops in selected communities nation-wide and provides post-workshop assistance to communities implementing protection strategies.

The Groundwater Foundation also offers an action plan template to help communities design and implement a local action plan to prevent pathogens from contaminating drinking water supplies.

INTERMEDIATE EDUCATION PROGRAMS – STATE AND LOCAL EXAMPLES

Missouri offers a database of registered installers by county. Installers must attend training courses in order to qualify as a registered installer (also see Resource Guide 11. Training and Certification/Licensing).

The local Department of Environmental Health Services in Marin County, California, periodically sponsors Septic Socials. Septic Socials are designed to give residents a basic understanding of individual wastewater management systems and to provide resources necessary to maintain compliance. Marin County officials also want to educate the public on newer, enhanced wastewater system technologies that are more efficient and better-performing. The county has recently adopted a "performance based" system design review process that focuses more on the function of the treatment systems, rather than strict adherence to design standards.

Like many communities, the Village of Willard, New Mexico, constructed its drinking water system without adequate consideration as to how to manage generated wastewater. Drinking water samples taken from 1995 to 1997 showed a five-fold increase in nitrate levels. In 1999, the community requested funds to install 40 individual conventional systems. But instead, the state proposed a project to demonstrate the benefits of an enhanced clustered approach.

The project involved the development of three soil-discharging cluster systems owned by the wastewater management utility. The project was discussed at many public meetings. Residents were also informed of the project through flyers and bulletins, and messages on water bills. Some residents stepped forward to help with crucial tasks, notably, selecting an engineering firm and conducting a house-to-house survey to determine baseline conditions.

Their participation not only helped advance the project; it signaled local support. Particularly during the early stages of the project, those residents who attended meetings and voiced support helped create the conditions that moved the project forward.

Advanced Education Program

An advanced approach to a public education program may include:

- Public participation in program development, review, and new program initiatives
- Development planning driven by low-impact planning, zoning, and other codes
- Advisory, variance, and complaint review panels staffed by informed citizens
- One-on-one consultation with homeowners during the system design phase
- Outreach programs at civic, school, and other events to promote program benefits
- Listings of approved service providers and specialized training for them

More advanced public education programs are typically employed in areas facing critical wastewater issues and where more comprehensive wastewater management programs are needed. The Rocky Mountain Institute documented several case studies where the public process included a comparison of conventional centralized solutions and distributed or decentralized solutions. These communities included Paradise, CA;

Washington Island, WI; Charlotte County, FL; Lake Elmo, MN; Broadtop and Coaldale, PA; and Johnson County, KS. The case studies describe eight stories of communities working to make choices about wastewater infrastructure. Some communities achieved broad support for their chosen approaches. Others did not. Some are still struggling to determine what wastewater system architecture suits them best. Common among these case studies is the importance of public involvement and buy-in to support the solution and long-term system management approach.

ADVANCED EDUCATION PROGRAMS – STATE AND LOCAL EXAMPLES

Block Island, Rhode Island, developed an onsite wastewater management program with selective use of enhanced treatment systems in high risk areas to protect critical groundwater supplies and sensitive coastal waters. The town adopted Rhode Island's first inspection-based wastewater system maintenance ordinance in 1996. It mandates regular inspection of individual system. Another ordinance adopted performance-based system design requirements. As the proposed ordinances were formulated, outreach expanded to include the public as well as town officials. Several public workshops and hearings were held. Town boards prepared fact sheets and newspaper articles about the ordinances. In addition, a local group of concerned citizens, known as the Ad Hoc Scientific Advisory Committee, was established to review the performance standards and supporting technical information. Although initially opposed to the ordinance, this group ultimately supported it with revisions. This support, coming from a group of respected local professionals, was critical to the adoption of the ordinance.

The Town of South Kingston, Rhode Island, included a provision to mandate a public education program in its Onsite Wastewater Management Ordinance. The town requires that a public education program shall be established and overseen by the ISDS Commission, in conjunction with the Public Services Department and Planning Department, to inform people about the findings, benefits, and goals of onsite wastewater management in South Kingstown. The educational program includes:

- – Proper inspection, operation, and maintenance of individual systems
- – Operation and management framework of the program
- – Proper disposal of hazardous waste, including household hazardous waste
- – Water conservation to reduce system hydraulic loads
- – Protection of sensitive resources, such as ponds and coastal areas
- – Use of environmentally sensitive cleaning products
- – Use of alternative and innovative septic systems and associated technologies
- – Availability of financial assistance

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

EPA 832-B-05-005 January 2010 Web Supplement

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 2. COMMUNITY PLANNING FOR WASTEWATER TREATMENT

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Individual onsite and clustered wastewater systems are an essential and permanent component of the nation's wastewater infrastructure. The U.S. Environmental Protection Agency (EPA), in its 1997 Response to Congress stated, "Onsite systems are a viable alternative to the ongoing operating cost and capital funding limitations of new and existing sewer infrastructure."

In its Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems, EPA outlines five Management Models—from basic to advanced—to improve state and local wastewater management programs. A common and critical element in each one of these management schemes is community planning. The consequences of inadequate wastewater planning can lead to public health threats, risks to environmental resources, unintended land use patterns, and lack of ability to achieve economic growth and natural resource conservation.

This guide reviews the planning process for community wastewater facilities, as well as additional factors that make up a wastewater management program. Included in this overview are the following topics:

I. Community Facilities Planning

- Getting Started
- The Planning Process
- Planning Timeframe and Reviews

II. Integrated Planning

- Low Impact Development
- Wastewater Facility Planning

- Land Use Planning and Zoning
- Source Water Protection Planning
- Wastewater Reuse
- Watershed Planning
- Economic Development Planning

III. Management Considerations

- Legal Authorities
- Program Funding and Staff
- Managing Data and Information

IV. Additional Resources

- Resource links and case studies are included throughout this guide.

I. COMMUNITY FACILITIES PLANNING

Wastewater is collected and treated differently based on the various approaches and technologies used. These technologies span a continuum that ranges from large centralized treatment plants serving densely developed urban areas to individual home “septic” systems, and can be generally categorized as centralized systems, clustered wastewater systems, and conventional or enhanced individual systems.

Selecting the appropriate wastewater collection and treatment technology is based on a number of factors, including environmental conditions, costs, public acceptance, and the community’s desired land use and economic development goals. In order to determine the best wastewater collection, treatment, and management approaches, a plan must be developed that fully considers a community’s unique social, economic, and environmental conditions.

WASTEWATER TREATMENT TECHNOLOGIES

Centralized wastewater system: A managed system consisting of collection sewers and a single treatment plant that collects and treats wastewater from an entire service area. Traditionally, such a system has been called a publicly owned treatment works (POTW) as defined in 40 CFR 122.2. Many discharge treated effluent to surface waters, such as rivers, lakes, and coastal waters, but some may discharge to the soil via sprayfields.

Cluster system: Sewage collection, treatment, and dispersal system designed to serve two or more homes or businesses, typically (but not always) discharging to the soil. The system can serve isolated clusters of existing buildings or new areas via a “distributed” or “modular” approach designed to provide treatment services on an as-needed basis.

Conventional individual treatment system: A wastewater system for a single home or other facility, often located on the property, typically consisting of a septic tank and subsurface infiltration area for final treatment and dispersal of the tank effluent.

Enhanced individual treatment system: A wastewater system for a single home or other facility, often located on the property, consisting of one or more tanks, media filter beds, pumps, and/or other components in various configurations designed to reduce the concentration of targeted pollutants.

Getting Started

A local government or non-governmental group, such as a town council, county planning agency, health department, citizens group, community assistance organization, service provider group, or other entity can take the lead in coordinating the wastewater planning process.

The first step typically involves forming a steering committing that engages key stakeholders, such as planners, health officials, environmentalists, system installers, developers, and interested citizens. The steering committee should also reflect community demographics in terms of geographic sub-areas and economic classes. Expertise of members is another important factor to consider, and includes technical, fiscal/financial, legal, outreach, and organizational training and experience. Participation of elected leaders is also critical, especially as it relates to building public support and enhancing funding opportunities. State or local regulatory authorities (health and environmental agencies) are key stakeholders as well and can offer valuable expertise on legal and technical considerations.

The typical wastewater planning process appears in **Table 1.** Wastewater planning programs that are more formalized and structured will follow a similar developmental process, but may include additional considerations. However, all plans should:

- Have sufficient local support and necessary legal authority
- Be flexible in adapting to changing demands
- Work towards ensuring reasonable homeowner costs

Table 1. General Approach for Wastewater Treatment Planning.

Generalized steps	Examples of typical activities or processes
Convene interested parties and initiate scoping, educational, and outreach activities.	Identify key stakeholders from the public and private sectors (regulators, planning departments, development companies, service providers, environmental/conservation organizations). Develop a steering committee of key stakeholders to characterize problems, assess available information, involve the community, determine the feasibility of developing a wastewater management plan, and identify its goals. Begin initial scoping of problems and possible solutions; develop and implement education and outreach initiatives to publicize current issues and the activities of the steering committee.
Identify and assess existing information to evaluate potential risks.	Inventory or otherwise collect information on existing wastewater treatment systems and impacts on receiving waters (i.e., drinking water sources, recreational waters, shellfish habitat, aesthetic attributes). Clearly characterize existing water quality and public health problems and the relative contributions to these from wastewater systems; review impacts on property values, the local economy, and other basic concerns of citizens. Analyze trends regarding new or proposed wastewater facilities and projected impacts based on land use plans, development proposals, or likely growth trends. Consider applicable water quality standards, monitoring and assessment data, and the vulnerability of water resources based on hydrogeologic, modeling, or other information. Estimate the likely future impacts of wastewater systems on groundwater or surface waters.
Identify, prioritize and target key problem areas.	Using mapping, system inventory, water quality, soils/slopes, development trends, and other data, identify 1) areas of existing systems that require improved wastewater treatment and 2) areas where new development will require additional treatment facilities. Conduct a community profiling and visioning process to identify the positive features about the community that should be preserved under any plan chosen. Ensure that the community is aware of the spatial distribution of wastewater problems identified and the potential social, financial, and other costs of the possible array of treatment options. Identify and address any data gaps causing unacceptable uncertainties in service area characterization studies. Synthesize vulnerability, monitoring/assessment, and other information to identify and prioritize existing and likely future problem sites or areas. Conduct a reality check to determine the availability of technical, financial, and other resources to address some or all of those priorities.
Develop clear goals and explore options to address identified problems.	Identify public health, water quality, and growth/development goals for the community. Define the range of wastewater collection/treatment options that address these goals, including individual, clustered, and/or centralized facilities. Develop initial cost estimates for the options, and basic pros/cons related to the ability of each option to meet community goals, minimize traffic and construction disruptions, accommodate existing development and new growth, and minimize long-term operation/maintenance/management and financing expenses. Evaluate the technical, financial, and legal capacity of the community to implement treatment options or tailored combinations of the options, such as bonding/borrowing authority, mandatory hookup rules, fee-for-service authority, etc.

Generalized steps	Examples of typical activities or processes
Select wastewater treatment options; develop and implement a workable plan to implement the selected alternatives.	Identify the selected wastewater treatment option(s) based on the criteria above. Develop the engineering, financial, and other studies required to implement the selected alternative. Prioritize geographic areas or components of the system for implementation sequencing, and devise a schedule for completing key activities. Work with those supporting engineering, financial, permitting, and other aspects of the project to ensure communication, coordination, and cooperation. Prepare for long-term management of the resulting wastewater treatment system(s) by identifying the responsible management entity or entities and the financial, technical, and legal capacities needed. Monitor progress via selected indicators. Evaluate progress and adapt as necessary through a regular review process.

The Planning Process

The process of developing a wastewater management plan generally follows a set of definable steps. Juli Beth (Hoover) Hinds, in her paper entitled Decentralized Wastewater Management: Linking Land Use, Planning & Environmental Protection, lists these steps as:

1. Needs Assessment
A needs assessment is a comprehensive, lot-by-lot inventory and evaluation of a community's wastewater treatment needs and existing systems. GIS mapping is used to assess site conditions affecting suitability (e.g., locations of onsite water supplies, impervious cover, building footprints, setbacks to surface water), the relationship to groundwater resources, source water protection plan requirements, hydrogeology, and soils. Regulatory constraints such as required setbacks from roads or property boundaries may be included in the assessment, or a purely natural resource-based assessment should be made. An assessment can then be made as to whether each site is suitable for a conventional treatment system, requires an advanced treatment unit, or requires an off-site solution (i.e., connection to a centralized sewer or cluster system).

2. Resource and Land Use Patterns
This part of the process dovetails with a community's comprehensive plan. To support future growth planning goals, localities must have a clear idea of what land use patterns they wish to support with their existing or new wastewater treatment capacity. In addition, the resources to be protected through improved wastewater management (e.g., swimming holes, beaches, shellfishing beds, ponds, aquifers) need to be identified so that appropriate protection strategies can be developed. In some cases, a future land use plan is adopted directly into the wastewater management plan as the guide for the engineering assessment. In others, the wastewater management plan and needs assessment are incorporated into the natural resource section of a local plan.

3. Engineering Assessment
Once a needs assessment is conducted and the land use pattern and resources to be promoted are established, an engineering assessment is conducted. The typical approach to centralized treatment maximizes the number of public sewer connections. However, a community may opt for a more decentralized approach that would minimize the number of connections to off-site systems or existing sewers in order to save costs or achieve land use goals such as limiting growth. Regardless of the approach selected, information regarding the array of potential options should allow municipalities and engineers to compare the short- and long-term costs of different solutions. Particularly with advanced treatment units and cluster systems, operation and maintenance costs that must be covered through user fees differ greatly depending on the type of system. The system with the lower initial construction cost may have extremely high annual maintenance costs, and vice versa.

4. Public Education and Outreach
From the experience of communities nationwide, the common factors in all successful wastewater planning and management programs are public understanding, acceptance, and support. Common elements of success noted in national studies include:

- Development of a mission statement and common goal for the wastewater planning process, and
- Involvement of a committee with affected landowners as well as officials, staff, and consultants.

5. Management Plan and Financial Structure Development
This is the core of the plan—providing an equitable system that ensures the proper functioning of wastewater systems and multiple types of users within one integrated management system. Its components are described in detail below.

Planning Timeframe and Reviews

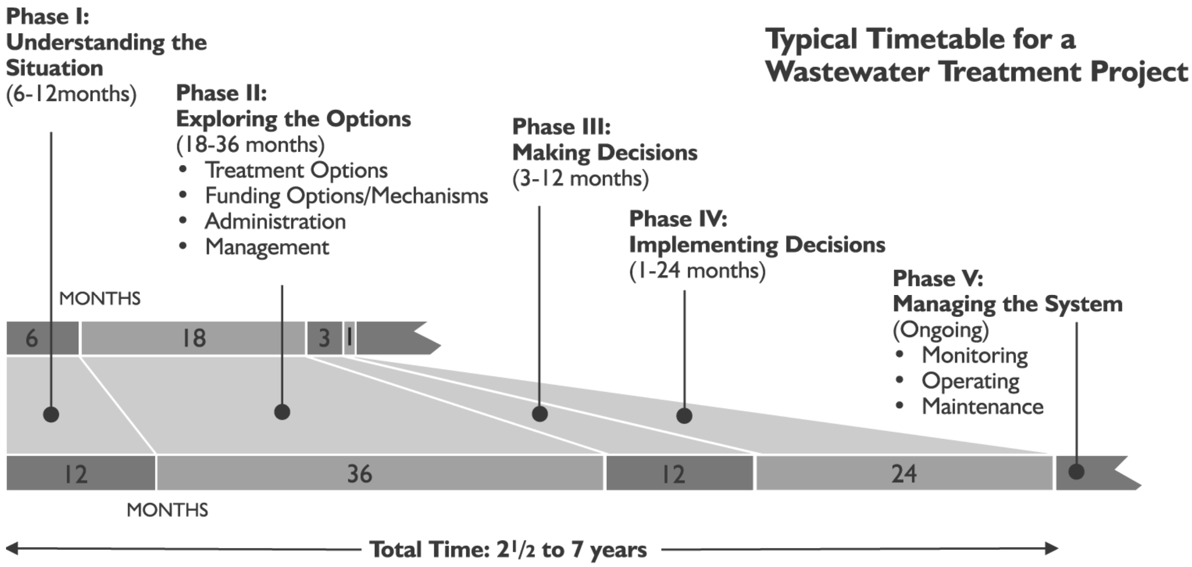
Developing and implementing a functional and sustainable wastewater plan can take anywhere from two and a half to seven years depending on the level of management (**Figure 1**).

Plans also require periodic reviews to ensure they are consistent with laws, regulations, and policies, and are meeting program goals and objectives. The National Small Flows Clearinghouse (2001) cited the primary reasons for unsuccessful wastewater management programs to be:

- Inadequate funding
- Suboptimal management program design
- Lack of adequate inspection, monitoring, and program evaluation capabilities
- Lack of public involvement and education

The most successful long-term decentralized wastewater management programs are adaptive, exhibit creative problem solving, have empathetic staff, secure dependable funding, and have strong administrative resources, including record keeping and data management.

FIGURE 1. Typical Planning Timetable for a Wastewater Treatment Project.



Source: http://www.extension.umn.edu/distribution/naturalresources/DD7734.html

II. Integrated Planning

Communities throughout the country are recognizing that wastewater management must be integrated into existing planning frameworks and programs to be efficient and cost effective. The goals and objectives of decentralized wastewater plans must be consistent with centralized wastewater facility plans, drinking water (source water) protection standards, water quality designated use standards, applicable underground injection control program requirements, and residuals management rules.

Low Impact Development

Planners must work with key stakeholders to make sure that the wastewater treatment options proposed for newly developed areas will be consistent with existing land use plans, watershed protection strategies, and the economic needs of developers, their financiers, and their customers. One approach to land development, called Low Impact Development (LID), uses various land use planning and design practices and technologies to conserve and protect natural resource systems and reduce infrastructure costs. LID allows land to be developed, but in a cost-effective manner that helps mitigate potential environmental impacts. Under this approach, developers carefully select the technologies appropriate to a site's unique regulatory, climatic, topographic, soil, and other conditions.

The Practice of Low Impact Development, a report prepared for the U.S. Housing and Urban Development, details the opportunities using the LID approach to consider a variety of conventional or alternative wastewater treatment system options. In practice, integrating LID with soil-discharging wastewater treatment typically involves an approach that identifies preferred areas for wastewater/stormwater infiltration, preserves mature trees and vegetation in critical areas, utilizes the existing drainage system as much as possible, and concentrates built structures in a manner that maximizes infrastructure cost efficiencies, space utilization, and overall aesthetics.

Wastewater Facility Planning

Section 208 of the federal Clean Water Act requires that areawide wastewater facility plans be prepared for sewage treatment in areas designated through a coordinated process of state and local involvement. The focus of the initial planning program was to ensure that federal construction grants did not fund wastewater treatment facilities in overlapping areas, but many states have retained the planning approach to ensure orderly and efficient development of treatment capacity. In most cases, wastewater facility planning has focused on developing cost-effective construction and operational alternatives to meet future wastewater needs. The report Valuing Decentralized Wastewater Technologies, prepared for EPA by the Rocky Mountain Institute (RMI), encourages that wastewater facility planning be expanded to include a broader examination of all aspects of a proposed wastewater system.

A second RMI report, Case Studies of Economic Analysis and Community Decision Making for Decentralized Wastewater Systems, consists of case studies of various communities that have struggled with wastewater infrastructure issues. The questions faced by the communities included how to manage dispersed wastewater systems, whether to replace septic systems with sewer systems, whether to extend sewers to developing areas, and determination of the optimum size of wastewater treatment facilities. Some of the communities studied *cluster systems* that serve groups of homes. In other cases, municipal sewer authorities reviewed the potential for managing conventional and other individual onsite wastewater systems in their immediate proximity as part of their utility services to take advantage of the efficiencies and effectiveness of such an integrated approach. The RMI studies and other cases illustrate the need to consider the time lag between planning for new capacity and the actual development of treatment capacity in centralized systems as well as the capital and financing costs of overbuilding centralized treatment capacity to accommodate expected future growth. Clustered soil-discharging systems offer a way to ensure that new development "pays for itself" through modular or distributed development of wastewater treatment capacity and can be used to relieve pressure on existing centralized facilities experiencing sanitary sewer overflows or other problems related to excessive wastewater flows.

Land Use Planning and Zoning

Land use plans can provide valuable information and support for wastewater management programs. These plans should serve as a primary basis for managing existing systems and determining the location, type, and capacity of future installations. Comprehensive land use plans provide one of the best vehicles available for ensuring that wastewater management issues are integrated into future growth and development scenarios. Comprehensive planning and zoning are closely related and are usually integrated. Planning sets overall guidance and policies, while zoning provides the detailed regulatory framework for implementation, usually at the lot or parcel level. Comprehensive planning that addresses environmental protection issues can be administered through zoning regulations that:

- Specify performance requirements for individual or clustered systems based on the quality of surface and ground water in the area
- Limit development on sensitive natural resource lands and within critical areas
- Encourage development within urban growth areas served by clustered or centralized systems, if adequate capacity exists
- Require consideration of factors such as wastewater system densities, hydraulic and pollutant output, proximity to water bodies, soil and hydrogeological conditions, and water quality impacts for all new development or existing system repairs

Source Water Protection Planning

Source water protection plans have been developed for nearly all municipal water supplies in the U.S., as required by the federal Safe Drinking Water Act and state laws. These plans generally outline the critical zones that must be protected to assure the safety of water supplies. In many rural and some urban areas, these plans show the existence of individual residential septic systems as potential contaminant sources. In some cases, larger dispersal systems, lower system densities, or conversion to better-performing clustered facilities might be required to certify that they will not contaminate drinking water sources. Several source water protection plans have led to the creation of decentralized wastewater management programs to assure that these waters are protected. An EPA fact sheet on Managing Septic Systems to Prevent Contamination of Drinking Water discusses siting and other measures that can be incorporated into source water plans.

Wastewater Reuse

In arid areas and other areas in the U.S. where water shortage occur, the reuse of treated wastewater and stormwater is necessary to meet water supply and use demands. EPA’s Guidelines for Water Reuse (EPA, 2004) summarize the key principles and practices for water reuse, including information to assist utilities and regulatory agencies charged with implementing wastewater reuse options. The guidelines cover water reclamation issues related to nonpotable urban, industrial, and agricultural reuse as well as augmentation of potable water supplies through indirect reuse. Both treated wastewater and storm water should be incorporated into water management plans to maximize the quantity of supplemental supplies and to match the desired water quality to available reuse options. For example, irrigation water for non-food crops requires less stringent levels of water quality than recreational waters.

Watershed Planning

Watersheds and subwatersheds represent an appropriate scale for assessing water quality, the impacts of polluted runoff and direct discharges, and appropriate management measures that meet the multiple objectives of wastewater, land use, and drinking water programs. An integrated watershed planning and management approach takes advantage of the inherent overlap among various programs and can help coordinate resources and leverage funding while avoiding the inefficiencies associated with “stovepiped” or disconnected programs. Integrated watershed plans provide mutual program benefits, operating efficiencies, and public education opportunities that can be difficult for agencies to achieve individually. There is a general movement on the part of state and federal agencies to manage water resources based on watersheds. Most states use watershed models to determine allowable pollutant loads from sewage treatment plant discharges and the effect of polluted runoff on surface water quality. The watershed assessment process has been found to be a valuable management tool for identifying the primary sources of pollutants, quantifying their relative contributions, and creating strategies for reducing water quality degradation. As the watershed approach becomes more predominant in the water resource management field, the value of integrated, broad-based wastewater management approaches will become more evident.

EPAs Handbook for Developing Watershed Plans to Restore and Protect Our Waters focuses on quantifying current pollutant inputs to surface waters from multiple sources (including wastewater treatment systems) and the expected benefits from improved treatment and management approaches. This handbook is recommended for planners who seek to integrate a wide range of water resource protection, restoration, and management efforts, including stormwater management, source water protection, wastewater facility planning, and nonpoint source pollution control.

Economic Development Planning

Economic development plans should address planning for wastewater collection, treatment, and long-term management of the needed facilities. An assessment should be made to determine if existing wastewater options are appropriate for current and future land use plans, and whether or not the wastewater program adequately addresses the types and quantities of wastewater generated in the community. If not, plans should be amended to address needed treatment capacity through individual system, clustered facilities, or centralized treatment plants. Community economic characteristics often inform the types of wastewater collection and treatment systems that can be supported. To promote the concept of integrated planning, the National Onsite Wastewater Recycling Association has offered workshops focused on integrating wastewater management into local and regional economic development planning.

INTERGRATED PLANNING – STATE AND LOCAL EXAMPLES

The Village of Warren, Vermont, has successfully integrated decentralized wastewater management into land use planning and zoning. The village is home to roughly 100 households and businesses. A wastewater committee and select board worked together to develop wastewater solutions to address new development. The plan maximized the use of individual treatment systems to minimize expansion of the village's small sewer system and to better manage growth. Enhanced treatment units are used to address environmental and space problems on the village's many small riverside lots.

In the Mobile, Alabama area, combined stormwater/wastewater sewers were overloaded and development pressure around the city was intense. In response, the Mobile Area Water and Sewer System (MAWSS) developed a strategy to support “sewer mining,” which provided relief for the existing sewer system and a strategy to use soil-discharging clustered systems to serve developing areas. A plan was devised and implemented to serve those areas with clustered systems managed by MAWSS and two other local utilities. There are currently 12 clustered systems in the area, each serving from 45 to 270 houses and commercial and educational institutions, charging fees ranging from $35 to $40 per month. The capital cost of these systems was $7,000 to $7,900 per residence. Treated effluent is discharged to the soil to recharge aquifers or meet other reuse demands as necessary. MAWSS thus expanded its customer base at very little cost and is reducing the existing overload to their sewers by withdrawing raw wastewater from sewer mains, treating it with low-cost decentralized technologies, then using the effluent for park irrigation.

The Town of Tisbury, Massachusetts, is working to improve its individual system management program through an integrated planning process. The community is using a risk-based approach to wastewater management with an emphasis on groundwater and surface water protection. The risk-based management approach strictly controls systems installed in locations that can threaten highly valued community drinking water sources. Lower level controls are applied to those parts of the watershed with lower-ranked waters or with waters that are not as susceptible to contamination, with all areas subject to controls designed to protect public health.

The Town of New Shoreham, Rhode Island, adopted a watershed approach to address the community’s dual objectives of managing growth and protecting its drinking water aquifer. The town’s comprehensive plan and sewer facilities plan both restrict centralized sewer service to the harbor business/village district to limit sprawl and excessive water use. Taking a watershed approach, the town worked with the University of Rhode Island's Cooperative Extension Service to conduct a screening-level wastewater needs assessment. Results indicated a need to better manage existing individual septic systems and to identify high-risk areas where enhanced treatment would be desirable. The next step was to identify and eliminate the most serious system malfunctions. In 1996, an ordinance requiring inspections with maintenance, as needed, and phasing out cesspools by 2005 was approved by the town. Wastewater performance standards were adopted by the town based on treatment zones. Most of the community fell into the basic "T1" treatment zone, which requires low-cost improvements to conventional systems such as septic tank access risers, effluent filters, and testing to ensure that septic tanks are water tight. However, in critical wellhead recharge zones and the coastal pond watershed (i.e., the "T2" treatment zones), enhanced treatment systems were required for all new systems and system repairs. The specific level and type of treatment depends on location and soil constraints. Wastewater management ordinances are strongly tied to the comprehensive plan goals, which specifically call for maintaining existing high quality waters. Similar programs are being undertaken in the nearby towns of South Kingstown and Charlestown.

III. Management Considerations

There are a number of key considerations when developing an effective wastewater planning program. These include:

- Public acceptance and local political support
- Funding availability and/or reasonable costs
- Visibility and accountability of local leaders
- Capability and attitude of technical/field staff
- Availability of creative, professional, and expert advisors
- Clear and concise legal authority, regulations, and enforcement mechanisms

The type and makeup of a wastewater planning program will vary widely across states and regions. **Table 2** summarizes and describes the types of basic, intermediate, and advanced wastewater planning approaches.

Table 2. Wastewater Planning Options.

Basic approach	Intermediate approach	Advanced approach
Coordinate wastewater program with regional planning office by sharing rules, soils, water quality, and other data.	Identify critical areas and sites requiring higher levels of pretreatment based on soils, hydrogeologic, ground water, and surface water information, or requiring more restricted development for planning, zoning, or other reasons.	Assess vulnerabilities of receiving water bodies and identify treatment standards based on health/water resource risks. Establish overlay wastewater treatment zones based on environmental sensitivity and potential health impacts. Identify areas where new development should incorporate clustered systems. Continually evaluate monitoring trends and revise requirements accordingly for existing and new development.

A key part of wastewater planning is determining how the constructed facilities will be managed over the long term. For centralized treatment plants, the engineering and fiscal studies will usually provide guidance on how the collection system and treatment works are to be operated and maintained and how these tasks will be paid for. For individual and clustered (decentralized) systems, EPA has developed management guidelines that identify key program management elements. All 13 elements of a wastewater management program described in EPA's Voluntary Guidelines can be evaluated during the planning process. The goals of each plan will guide how each program element is addressed. The authority to implement the program must be incorporated into applicable local/county ordinances to ensure the responsible management entity has all necessary powers and technical, managerial, and financial resources to implement and sustain the program. Once established, the management entity must continue to work with planners, elected officials, and regulators to implement the program and revise planning strategies as needed.

Some communities opt to manage individual treatment systems through local health agencies in coordination with other state and local regulatory authorities, water resource agencies, planning departments, service providers, homeowners, and other interested parties (e.g. volunteer monitoring groups, homeowner associations, etc.). Where large number of systems exist or where clustered facilities require management, identification of a public or private responsible management entity with the technical, managerial, and financial capacity to ensure long-term, cost-effective management of all facilities is highly recommended. The exact configuration of local management program will be based on the resources available, the nature of public health and water resource threats, and the creativity and commitment of the regulatory authority and the community. These resources include management authority such as regulatory codes, permitting processes, certification programs, resources and staffing, and public education programs, as well as data management compatibilities.

Legal Authorities

As part of the program planning process, stakeholders must review their state's enabling legislation to determine what legal authority is available to manage decentralized wastewater systems, if they will be part of the treatment facilities mix selected. Statutory and regulatory powers to manage decentralized systems vary by jurisdiction, so it is important to review this authority to determine:

- Ability to adopt/revise wastewater rules
- Ability to bring problem systems into compliance
- Ability to grant appeals and variances
- Ability to allow enhanced systems and require inspections and data collection

In order to be effective, wastewater management programs should have the authority to conduct a range of activities including:

- Provide policy and management continuity
- Charge fees for services (e.g., record-keeping, inspections, etc.)
- Implement compliance measures
- Ensure sustainable financial and legal support and responsibility
- Hire and retain qualified employees
- Enter into contracts and undertake debt obligation
- Have access to inspect systems that are located on private property

Many local jurisdictions rely on ordinances to provide authority to manage decentralized wastewater systems. These ordinances vary based on state-enabling legislation, applicable state and federal codes for wastewater management, and proposed rules of the management program. However, it is recommended that local ordinances include at the minimum:

- General rules or objectives of the program
- Design requirements for approvable systems
- Use of certified/licensed service providers
- Inspections, access requirements/easements, and procedures
- Operation, maintenance, and reporting
- Fee structure and payment frequency
- Enforcement procedures and appeals processes
- Program review procedures and frequency

Typical responsibilities and functions of governmental units and program participants are listed in **Table 3**.

Table 3. Institutional Considerations in Selecting a Management Entity.

	Responsibilities	Financing Capabilities	Advantages	Concerns
State Agency	Enforcement of state laws and regulations	Usually funded through appropriations, grants, and loans (e.g., revolving fund)	Authority level and code enforceability are high; programs can be standardized; scale efficiencies	Management entity must be separate from regulatory role
County	Enforcement of state codes, county ordinances	Able to charge fees, assess property, levy taxes, issue bonds, appropriate general funds	Authority level and code enforceability are high; programs can be tailored to local conditions	Same as state agency
Municipality	Enforcement of municipal ordinances; may enforce state/county codes	Able to charge fees, assess property, levy taxes, issue bonds, appropriate general funds	Authority level and code enforceability are high; programs can be tailored to local conditions	Same as state and county agencies
Special or sanitation district	Powers defined; may include code enforcement (e.g., sanitation district)	Able to charge fees, assess property, levy taxes, issue bonds	Flexible, renders equitable service (only those receiving services pay); simple and independent approach	Must ensure adequate financial reserves to serve present and future O&M needs
Improvement District	State statutes define extent of authority	Can sell bonds, apply special property assessments, user charges and other fees	Can extend public services without major expenditures; service recipients usually supportive	Must ensure adequate financial reserves to serve present and future O&M needs
Public Authority	Fulfilling duties specified in enabling instrument	Can issue revenue bonds, charge user and other fees	Can provide service when government unable to do so; autonomous, flexible	Financing ability limited to revenue bonds; local government must cover debt
Public nonprofit corporation	Role specified in articles of incorporation (e.g., homeowner association)	Can charge fees, sell stock, issue bonds, accept grants/loans	Can provide service when government unable to do so; autonomous, flexible	Capacity to provide all services (e.g., enforcement) may not be possible
Private nonprofit corporation	Role specified in articles of incorporation (e.g., homeowner association)	Can charge user fees, accept grants/loans	Can provide service when government unable to do so; autonomous, flexible	Same as for public nonprofit corporation
Private for-profit corporation	Role specified in articles of incorporation	Can charge fees, sell stock, accept some grants/loans	Can provide service when government unable to do so; autonomous, flexible	Enforcement powers must be provided by governmental entity; possibly not eligible for grants

Program Funding and Staff

One of the most difficult challenges during the planning process is securing funds to establish, implement, and manage the selected wastewater treatment option(s). A comprehensive and effective construction and management program may require more funding resources and staff than have traditionally been allocated in the past, especially for decentralized treatment facilities.

Base funding from local agencies, grants, or other sources can be supplemented through various fee-for-service mechanisms. For example, EPA Management Model 4 and 5 programs that own and/or operate decentralized treatment facilities typically charge fees of between $300 and $450 per residence per year. This cost may not include certain one-time costs (e.g., tap-on fees) or fees for special services. Low-level management programs (e.g., EPA Management Model 1) for individual systems typically cost less than $75 per residence per year, mostly to cover periodic inspections, minor system repairs, and pumpouts. Intermediate management programs such as EPA Model 2 (Maintenance Contract) and Model 3 (Permitting) approaches vary widely depending on what services are included, whether private contractors are used, and the types of technologies and monitoring/inspection programs employed. More information on financial resources to support decentralized wastewater management can be found in Resource Guide 5. Financial Assistance.

Another consideration during the program planning process is ensuring adequate program staff. If enhanced systems are used in a community, more and better-trained staff may be necessary to review designs and conduct inspections during and after construction. Adequate staff must also be available to oversee public education and system management programs to ensure that appropriate materials and guidelines are used and that the programs are achieving their desired goals. The number and qualifications of staff members are a function of the desired management program, resources available, and the tasks that will be performed. The number of required staff will be smallest in programs that use contract service providers to perform most field tasks, especially with low-level management programs. In some instances, however, higher level programs may choose to rely on service providers with some oversight responsibilities to assure proper performance.

INSTITUTIONAL OPTIONS – STATE AND LOCAL EXAMPLES

California permitted the creation of wastewater management districts by any public agency in 1977. The State of Washington’s 1994 onsite wastewater code (later amended) directed “areas of special concern” to bring individual systems under immediate management, including inspections at least every three years. In both states, the result was a series of management districts for individual and clustered systems.

Rhode Island state law provides for management programs with the authority to access/inspect systems on private property; require proper operation, maintenance, repairs, and/or replacement of malfunctioning systems; and assess fees and enforce program rules. It also dictates a uniform inspection program, allows local rules to be stricter than the state code, encourages public outreach and involvement activities, and provides financial assistance to home owners. The Rhode Island programs are supervised by municipalities. The University of Rhode Island offers examples of local ordinances used in Block Island, Charlestown, Kingstown, and other communities on their Web site. The coordination of these ordinances with the applicable state codes constitutes the basis of the state’s decentralized management program.

Iowa has been a leader in the development of high-level wastewater management programs since the passage of progressive enabling legislation. Partnerships with USDA’s Rural Development Program and the rural water districts have been vital to the program’s success. The state Department of Natural Resources has also made generous use of the Iowa State Revolving Loan Fund for individual and clustered systems, providing more than $1 million to almost 200 recipient communities.

Michigan law provides for a number of institutional options for community wastewater management. Rural townships can contract for management services from an adjacent community with a pre-existing wastewater management entity. Or, if the county has a sewage or water district, local governments can contract directly with the county for wastewater management services. Alternatively, small communities, townships, and villages can contract with a private company to monitor and maintain individual and clustered wastewater systems. Also, several townships and/or villages can establish a joint authority such as a sewage district or management district to share system construction and management costs. Finally, neighborhoods and subdivisions can form a nonprofit corporation (e.g., homeowners’ association) to build and manage their own treatment system(s). Nonprofits can receive state and federal grants directly.

Tennessee Onsite Wastewater Systems, Inc. and American Water in New Jersey are two examples of private management entities. These two companies own and operate systems under an EPA Management Model 5 approach, using partnership agreements with local governments. Iowa, Rhode Island, Connecticut, North Carolina, Tennessee, Missouri, Kansas, Idaho, Pennsylvania, Alabama, Massachusetts, New York, and Minnesota also have enabling legislation that supports development of independent management entities.

Managing Data and Information

Communities need mapping, topographical, soils, water quality, growth planning, and other data to explore existing problems and develop effective solutions. Many kinds of information are readily available, but sources and completeness of data may vary from community to community. A local jurisdiction should evaluate the adequacy of partnerships and data-sharing policies with other agencies involved in growth planning, public health, and environmental protection. Improved data-sharing cooperation will help improve efficiency and overall program performance. Each community must build or strengthen existing databases to accommodate information needs. Additional information on data management is available in Resource Guide 4. Inventories, Reporting, and Recordkeeping.

DATA MANAGEMENT SYSTEMS–STATE AND LOCAL EXAMPLES

The Maryland Department of the Environment and the Prince George County Health Department worked together to develop a geographic information system (GIS) to quantify and mitigate nonpoint source nutrient loadings to the lower Patuxent River, which empties into the Chesapeake Bay. The agencies developed a database of information on existing individual wastewater systems, including system age, type, and location, with additional data layers for depth to groundwater and soils. The resulting GIS framework allows planners and decision-makers to quantify nitrogen loadings and visualize likely impacts under a range of management scenarios and for use in managing wastewater in new developments.

Gwinnett County, Georgia, received federal Clean Water Act Section 319(h) grant funding in 2003 to complete a color infrared (CIR) aerial photographic survey of the county to quantify the magnitude of individual systems that were malfunctioning. Poorly performing systems exhibit distinct aerial photographic signatures (characteristics) on CIR aerial photographs taken at the appropriate time of year, which show up as differences in surface vegetation density. The image acquisition phase of the study, successfully completed in mid-March 2004, resulted in the collection of approximately 1,500 CIR aerial photographs. Following the ground-verification phases, the total number of septic system malfunctions identified was 1,078. This included 121 surface failure sites, 508 seasonal failure sites, and 449 seasonal stress sites. Results of the study were classified into six priority listings, which became “hit lists” for corrective action.

IV. Additional Resources

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPAs Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 3. PERFORMANCE REQUIREMENTS

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links, or any technical problems click here to contact us.

INTRODUCTION

Most states regulate individual and clustered wastewater systems using a prescriptive regulatory code that evaluates the physical features of a site to determine if a conventional wastewater system or an approved enhanced system would be appropriate. Prescriptive standards are based on the presumption that if a system is sited and designed to meet certain prescribed requirements, such as specific setbacks to water sources and minimum depth to groundwater, they will protect the public health and environment. Prescriptive codes typically specify several pre-approved onsite treatment systems and often limit the use of innovative or enhanced technologies. States are now looking at performance-based management approaches as a means to promote technological innovation and protect environmental integrity. This overview provides readers with information about use of performance-based approaches in wastewater system management. Included in this overview are:

I. Issues and Management Considerations

- Management Issues
- Program Funding Constraints
- Public Participation and Partnerships

II. Risk Assessment and Management

- Risk Assessment Methods

III. Performance-Based Management Approaches and Tools

- Site Evaluation
- System Design and Performance
- Operation and Maintenance
- Permits

- Inspections and Monitoring
- Enforcement and Compliance

IV. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to performance-based onsite wastewater standards.

I. Issues and Management Considerations

Performance-based management programs are derived by characterizing risks posed by individual and clustered (decentralized) wastewater systems to public health and water resources. These programs establish pollutant loading limits for both onsite and cluster wastewater facilities, and expect system designers to meet the load limits.

PERFORMANCE-BASED CODES AND PERFORMANCE-BASED STANDARDS

Performance-based codes are regulations requiring that wastewater treatment systems meet specific measurable or demonstrable performance standards, but do not prescribe the methods or required site conditions. The use of performance-based codes requires enhanced pretreatment for sites where the prescriptive rules cannot be met, such as in critical areas or other sensitive receiving environments.

Performance standards specify measurable or demonstrable treatment requirements, usually in the form of effluent pollutant concentrations at a specified performance boundary, such as the seasonal water table or property line. Designers are required to meet the standards by assembling a series of wastewater treatment processes, including treatment unit and soil-based processes, that address the pollutant limits specified. Such standards do not require that site characteristics or treatment methods be specified by the regulatory authority, though in some cases the regulatory authority will approve certain types or classes of treatment systems as meeting the performance standards for designated conditions. *Source: Washington State Department of Health*

Management Issues

The goal of a performance-based program approach is to promote the desired level of wastewater treatment in a manner that protects public health and water quality. Depending on the type of public health risks or environmental impacts, standards can be established and applied to protect a particular water resource. The development of a state or local performance-based program will require careful consideration of a number of management issues including:

1. How do we match risk reduction strategies to receiving environmental risk factors?
2. Can the performance standard or requirement actually be met, i.e., can the treatment technology overcome known site constraints?
3. Will the standard result in actual conservation/environmental benefits (reductions in pollutant loads, energy use, or other impacts)?
4. Are additional or better-trained regulatory and/or management authorities necessary for permitting, operation, maintenance, monitoring, and enforcement?
5. What is the cost of implementing the standard or requirement (capital, operational, personnel, administrative) and how practical/economical is its application (equity of costs among users)?
6. What type of training and data management infrastructure is required to support design review and long-term monitoring and management of systems?
7. Will it be acceptable to the public?

Adapted from A *Massachusetts Guide to Needs Assessment and Evaluation of Decentralized Wastewater Treatment Alternatives*

The National Onsite Wastewater Recycling Association (NOWRA) has been working to develop a model onsite code framework. NOWRA's five-year effort identified many difficulties that are encountered when developing a national model that is protective of water quality and easily implemented. The final framework, adopted by NOWRA in 2006, contains policy options to be considered when adopting a state or local performance-based code. It suggests the establishment of site-specific rather than statewide performance requirements in order to match site or area risk conditions with performance requirements.

NOWRA PERFORMANCE-BASED CODE DEFINITION

A performance code is an administrative regulation that specifies the end or result of a process or activity. It allows the general use of solutions that demonstrate achievement of the objective requirement or standard without a code revision. The deployment of treatment and dispersal methods creates a link between demonstrated performance and site risk. Performance of treatment components and skilled personnel is assessed by the creation of measurable standards and an evaluation tool to assess compliance with the standard. This process can be applied to treatment components and skilled personnel and is intended to allow their deployment across multiple political jurisdictions. *Source: NOWRA Executive Summary*.

Program Funding Constraints

One of the major concerns expressed by state and local officials is the ability to fund a performance-based requirement. State or local officials must be equipped with trained staff to conduct design review, permitting, inspection, monitoring, and data analysis. Data management systems are needed to track system performance. Compliance inspections and/or requirements for mandatory quick response to emergency alarms may be necessary. Program choices will have to be realistic based on a community's resources. This may mean targeting a particular area where impacts of poorly performing systems are threatening a water supply or ecological resource.

Most wastewater management programs are financed through state and local government appropriations. Permit and inspection user fees are often used to help supplement those funds. In some cases, additional program funding and support may be available through state or federal grants or loans. A mitigating factor, such as an impaired waterway, will often drive additional funding and support for a performance-based program. For example in 2004, Maryland established the Bay Restoration Fund to reduce nitrogen loading to the Chesapeake Bay. The law authorized the collection of a $30 annual fee from users of individual wastewater systems. The fund generates an estimated at $12.6 million per year to upgrade these systems and plant cover crops to reduce nitrogen inputs to the bay.

NOWRA, in its Model Code Framework, also suggests that local programs consider shifting certain responsibilities, such as site evaluations and construction inspections, to the private sector. This will free up staff and program resources to target monitoring and oversight of system operations. In 2007, NOWRA began hosting workshops across the country to educate state and local officials about the model code framework.

Public Participation and Partnerships

Numerous case studies of local wastewater programs reveal the importance of public participation and involvement in the decision-making process. Early, continuous, targeted, and transparent communication among all stakeholders is critical to a successful outcome; whether it is developing a basic inspection program or an advanced performance-based code. Partnerships with the public and private sector should be explored in order to build the capacity to strengthen and sustain decentralized wastewater management programs. It may be necessary to conduct additional research at several junctures during the rule-making or program development process in order to seek consensus among stakeholders.

II. RISK ASSESSMENT AND MANAGEMENT

Poorly treated wastewater discharges pose inherent public health and environmental risks due to the presence microbial and chemical constituents. The challenge is to assess the type and magnitude of risks in a given situation and decide on the most appropriate method to manage those risks. EPA has recommended that performance requirements be developed in accordance with a risk-based analysis that establishes specific measurable performance criteria in the form of measurable or demonstrable effluent standards, such as specific concentrations of fecal coliform or nitrogen, on a regional or site-specific level. Such an assessment should consider:

- The hazards of each potential pollutant in the wastewater
- Pollutant transport and fate
- Potential exposure paths
- Projected effects on humans and environmental resources

Lot-level performance requirements specify standards for each wastewater treatment system. The exposure pathways include the system and nearby water resources, such as a household well, lake, stream, or estuary. Macro-level concerns include wastewater system impacts on the receiving water as well as the cumulative loading of all sources that will discharge directly or indirectly to that receiving environment and the risks posed to downstream ecosystems and water users. EPA encourages the use of performance-based requirements on a watershed, sub-watershed, or source water protection zone basis. These are natural units on which to develop and implement performance-based management strategies. In situations where jurisdictional boundaries cross watersheds, sub-watersheds, or source water recharge boundaries, inter-governmental coordination is needed.

Establishing performance standards for individual watersheds, sub-watersheds, or source waters allows the program manager to estimate total loadings and allocate hydraulic and pollutant loads to ensure that the goals of the community and regulatory agencies can be met. Depending on the local physical and socio-economic situation, different technologies, standards, or system configurations (e.g., clustered facilities) can be identified to address specific site and regional sensitivities.

Risk Assessment Methods

There are a variety of risk assessment methods, varying from simple to highly complex, that have been created to develop performance-based requirements. Whatever method is employed, a watershed-based risk assessment should identify wastewater pollutant impacts and vulnerable or critical resources. In more environmentally sensitive (i.e., lakeside communities, recreational waters, marine resources, etc.) or high-density residential areas, enhanced or clustered systems may be needed. Three risk assessment methods and approaches appear below. The selection and use of these methods should be based on community needs as well as the ability of the model to accurately and consistently approximate actual event/response relationships.

Water Quality Standards. Existing national water quality standards for surface water and drinking water provide a good starting point for selecting appropriate performance requirements. Generally, these standards were developed using risk assessment processes and procedures that consider the designated uses of receiving waters, the hazard and toxicity of the pollutants, the potential for exposure to humans and ecosystems, and the estimated impacts of exposure. By estimating the mass of cumulative pollutants discharged by the treatment systems and other pollutant sources to groundwater or surface waters and calculating the assimilative capacity of the receiving waters, the pollutant reductions needed can be quantified and then allocated by source (e.g., urban yards and landscaped areas, row crop lands, animal feeding operations). The results of these analyses are then used to determine the relative contribution by each source to the total pollutant load. If the contribution from soil-based dispersal systems is small relative to the total, it is not normally cost effective to place stringent limits on them before attempting to reduce sources with larger contributions. In most cases, the approach would be to abate the larger sources first and measure the results of those efforts before addressing the smaller sources.

MANAGE Model. The Method for Assessment, Nutrient-loading And Geographic Evaluation (MANAGE) uses map analyses that incorporate landscape features, computer-generated GIS, and a spreadsheet to evaluate pollution risks of proposed land uses. MANAGE is a screening-level analysis designed for area-wide assessments of aquifers, wellhead protection areas, or small watersheds. Local knowledge is needed to identify critical resource areas, refine the map data, and select management options for analysis. Community decision makers participate actively in the assessment process.

RISK ASSESSMENTS – STATE AND LOCAL EXAMPLES

Malibu, California, relies on individual soil-discharging treatment systems to protect valuable inland and coastal waters. A team of consultants and city staff conducted a three-year risk management study to develop recommendations to protect these resources and to meet state water quality standards. Many stakeholders, including regulators and environmental advocacy groups, were involved throughout and were essential to the study's success. The study area includes groundwater recharge zones in the alluvial aquifers around Malibu Creek and Lagoon, Winter Canyon, and the surf zone of the Pacific Ocean near Surfrider Beach. The groundwater aquifer was the focus of the study because it receives the treated effluent from onsite systems and transmits groundwater to local surface waters. A three-dimensional groundwater model evaluated impacts of onsite systems on groundwater quality. The risk assessment approach used six steps:

1. Define receiving waters and objectives for key water quality constituents
2. Identify, locate, and quantify contamination contributed by onsite systems
3. Evaluate hydrological conditions to determine groundwater flow directions and travel times
4. Estimate the assimilative capacity of unsaturated and saturated zones to account for the reduction or assimilation of pathogens and nitrogen during groundwater transport
5. Delineate specific areas that might pose pathogen and nitrogen risks to the receiving waters
6. Identify and evaluate alternative strategies to reduce risks to acceptable levels

The results indicated that portions of the study area might be contributing pathogens or nitrogen to Malibu Creek and Lagoon or the surf zone. The recommendations focused on the desired water quality outcomes—specifically, meeting Total Maximum Daily Loads (TMDLs) for pathogens and nitrogen. Suggested actions included initiating a point-of-sale wastewater system inspection program, requiring inspections for systems within the six-month pollutant travel time zones, evaluating a proposed clustered wastewater collection/treatment/dispersal system, and requiring disinfection or nitrogen removal for systems in the contributing areas. The City of Malibu is incorporating the action items into its Wastewater Management Plan.

The Town of North Kingston, Rhode Island, and the University of Rhode Island conducted a risk assessment using the MANAGE model to evaluate present and future water pollution threats from onsite wastewater systems. The assessment identified hot spots where the risks of system failure and pollutant delivery to sensitive water resource areas were the greatest. The risk assessment provided the basis for the adoption of a wastewater management program with site-specific wastewater treatment standards based on a combination of site suitability and location in a variety of sensitive resource protection areas.

The Town of Tisbury, Massachusetts, conducted a risk-based assessment to delineate environmentally sensitive areas in the community and identify wastewater management districts. The assessment served as a basis for program development including the development of a long-term maintenance program for onsite systems and expansion of loans for system upgrades.

The MANAGE model generates maps and charts in three areas:

- Pollution "hot spot" mapping of potential high-risk areas.
- Watershed indicators based on soil and land use characteristics (e.g., percent of impervious area, forest cover).
- Nutrient loading in the watershed based on estimates from current source research and general fate of nitrogen and phosphorus (*Joubert et al., 1999*).

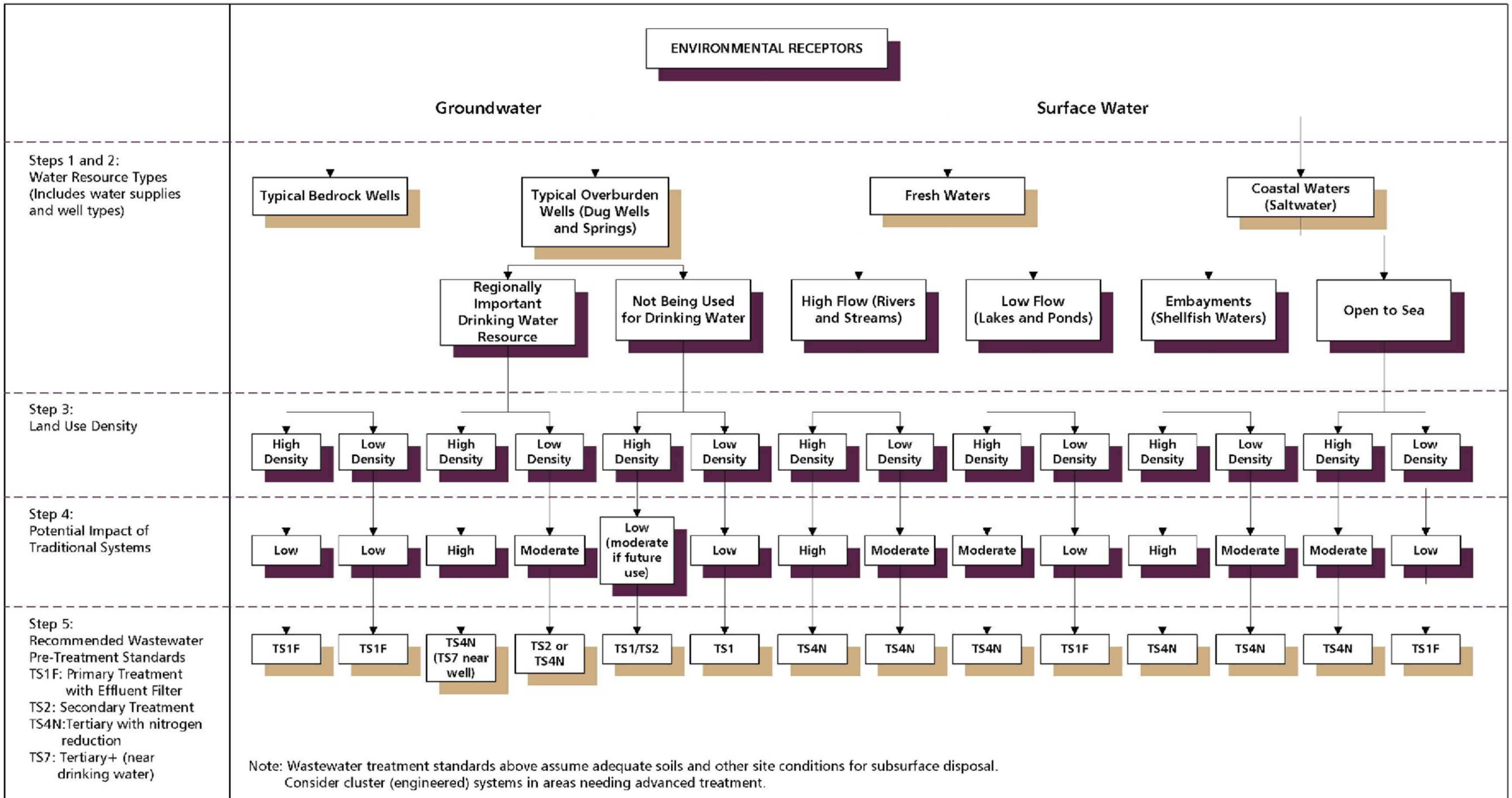

TABLE 2: MATRIX OF WASTEWATER TREATMENT OPTIONS BASED ON PERFORMANCE STANDARDS
Technology and System Options and Constraints for Decentralized Wastewater and Water Supply
Maine State Planning Office

Path: O:\Proj-03\1409-W-MaineSPO\Reports\WhitePapers\TreatmentOptionsMatrix.vsd
int: 05/30/03 amm; rev: 12/10/03 amm

STONE ENVIRONMENTAL INC

Probability of Environmental Impact. A more simplified probability of environmental impact approach can be used when data are insufficient for a more rigorous assessment. The approach described by Otis (1999) is in the form of a decision tree that considers mass loadings to the receiving environment (groundwater or surface water), population density, and the fate and transport of potential pollutants to a point of use. A decision tree estimates the relative probability of water resource impacts from wastewater discharges generated by sources in the watershed. Based on the existing or expected use of the water resource, discharge standards for the treatment systems are established. The system designer can use these discharge standards to assemble an appropriate treatment train. An example of this approach produced for Maine appears on the following page.

III. Performance-Based Management Approaches and Tools

Table 1 shows the various approaches—from very basic to more advanced—to facilitate performance-based management. Within the United States, no state has yet to adopt a comprehensive performance-based code. However, many states have incorporated (or are moving towards the incorporation of) elements of a risk-based regulatory framework that retains prescriptive requirements that have proven effective. For example, North Carolina, Florida, Arizona, and Massachusetts have modified their wastewater codes to establish zones requiring advanced treatment standards to be met, in particular for nitrogen-removal near drinking water supplies, sensitive embayments, and estuaries.

Table 1. Performance-Based Management Approaches

Basic Approach	Intermediate Approach	Advanced Approach
Prevent direct and indirect contact with wastewater through prescribed site requirements, hydraulic loading restrictions, separation distances and specific, acceptable system designs.	Specify enhanced treatment technologies for certain sites or conditions that do not meet prescribed requirements. Establish inspection and maintenance reporting requirements based on system type and performance desired.	Identify water resource uses and characterize surface and groundwater quality; evaluate cumulative impacts/allotments for all sources of critical pollutants; establish numeric and narrative performance requirements for individual/clustered systems based on water quality criteria and assimilative capacity of land and water resource(s). Develop protocols and frequencies for measuring (monitoring/inspections) compliance against performance requirements.

These hybrid programs often represent a more realistic approach to performance-based management, especially in communities with limited financial resources. Since the concept of performance-based requirements is new to onsite wastewater management, local and state officials should work together to target those technologies that are cost-effective, sustainable and suitable to local conditions. A number of states and communities have created technical committees composed of public and private sector representatives to review performance-based options. For example, Washington State's technical review committee developed recommendations for effluent treatment performance-based standards following the review of more than 40 publications and a thorough analysis of state law.

A performance-based program must have the appropriate tools and resources to be effective. In general, an assessment should be conducted to help in:

- Defining legal authority to enact management regulations
- Identifying management areas
- Identifying program goals
- Identifying specific resource areas that need an additional level of protection (i.e., aquifers, areas with existing water quality problems, and areas likely to be at risk in the future)

- Establishing performance goals and performance requirements for the management area and specific watersheds, subwatersheds, or source water protection areas
- Defining performance boundaries and monitoring protocols
- Determining and setting specific requirements for individual and clustered systems based on protecting specific management areas by achieving a specified level of treatment (e.g., within a particular sub-basin, there will be no discharge that contains more than 1.0 mg/l of total phosphorus)
- Developing or acquiring information on enhanced treatment technologies, including effectiveness information and operation and maintenance requirements
- Developing a review process to evaluate system design and system components

Source: *U.S. EPA Onsite Wastewater Treatment System Manual*

Implementing a performance-based management approach will require states and communities to develop appropriate standards and protocols for conducting site evaluations, evaluating system design/performance, conducting operation and maintenance activities, and monitoring system performance. Due to the resources involved in establishing and operating a performance-based program, some regions, states, and multi-state groups have established cooperative approaches for approving various system configurations and proprietary products as meeting broad categories of performance requirements when they have been tested, certified by an established testing program, or subjected to treatment process and hardware reviews by qualified technical experts. This manifestation of the hybrid approach is particularly beneficial, due to the efficiencies and effectiveness associated with practical application of joint management actions.

Site Evaluation

The site evaluation process for individual wastewater systems in a number of states and communities has become more refined and comprehensive. Besides simple percolation tests, risk and other performance factors are identified through the analysis of soils, restrictive horizons, and seasonal water tables (See Resource Guide 6. Site Evaluation). These enhanced evaluations are based on site-specific variables. They typically take the form of new regulations that are applied to a wider variety of systems and sites.

System Design and Performance

Design reviews require some knowledge of the potential performance by each unit process in the treatment train. The designer must back-calculate the pollutant removals required by each unit process, starting with the water quality criteria or other limits associated with the receiving waters. For example, if the receiving water quality limit for the pollutant is known, what removal would be expected during travel through the saturated soil (groundwater) and the unsaturated soil that receives the pretreated effluent? If these can be estimated, the required pretreatment unit effluent concentration limit can be estimated. The designer would then choose a pretreatment unit from unit processes or prefabricated treatment unit(s) that can produce an effluent that is less than this concentration limit.

A designer of an individual or cluster treatment system requires credible performance data for various system types to determine their ability to treat wastewater within a particular setting. Information sources for this purpose vary. **Table 2** ranks them in descending order, based on the value of the data. EPA's Environmental Technology Verification Program (ETV) tests and verifies individual wastewater treatment technologies, and is completely voluntary. Some states, however, recommend or require vendors of new technologies be verified through ETV or to use ETV protocols. For example, North Carolina began requiring vendors to test new technologies according to the ETV protocols in 2001.

Some states and communities have initiated pilot projects to better assess the capability of a system to be meet certain performance level. Massachusetts has a three-tiered program in which an installer/homeowner can apply for a pilot test to use an enhanced system. If the system proves successful, it may be used by other homeowners testing new situations and different conditions. When certified, the data from these home trials are used to determine the conditions of use. In 2002, the New Jersey Pinelands Commission Alternate Design Treatment Systems Pilot Project tested five enhanced denitrifying treatment technologies. The two-year project includes quarterly sampling of effluent; a pre-paid, five-year maintenance contract; and annual service calls. Manufacturers are also required to submit semi-annual monitoring reports. Eighty-five Pinelands enhanced treatment systems have been installed and activated, and implementation ordinances have been certified in 34 communities.

Table 2. Hierarchy of Decentralized Wastewater Technology Data Sources.

Higher Value

Quality Controlled Field Studies
• EPA treatment system demonstration projects
• State wastewater treatment training centers
• University research projects such as
  ○ University of Minnesota Resource Center
  ○ Texas Onsite Wastewater Treatment Council
  ○ Purdue Residential Onsite Wastewater Disposal

Expert Panel Review • National Decentralized Water Resources Capacity Development Project
3rd Party Testing • National Sanitation Foundation Systems Certified Wastewater Treatment Units • EPA Environmental Technology Verification Program
Manufacturer and Product information • Manufacturers Web site • Product information • EPA Region 1 Web site: Innovative Technology for Decentralized Systems

Lower Value

Operation and Maintenance

Performance-based requirements focus on a system's performance, maintained through proper operation and maintenance. States have increasingly incorporated operation and maintenance requirements based on the complexity of wastewater systems and the risks posed. For example, the North Carolina wastewater rules recognize the increased need for maintenance and regulatory oversight for more complex treatment and dispersal alternatives. Permanent service or maintenance contracts or other legal mechanisms to ensure system maintenance should be considered, along with monitoring requirements or inspections tied to the system type, performance history, and operation and maintenance needs.

Permits

Some states, such as Florida and New Jersey, have incorporated performance standards into their National Pollutant Discharge Elimination System (NPDES) permit programs. NPDES permits are required for any and all systems that discharge effluent to surface waters defined as waters of the U.S.(see link to the NPDES program for specific information). EPA's Voluntary National Guidelines for Onsite and Clustered (Decentralized) Wastewater Treatment Systems notes that *"If a decentralized system is required to have an NPDES permit and an authorized state or tribe is administering a decentralized management program under this strategy, the requirements of the program should be incorporated into the applicable NPDES permit, which is the primary regulatory instrument."*

A number of state and local agencies have established construction and/or operating permit programs to regulate the design, installation, and operation of residential systems that treat domestic waste. State wastewater operating permit programs are typically used when prescriptive guidelines do not apply. For example, Massachusetts requires operating permits for more complex treatment systems such as recirculating media filters and other enhanced technologies.

Finally, soil-discharging wastewater systems that have the capacity to serve 20 or more people per day are defined as large capacity septic systems and are required to obtain permit coverage under the federal and state Underground Injection Control Program rules for Class V injection wells. Most of these systems are permitted by rule through a state registration process. System operators should check their state's regulations for specific permit requirements.

OPERATING PERMITS – STATE AND LOCAL EXAMPLES

Arizona adopted a performance-based general permit approach in 2005, using site evaluation and design algorithms for each system installation. Compliance is determined by an inspection of observable site conditions (e.g., evidence of a changed dwelling, facility tampering, inadequate maintenance, system malfunction) and maintenance records.

Florida adopted provisions for permitting residential performance-based treatment systems in 2000. The regulations apply to a variety of alternative and innovative methods, materials, processes, and techniques. Discharges under the performance-based permit program must meet the criteria for secondary, advanced secondary, or advanced wastewater treatment, depending on system location and the proximity of protected water resources. Operation and maintenance manuals, annual operating permits, signed maintenance contracts, and biannual inspections are required for all performance-based systems.

St. Louis County, Minnesota, adopted performance requirements in lieu of standard prescriptive requirements where less than three feet of unsaturated, permeable soils are present. The county issues renewable operating permits for higher-performance (enhanced) treatment systems. The operating permit is based on an evaluation of system performance rather than design prescription. The permit is issued for a limited term, typically five years. The owner must document that the permit requirements have been met in order to renew the permit. The permit program is self-supporting through permit fees.

The Canadian Province of British Columbia adopted outcome-based performance standards. These standards are attached to the type of treatment system and the quality of the effluent discharged to the distribution area. The regulation applies to wastewater systems for single-family homes and more complex multi-residential, industrial, and commercial systems.

Inspections and Monitoring

Wastewater regulatory programs that include a performance-based approach must have strong inspection and monitoring requirements to ensure systems are performing as required.

Performance-based monitoring may include:

- *Process control monitoring* This includes monitoring of flows, wastewater constituents, and conditions at various points in the treatment process, as well as effluent monitoring (if possible) to identify needed process adjustments.
- *Discharge monitoring* Measurement of the volume and pollutant concentrations of effluent—and NPDES permit coverage—is required for all facilities that discharge to waters of the U.S. Discharge monitoring is particularly important in sensitive areas where the potential risk to human health and the environment from system malfunction is great enough to warrant the cost of sampling and analysis.
- *Ambient monitoring* Regulatory agencies may require ambient water quality monitoring for decentralized facilities in some cases. This typically takes the form of groundwater monitoring wells located downslope of wastewater soil absorption systems, and often upslope as well. Any monitoring program should consider public health and water quality objectives and agency administrative and operational capacity.

Components of a monitoring program include:

- Clear definition of the parameters to be monitored and measurable standards against which the monitoring results will be compared
- Strict protocols that identify when, where, and how monitoring will be done; how results will be analyzed; the format in which the results will be presented; and how data will be stored
- Quality assurance and quality control measures to ensure credible data

MONITORING – STATE AND LOCAL EXAMPLES

The Critical Point Monitoring (CPM) process is helping to meet a statewide monitoring mandate for local health agencies in Washington State, which must develop and implement plans to initiate periodic monitoring of all onsite wastewater systems. The CPM process provides a systematic, preventive-based approach for monitoring individual and clustered wastewater systems. By concentrating on the wastewater flow points in a system that are most critical to monitor and control, CPM catches problems in the early stages, before they become serious and expensive to correct. While CPM is a process-based standard, in practice its application requires choosing performance standards for the identified critical monitoring points. The seven steps in the CPM process include a system hazard analysis, critical monitoring point identification, establishing critical limits, monitoring procedures, corrective actions, record keeping, and verification procedures.

Source: Critical Point Monitoring: A New Framework for Monitoring Onsite Wastewater Systems.

Enforcement and Compliance

Performance-base standards focus on outcomes and a set of measures to determine those outcomes. Under this type of management approach, the regulated entity has the responsibility to meet those outcomes. For example, if monitoring shows continued water quality problems, additional steps may be necessary to achieve an acceptable outcome. The regulatory role is one of oversight through mandatory maintenance requirements, inspections, and monitoring.

If expected outcomes are not achieved, the state or local regulatory entity must have adequate legal authority, effective enforcement mechanisms, and compliance incentives to initiate remedial actions. In most states, enforcement powers are vested in the local governments through certain “home rule” provisions, but there are numerous variations when dealing with individual and clustered wastewater systems. In some states the power to enforce rules can be granted to a responsible management entity, but the power to impose user fees and fines may still be limited to the local government.

COMPLIANCE – STATE AND LOCAL EXAMPLES

The Pineland Commission of New Jersey adopted a pilot program for five enhanced systems that includes ongoing reporting and compliance measures including:

- Interim reports to monitor problems with one or more of the technologies
- A hearing process to give the system manufacturer an opportunity to refute Commission conclusions and/or propose remedial response
- The option to continue use of technology with modifications, increase the minimum lot size to meet the 2 mg/l nitrogen requirement, or stop future installations of a problem system

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach

2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

EPA 832-B-05-005 January 2010 Web Supplement

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 4. INVENTORIES, REPORTING, RECORDKEEPING

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Effectively managing individual and clustered wastewater treatment system depends on data system inventories, inspection and service reports, and records ranging from installer contact information to manufacturer operating manuals. The availability of electronic database systems and online reporting and data retrieval capabilities has transformed information collection and management over the past 20 years. Management entities can now track system installation and even operation remotely and have the ability to view inventory and other information from their office or browser-enabled cell phones.

This guide provides information on the key components of wastewater system data collection and management efforts and cites examples and resources for those requiring additional details. Program managers can use the information in this guide to help them meet state and local reporting and recordkeeping requirements and hopefully build the capacity over time to provide greater support for wastewater planning, watershed studies, and research on field performance of various treatment system types. The guide is organized as follows:

I. Individual and Cluster System Inventories

- TWIST and Other Inventory Tools
- Other Useful Data
- Inspections, Surveys, and Analytical Tools

II. Reporting

- Maintenance reporting

III. Database Tools and Resources

- Examples from State and Local Programs

IV. References and Additional Resources

- Resource links are included throughout this guide to provide more specific information.

I. INDIVIDUAL AND CLUSTER SYSTEM INVENTORIES

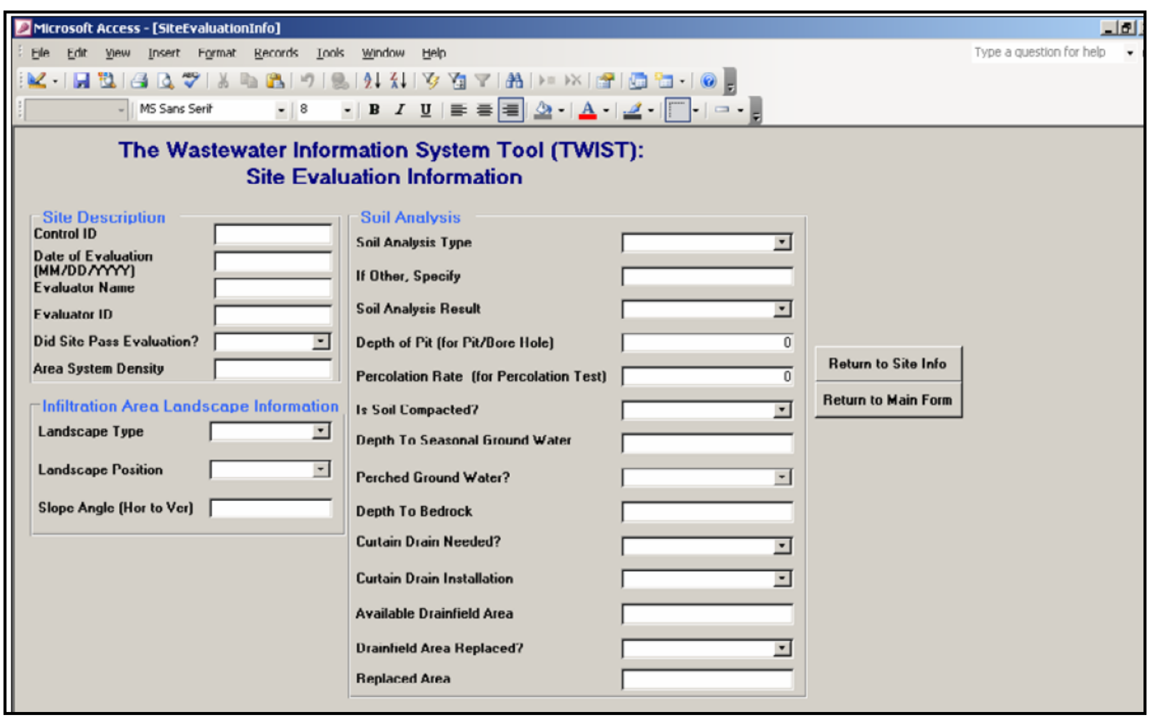
Without a good base of information, it is difficult for a community to assess its wastewater management needs and develop effective solutions. One of the first steps in developing or enhancing a wastewater management program is to conduct a comprehensive inventory of systems.

Most local health agencies with individual/cluster system permitting or inspection programs will have some basic information on the number and location of and other types of wastewater treatment systems. However, most of these inventories do not include older systems (for example, those installed before 1970). Many of these older systems have been neglected for years and are performing poorly, and some may be threatening drinking water and water quality. Several states now require communities collect data on all soil-discharging treatment systems. For example, in 2000 the State of Wisconsin changed its plumbing code to require that all systems, regardless of age, be inspected by a qualified individual at least once every three years. Counties are charged with administering the program and as such are required to compile a database of all treatment systems to verify compliance.

TWIST and Other Inventory Tools

As noted above, inventories of existing individual and cluster systems provide the basis for system management. Programs that know where treatment facilities are located and their type, size, components, installation date, and inspection/service records can use this information to craft risk-based management approaches tailored to factors such as treatment system complexity, installation densities, proximity to water resources, and other risk parameters.

FIGURE 1. TWIST Site Information Data Entry Screen.



In response to these and other management needs, EPA developed The Wastewater Information System Tool (TWIST). TWIST is a free-use Microsoft Access based platform for recording and tracking information about sewage generation, the treatment system, the installation site, inspections, pumpouts, and other data (see example data entry screen). TWIST is distributed at no cost on EPA's TWIST Web page link.

The database is designed so that users can adapt TWIST to their needs. For example, those familiar with the software can add or delete data fields (see list in **Table 1**), create tailored reports, or adapt the system for use as a Web-based tool with user interface and data entry allowed from any work station with the proper identification and password.

The State of Indiana is using TWIST as an inventory platform for soil-discharging wastewater systems in the coastal area and plans to expand the database statewide as a Web-based system. Other systems for inventorying and managing wastewater treatment systems are also available, including:

- SepTrack
- SepticPlanner
- SIMS (Septic Information Management System)
- CASST (Computer Aided Septic System Tracking)
- Vericomm
- Purdue University Wastewater System Permit Database
- ArcPad
- Carmody Data Systems
- Ayres Associates
- CDP (Custom Data Processing) Web-based Wastewater Inspection Management System
- National Sanitation Foundation

Table 1. TWIST Data Categories and Data Elements

Data category	Data elements
Front Page	Agency Name Action Taken
General Site Information	Property Owner Property Information
Permit Information	Permit Type Permit Issued To Permit Details Operating Permit Needed Y/N Maintenance Contract Needed Y/N Permit Violations
Facility Served	Facility Address (If Different) Type of Facility Facility Information Water Supply Source
Site Evaluation Info	Site Description Type of Soil Analysis Soil Analysis Results Landscape Position – Infiltration Area
Treatment System	Installation Information System Manager (If Not Homeowner) Wastewater Information Tanks – Number, Type, Size, etc. Post-Tank Treatment Soil Infiltration System Surface Discharging System Y/N Design Flow of System Electrical/Mechanical Features Infiltration System Setbacks
Service Reports	Service Information Inspections Tank Pumpouts System Repairs

Other Useful Data

Inventorying wastewater treatment systems is often a huge undertaking for communities, which can take considerable time and resources. It is important that an inventory be designed to collect information in the most efficient manner possible based on a community's needs. The first step in designing a wastewater inventory is to identify existing sources of data. There are a number of data sources that can be mined to help build a system inventory, including property records, service provider records, billing/fee collection records, and permit records. Other sources include:

- Census data
- Facility or other plans for wastewater, drinking water, and other utilities
- Soils data from Natural Resource Conservation Service (NRCS) and installers
- Topographic data from United States Geological Service and state or tribal sources
- Existing wastewater and septage facilities

- Land-use and development data from local and regional planning agencies
- Water quality data from public agencies and volunteer monitoring programs
- Watershed characterization and assessment information
- Aerial photographs from transportation agencies, NRCS, and local utilities

Inspections, Surveys, and Analytical Tools

Inventories of existing systems can be developed through inspections, surveys, and analytical tools. In many cases, developing a new management program, or enhancing an existing one, focuses on a group of wastewater systems believed to pose elevated risks to groundwater or surface waters, such as those in a well recharge zone or around a recreational lake. In these cases, inventory information can be collected and walkover inspections can be conducted simultaneously. Physically inventorying systems can result in the most complete data sets, but is resource-intensive. Health officials in Fillmore County, Minnesota, for example, visited more than 2500 rural residences in 17 townships during the past 10 years to locate wastewater systems. Homeowners are offered a $300 incentive payment to replace problem systems. To receive the $300 payment, homeowners are required to attend a workshop on operation and maintenance of their system sponsored by the county.

Most communities, however, lack the resources and staff to conduct door-to-door surveys. Instead, a number have preformed selective surveys based on environmental or health concerns. For example, the Town of Brunswick, Maine, used a $34,000 National Estuary Program grant to inventory the status of systems on 542 developed lots in a coastal protection zone and develop a management program for these systems. The town's wastewater management program now serves as model for other communities in Maine.

Another approach for identifying and inventorying systems is linked to lake water quality studies. The Ten Mile Lake Association in north central Minnesota periodically monitors bacteria concentrations during dry weather along the lake shore to determine likely areas of rapid effluent migration from overloaded or poorly designed treatment systems. High bacteria concentrations are noted in the association's newsletter, with system operational status verified through field inspections and discussions with property owners, in some cases.

One promising field that has been used to identify treatment systems with rapid effluent migration to land or water surfaces is color infrared aerial photography. This technique uses color infrared aerial photography of targeted sites to identify areas where warm effluent might be surfacing. This method uses variations in vegetative growth or stress patterns over effluent infiltration areas to identify those systems that might be hydraulically malfunctioning. Then a more detailed visual and physical inspection will confirm whether the system has truly malfunctioned and the extent of the repairs needed. South Carolina is using Forward Looking Infrared Imagery to identify malfunctioning treatment systems. Aerial infrared images taken during the winter are used to locate hot spots which may indicate leaking tanks or surface water discharges. These areas are then targeted for monitoring and sampling. Gwinnett County, Georgia, used infrared photos to spot plumes of extra-lush vegetation nourished by nutrients flowing from problem septic systems. Similar surveys have been used in Indiana, North Carolina, and Arkansas.

Most wastewater management programs rely on complaints to identify malfunctioning systems. However, using complaints to generate an inventory falls does not result in the type of comprehensive information needed to support a management program. Another inspection tool being used in a number of communities are property transfer inspections. This approach requires inspections of wastewater systems prior to the sale of property in order to identify problem systems and generate an inventory. For example the community of Story, Iowa, requires all properties with wastewater systems be inspected prior to a sale to determine compliance with state and local rules. Washtenaw County, Michigan, also has a well-established time-of-sale system inspection program. Inspectors must be approved, and needed corrective actions identified by inspectors must be logged and addressed before the property is sold. Additional information on property transfer inspections can be found in Resource Guide 12. Inspection and Monitoring.

SYSTEM INVENTORY – STATE AND LOCAL EXAMPLES

In Warren, Vermont, numerous reports of treatment system malfunctions in the narrow Mad River Valley were amplified by revelations of high pathogen counts in the river and drinking water well contamination in the porous ledge rock setting. An EPA grant provided funding to document and inventory all the water and wastewater systems in the community using a Global Positioning System to create a database in a Geographic Information System format.

Cannonsville Reservoir Watershed, New York, researchers used digital soil survey information to develop a database of site conditions from more than 1,100 existing wastewater systems. Soil map units were grouped into four classes based on their suitability to meet common system design criteria. A geographic information system was found to be a useful tool for the assessment and visual display of treatment system and landscape information. Geographic information system analysis indicated 80 percent of soils in the watershed have characteristics that are not suitable for conventional soil-discharging systems. The 69 percent of individual systems installed were of designs suited for soils with no or few restrictive parameters. The results imply that many systems in the watershed are in need of improvements to perform adequately.

In the spring of 2005, the North Carolina Underground Injection Control (UIC) program initiated a pilot effort to identify large capacity and industrial process wastewater treatment systems that discharge to the soil. Initially, the UIC program staff contacted or visited six county health departments in order to identify systems of this type that had been permitted by local health departments. The effort identified 71 such systems. The survey was expanded statewide in July 2005. The UIC Program is currently working to determine the operating status and geographic coordinates of these systems and will conduct quality checks of the data collected to determine its accuracy, precision, and completeness.

McHenry County, Illinois, used a GIS mapping approach to develop system inventory information for planning and other purposes. Upon completion of the planning effort, the database was converted to a management entity inventory and information archive. GIS-based inventory and system mapping data provides useful information for watershed studies, long-term wastewater planning, and feedback on system performance via linking system type/location information with water sampling results.

The Upper Susquehanna Coalition teamed up with the Environmental Resource Research Institute at Penn State to develop a suite of ArcView GIS-based environmental assessment tools for use by environmental professionals in the Upper Susquehanna watershed. The ArcView Stream & Environmental Assessment Monitoring System (AVStrEAMS) is a collaboration of many components that aid in providing an environmental assessment report pertaining to a particular stream segment and its surrounding area. AVStrEAMS uses either USGS Digital Topographic maps or Digital Aerial Photography as base maps. The user is given specially designed tools to create points or line segments on the base maps corresponding to the desired application. For example, the user can click on the base map to create a point for a stream monitoring site or draw a box around a section of stream to delineate a badly eroded segment.

II. Reporting

Most state and local governments now require reports regarding new system installations and major repairs, and some are also beginning to track inspections and services, such as tank inspections and pumpouts. For example, Santa Barbara County, California, requires mandatory reporting of service calls by tank pumpers in order to inventory the systems and identify potential problems. Such reporting is often conducted as part of the management requirements for enhanced individual and clustered systems, which typically feature pumps, float switches, timers, and sometimes modems and other electronic equipment.

Collecting data on system operation, maintenance, and repairs can provide a wealth of information on the reliability of overall performance of various system technologies, how resources might be allocated during budget projections, and whether maintenance schedules might need to be adjusted.

Maintenance Reporting

Reporting tools are typically used to monitor more advanced systems or those that are considered high-risk dischargers. Owners and service providers of these systems periodically file maintenance and monitoring reports with local or state agencies. In Texas, maintenance providers of systems that use secondary treatment systems, nonstandard systems, drip irrigation, and surface application must submit a report to the permitting authority and owner at least once every four months. In Massachusetts, service contractors for enhanced systems are required to periodically report maintenance visits and submit water quality data to the local health department and to the state.

III. Database Tools and Resources

Efficient record keeping involves the use of a data management system that includes database development, data entry, data access and retrieval, data analysis, and data use. The use of electronic databases, spreadsheets, and geographic information systems increases the ease of collecting, storing, retrieving, using, and integrating data. A basic information management system should include the following data:

- System owner and contact numbers
- System location and components from as-built drawings lot-level plans
- Site evaluation information and provider
- System designers, inspectors, and permitting officials
- Operation and maintenance activities such as dates, performing individuals, and reports
- Complaints including dates, responding personnel, and reports
- System rehabilitations (dates, as-builts, contractors, and approving official)
- Monitoring data (dates, reports, sampling, and analytical performers)

Examples from State and Local Programs

Information collection and reporting systems for wastewater treatment facilities support wastewater treatment programs, planning activities, and water resource protection protection efforts. The development of an information system can be a challenge for a small community. Universities and their cooperative extension programs can be a good source of technical assistance. For example, Montgomery Township in Mercer County, New Jersey, worked with Rutgers Cooperative Research and Extension to update its management program database. The enhanced database was implemented in 2004. It is linked to the municipality's geographic information system, and is automated to generate form letters, invoices, late notices, and license renewals. This database has increased productivity, improved tracking abilities, and resulted in faster identification of systems needing inspection for the municipality.

In some states, communities have access to a statewide database of treatment systems. The Rhode Island Wastewater Information System is a new Web-based wastewater management information system available statewide for use in Rhode Island. This database can be easily accessed by any community and used to track treatment system conditions, inspection results, maintenance, and performance. Maintenance providers can also use the system to track their client's inspection and maintenance schedules.

The use of geographic information systems and global positioning systems and other software packages provide powerful mapping tools to enhance and implement programs. GIS enables a clear understanding of what systems are located where in relation to other environmental features, such as waterways, varying soil types, and slopes. Collection of this information is an essential step in developing risk-based approaches to management, particularly with respect to cumulative risk. Santa Barbara County, California, has delineated areas served by individual soil-discharging systems through the use of GIS. The county is also working on a data conversion/GIS enhancement process to map high-risk areas using treatment system surveys, water well locations, soil data, groundwater profiles, water quality monitoring and other information. The newly formed Crow Wing County Sanitary Management District in Minnesota is developing a customized GIS database that will help the district and homeowners track the performance and maintenance of their wastewater systems. Overlaying the mapping database with current aerial photography provides the district with an effective tool for comprehensive planning and management of the rural wastewater infrastructure.

DATABASES – STATE AND LOCAL EXAMPLES

For five years Jamestown, Rhode Island, has been using a Web-based database to manage and maintain all of the county's 12,000 individual treatment systems. The Web-based database is also being used by Key West, Florida.

With the help of EPA funding, Monroe County, Florida, installed an internet-based system tracking program in 2002. Maintenance and monitoring data are entered by service providers. The system facilitates service scheduling and billing for operating permit fees and identifies when maintenance services are overdue. The database was populated with operating permit data and has subsequently been expanded through service provider inputs. The Web-based management system, which is supported through Clean Water Act Section 319 grants, is now available for use in all 67 Florida counties. Carmody Data Systems, Inc. currently has similar systems in 13 states, including Wisconsin, and the Chesapeake Bay.

The Town of Tisbury, Massachusetts, uses the SIMS inventory system to schedule operation/maintenance events, in addition to its value as a complete inventory of the location of treatment systems and site conditions, the database is also used to monitor system performance and environmental impacts.

Barnstable County, Massachusetts, developed a database for innovative/alternative systems that can be searched by multiple parameters, including town and technology type. The database can also be queried to find noncompliant systems through cancelled contracts, system not inspected, sampling not performed, and violations of effluent limits.

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Upper Susquehanna Coalition Website Home Page http://www.u-s-c.org/

Upper Susquehanna Coalition GIS page http://www.u-s-c.org/html/GIS_Data.htm

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 5. FINANCIAL ASSISTANCE

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Communities have several options for funding wastewater management programs for individual and clustered treatment systems. For most, the cost of operating the management program will be the most important consideration in program design. One option is to charge fees, such as permit fees, member fees, monthly or annual service fees, or fees for specific services, such as inspections or septic tank pumping. Management entities may also need the authority to levy taxes, issue bonds, or receive state or local funding. Most will choose a combination of strategies.

Funding for system installation or construction is also needed in many cases. A significant portion of these funds will likely come from system users through tap-on assessments, permit, fees, service charges, and other sources. Some communities have tapped low-interest loans provided under Clean Water State Revolving Fund (CWSRF) programs to fund wastewater projects. Any treatment system project or activity funded under the CWSRF must meet state planning and other requirements.

This overview provides readers with general information about funding options for onsite wastewater systems and programs. Included in this overview are:

I. Financial Tools

- Program Planning
- Infrastructure Development
- Management Programs

II. Federal Funding Sources

III. State Loan and Grant Programs

IV. References and Additional Resources

- Resource links are also included throughout this guide to provide users with more specific information related to financial assistance.

I. FINANCIAL TOOLS

Program Planning

Planning is one of the first initiatives that a community must undertake to design a wastewater management program. It is important that a community obtain the necessary funding to initiate the planning process. Many communities fund planning activities through general revenues. However, a few states offer community incentives, in the form of grants, to encourage program planning.

PROGRAM PLANNING – STATE AND LOCAL EXAMPLES
Massachusetts established a loan program on either a community-wide basis or for a portion of the town or a targeted sensitive areas (e.g., shellfish beds, recreational lake water supply) with high system malfunction rates. Under this option, a $20,000 pre-loan assistance payment is awarded to assist communities in identifying priority areas and establishing a comprehensive management approach. Upon approval of the plan, loans of $20,000 are available. Communities proposing a comprehensive inspection program that meets the state's requirements for the time of transfer and communities that join other communities will be eligible for larger loans.

Infrastructure Development

The next and most critical step is to obtain the funds to cover the initial construction costs for the physical infrastructure, if applicable, and technical elements of the program. Funding may also be needed for demonstration projects or enhancements to existing systems.

Several communities have elected to make the transition from individual systems to a clustered approach to capitalize on the financial and other benefits associated with the joint use of lagoons, drain fields, and other system components linked by gravity, vacuum, or low-pressure piping. Developers of projects involving cluster systems that may have on-lot, collection, and treatment/dispersal components have been particularly creative and aggressive in obtaining financing for system installation. In the case of new development, some approaches may require the developer to install septic tanks at individual homes, install the collection system piping, and provide a dedicated site for the treatment facilities and dispersal area, all according to the specifications of the wastewater system operator.

Sources of funding for program infrastructure development include state finance programs, capital reserve or savings funds, bonds, certificates of participation, notes, and property assessments. Twenty states offer some form of financial assistance for system installation through grants, loans (state or CWSRF), or special project cost-share funding. Capital reserve or savings funds are often used to pay for expenses that might not be eligible for grants or loans, such as excess capacity for future growth.

In some cases, the management entity makes arrangements with CWSRF-designated, state-approved local lending institutions to offer special terms (i.e., lower interest, longer payback periods) to customers who are unable to pay the cost of required repairs or upgrading in order to come into compliance in a timely manner. In effect, the entity is a co-signer of such loans and guarantees them against default. In areas where there are major commercial wastewater sources, the potential of using private financing through a partnership arrangement should be investigated since these contributors may have the most to gain from a successful decentralized management program.

Management Programs

Most communities use a combination of financing approaches to fund wastewater programs. **Table 1** reviews the advantages and disadvantages of different funding mechanisms. The selection of funding approaches will depend on a number of factors and tools available to communities. It is up to each community to select the most reasonable financing strategy to provide for the long-term community/regional or watershed-based wastewater solutions.

The most widely used financial options to fund the operation of decentralized wastewater management programs include general state/local revenues, property taxes, user fees, permit fees, and direct payment for services. These sources are most often used to support site evaluation, permitting, and enforcement programs.

ONSITE WASTEWATER PROGRAM FUNDING SOURCES

Local Revenues and Taxes. Many communities fund important community services through local revenues such as property taxes. If only a portion of a community requires management of wastewater systems, tax increment financing may be one way to utilize a portion of the taxes collected from that neighborhood for the purpose of managing their systems.

User Fees. A common way to pay for wastewater treatment and management services is through user fees, as part of a regular sewer bill. In this way, the cost of providing management services is spread out throughout the year. This approach works especially well if another public utility, like a water company or electric company, is providing the wastewater management services.

Permit Fees. Operating permit fees fund most state environmental permitting programs. This concept can be extended to individual and clustered treatment systems.

Payment for Services. Some communities bill property owners when the service is delivered. While this approach may make budgeting and planning more difficult, it works well in communities that have a wide range of service needs.

Table 1. Advantages and Disadvantages of Various Funding Sources.

Funding source	Description	Advantages	Disadvantages
Loans	Money lent with interest; can be obtained from federal, state, and commercial lending institution sources.	State and federal agencies can often issue low-interest loans with a long repayment period. Loans can be used for short-term financing while waiting for grants or bonds.	Loans must be repaid with interest. Lending agency might require certain provisions (e.g., power to levy taxes) to assure managing agency has ability to repay the debt. Commercial loans generally have higher interest rates; might be difficult to obtain without adequate collateral.
Grants	Funds awarded to pay for some or all of a community project.	Funds need not be repaid. Small communities might be eligible for many different grants to build or upgrade their environmental facilities.	Applying for grants and managing grant money require time and money. Sometimes grant-imposed wage standards apply to an entire project even if the grant is only partially funding the project; this increases project expense. Some grants have material and design requirements that exceed local standards and might result in higher costs. Grant funds are quite scarce in comparison with loan funds.
General obligation bonds	Bonds backed by the full faith and credit of the issuing entity. Secured by the taxing powers of the issuing entity. Commonly used by local governments.	Interest rates are usually lower than those of other bonds. Offers considerable flexibility to local governments.	Community debt limitations might restrict use. Voters often must approve of using these bonds. Usually used for facilities that do not generate revenues.
Revenue bonds	Bonds repaid by the revenue of the facility.	Can be used to circumvent local debt limitation.	Do not have full faith and credit of the local government; rates often are higher than those of general obligation bonds.

Table 1. Advantages and Disadvantages of Various Funding Sources. (continued)

Funding source	Description	Advantages	Disadvantages
Special assessment bonds	Bonds are payable typically from collection of special assessments. Property taxes often cannot be used to pay for these.	Removes financial burden from local government. Useful when direct benefits can be readily identified.	Can be costly to individual landowners. Might be inappropriate in areas with non-uniform lot sizes. Interest rate might be relatively high.
Bond bank monies	States use taxing power to secure a large bond issue that can be divided among communities.	States can get the bond at a lower interest rate. The state can issue the bond in anticipation of community need.	Many communities compete for limited amount of bond bank funds.
Certificates of participation (COPs)	COPs can be issued by a community instead of bonds. COPs are issued to several lenders that participate in the same loan.	Costs and risks of loan spread out over several lenders. When allowed by state law, COPs can be issued when bonds would exceed debt limitations.	Requires complicated agreements among participating lenders.
Notes	A written promise to pay a debt. Can include grant and bond anticipation notes.	Method of short-term financing while a community is waiting for a grant or bond.	Community must be certain of receipt of the grant money. Bond notes are risky because voters must approve general obligation bonds before they are issued. Voter support must be overwhelming if bond notes are used.
Property assessment	Direct fees or taxes on property. Sometimes referred to as an improvement fee.	Useful where benefits from capital improvements are identifiable. Can be used to reduce local share debt requirements for financing. Can be used to establish a fund for future capital investments.	Initial lump sum payment of assessment might be a significant burden on individual property owners. Some states and localities restrict the allowable burden on individuals.
User fees	Fee charged for using the wastewater system.	Generates steady flow of revenue. Graduated fees encourage water conservation.	Flat fees discourage water conservation. Graduated fee could discourage high-volume water using industries or businesses from locating in an area.
Service fees	Fee charged for a specific service, such as pumping the septic tank.	Generates funds to pay for operations and maintenance. Fees not imposed on people not connected to the system.	Revenue flow not always continuous.
Punitive fees	Charges assessed for releasing pollutants into the system.	Generates revenue while discouraging pollution.	Generation of funds not always reliable. Could encourage business to change location or participate in illegal activities to avoid fees. Could generate opposition to O&M scheme.
Connection fees	Charges assessed for connection to existing system.	Connection funded by beneficiary. All connection costs might be paid.	Might discourage development. Can be restricted by state/local laws.
Impact fees	Fees charged to developers.	Paid for only by those who profit. Funds can be used to offset costs.	Might reduce potential for development. Can be restricted by state/local laws.

Sources: Ciotoli, P.A., and K.C. Wiswall, 1982. *Management of On-Site and Small Community Wastewater Systems*. EPA 600-8-82-009, Office of Research and Development, Cincinnati, OH; U.S. Environmental Protection Agency, 1994. *Environmental Planning for Small Communities: A Guide for Local Decision-Makers*. EPA 625-R-94/009, Office of Research and Development, Cincinnati, OH.

MANAGEMENT PROGRAMS – STATE AND LOCAL EXAMPLES

Lake Panorama in Guthrie County, Iowa, has individual systems in its 5,100-acre rural development since 1980. About 600 systems are inspected each year by the county health department. The management program is supported by county funds appropriated by the County Board of Supervisors.

The Georgetown Divide Public Utility District provides drinking and irrigation water to a foothill region of the Sierra Nevada Mountains in west-central California. Since 1970, it has also operated a wastewater management program for 965 residential systems and lots in a 3,538-acre rural development called Auburn Lake Trails. Each property owner pays for both water and sewage services through a bimonthly utility bill.

The Will County Health Department manages over 2,500 individual wastewater treatment systems in the rural areas around Joliet, Illinois. Annual renewable operating permit fees fund the program.

Crystal Lakes, in Larimer County, Colorado, manages over 300 household holding tanks. The Crystal Lakes Water and Sewer Association purchased its own pumper truck and operates and maintains three wastewater treatment and dispersal systems to handle the pumped wastewater. Each property owner is charged $75 each time a holding tank is pumped out.

The 2006 session of the Minnesota Legislature appropriated $1 million to its Small Community Wastewater Treatment Program for soil-based systems with an average daily flow of under 10,000 gallons/day for communities with priority problems.

II. Federal Funding Sources

The following federal agencies and national programs are among the most popular sources of funds for onsite system management and installation programs.

U.S. EPA Clean Water State Revolving Fund. The Clean Water State Revolving Fund (CWSRF) is a low- or no-interest loan program that has been a major financier of centralized sewage collection and treatment facilities. Program guidance issued in 1997 by EPA specified that the fund can be used as a source of financial support for the installation, repair, or upgrade of onsite systems in small towns and rural and suburban areas. Projects that may be eligible for CWSRF funding include individual new system installations, replacement or modification of existing systems, and costs associated with establishing a management entity to oversee onsite systems in a region, including capital outlays (e.g., trucks, storage buildings). Funding for this program is managed by state agencies with input and some oversight by EPA.

U.S. EPA Clean Water Act Nonpoint Source Pollution Program. The Clean Water Act (CWA) section 319 (nonpoint source pollution) funds can support a wide range of polluted runoff abatement, including onsite wastewater projects. Projects funded in the past have included direct cost-share for onsite system repairs and upgrades, assessment of watershed-scale onsite system contributions to polluted runoff, regional remediation strategy development, and a wide range of other programs dealing with onsite wastewater issues. Funding for this program is managed by state agencies with input and some oversight by EPA.

U.S. EPA Clean Water Indian Set-Aside Program. Section 518(c) of the 1987 Amendments to the Clean Water Act established the Clean Water Indian Set-Aside Program and authorized EPA to administer grants in cooperation with the Indian Health Service (IHS). This partnership maximizes the technical resources available through both agencies to address tribal sanitation needs. The program uses IHS Sanitation Deficiency System to identify high-priority wastewater projects for funding.

U.S. Department of Agriculture. Rural Development programs provide loans and grants to low/moderate income individuals. State Rural Development offices administer the programs. These include:

- *Rural Housing Service*. This agency offers homeownership opportunities to low- and moderate-income rural Americans through several loan, grant, and loan guarantee programs. Applicants may obtain 100 percent financing to build, repair, renovate, or relocate a home or to purchase and prepare sites, including providing water and sewage facilities.

- *Home Repair Loan and Grant Program*. For very low-income families, this program offers loans and grants for home renovation. Money may be provided to repair a leaking roof, to replace a wood stove with central heating, or to replace an outhouse and pump with running water, a bathroom, and a waste disposal system.

- *Rural Utilities Service (RUS)*. This program provides assistance for public or nonprofit entities, including wastewater management districts. Loans are available for water and waste disposal systems in rural areas and towns with a population not in excess of 10,000. Technical assistance is also available directly and indirectly through contractors and nonprofit organizations funded by RUS.

- The Rural Business-Cooperative Service. This program provides business- and industry-guaranteed loans to help create jobs and stimulate rural economies by providing financial backing for rural businesses. Loan proceeds may be used for working capital, machinery and equipment, buildings and real estate, and certain types of debt refinancing.

Rural Community Assistance Partnership Revolving Loan Fund. This program provides short-term financing to eligible applicants for pre-development costs associated with proposed water and wastewater projects.

Environmental Finance Information Network (EFIN). EFIN is a central source of information on funding alternatives for state and local communities and consists of environmental services centers located at various universities nationwide. The centers provide state and local officials with advisory services, education, publications, training, technical assistance, and analysis of financing alternatives.

U.S. Department of Housing and Urban Development Community Development Block Grants. The U.S. Department of Housing and Urban Development (HUD) operates the Community Development Block Grant (CDBG) program, which provides annual grants to 48 states and Puerto Rico. CDBG grants can be used for numerous activities, including rehabilitation of residential and nonresidential structures, construction of public facilities, and improvements to water and sewer facilities, including onsite systems. EPA is working with HUD to improve access to CDBG funds for individual wastewater system owners by raising program awareness, reducing paperwork burdens, and increasing promotional activities in eligible areas.

Appalachian Regional Commission. The Appalachian Regional Commission's (ARC) mission is to be an advocate for, and partner with, the people of Appalachia to create opportunities for self-sustaining economic development and an improved quality of life. The ARC can assist communities in Appalachia fund the development of onsite management programs.

Indian Health Service Sanitation Facilities Construction Program. The IHS Division of Sanitation Facilities Construction administers a nationwide Sanitation Facilities Construction Program that is responsible for the delivery of environmental engineering services and sanitation facilities to American Indians and Alaska Natives.

III. State Loan and Grant Programs

Several states have created grant and loan programs using various funding sources to assist individuals and communities in addressing wastewater problems. Below is a sampling of the wide range of approaches used throughout the country.

LOAN AND GRANTS – STATE AND LOCAL EXAMPLES

The Kentucky PRIDE Program is a local, state, and federal partnership to address the challenge of cleaning up Kentucky's rivers and streams. The program, funded through federal grants, provides grants and loans to replace malfunctioning wastewater systems.

The Pennsylvania Infrastructure Investment Authority provides low-interest loans to qualifying homeowners for wastewater system rehabilitation, improvement, or repair or replacement of an existing system located on a single family, owner-occupied property that is the primary resident of the owner.

Massachusetts developed three programs to help finance wastewater systems and management programs. One program offers loans at below-market rates. Another program provides a tax credit of up to $4,500 over three years to defray the cost of onsite system repairs for a primary residence. Finally, the Comprehensive Community Septic Management Program provides funding for long-term community, regional, or watershed solutions through low-interest loans of up to $100,000.

The Texas Commission of Environmental Quality authorizes the use of funds collected under its Supplemental Environmental Projects to assist low-income people in repairing or replacing their systems.

The Washington State Clean Water Pollution Control Revolving Fund provides low-interest loans to individuals and small businesses for needed repairs and upgrades of wastewater treatment systems. The loan program is administered by local health jurisdictions that apply for funding through the Department of Ecology's Water Quality Financial Assistance Program. The CWSRF has provided almost $10 million to repair or replace more than 500 malfunctioning systems.

In 2004, Maryland created the Bay Restoration Fund. The dedicated fund, financed by wastewater treatment plant users, is used to upgrade wastewater treatment plants with enhanced nutrient removal technology to achieve wastewater effluent quality of 3 mg/l total nitrogen and 0.3 mg/l total phosphorus. A fee is also paid by individual system users to help finance nitrogen removal system upgrades. The Maryland CWSRF linked deposit mechanism also provides a source of low-interest financing to encourage qualifying individual and water system owners to implement capital improvements that will reduce the delivery of nutrients to the Chesapeake Bay and its tributaries. The term "linked" refers to the relationship between the below-market rate of interest investment provided to a participating lender and the borrower's below-market rate of interest loan used to fund certain water quality capital projects. The below-market interest rate loan the borrower receives is "linked" to the lender's below-market rate of interest investment. Nonpoint source projects, including the repair of soil-discharging systems, are eligible for the CWSRF loans through a linked deposit program.

Finding the appropriate mix of resources to finance wastewater programs is a challenge. EPA developed the Environmental Finance Program (EFP) to assist communities in their search for creative financial approaches. The EFP provides financial technical assistance to the regulated community along with advice and recommendations on financing issues, trends, and options. University-based Environmental Finance Centers help communities lower costs, increase investment, and build capacity by creating partnerships with state and local governments and the private sector to fund environmental needs.

IV. References and Additional Resources

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 6. SITE EVALUATION

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

INTRODUCTION

This resource guide contains information for evaluating sites for individual and clustered treatment systems that discharge effluent below the surface of the ground (i.e., to the soil) for final treatment and dispersal. Systems that discharge to surface waters or water reuse systems are not addressed. Site evaluations for those systems are less dependent on the type of topographical, soil, groundwater, and other investigations discussed in this guide.

Site evaluations are a key driver of treatment system design. The success of any soil-discharging wastewater treatment system depends on the appropriate match between wastewater flow/strength, the treatment system design, and the site that receives effluent from the system. Site-specific observations and characterization by a qualified, experienced professional is essential to understanding local site conditions and ensuring the proper operation of individual and clustered wastewater systems.

This overview provides readers with general information about the site evaluation process in onsite wastewater management programs. Included in this overview are:

I. Site Evaluation Objectives

- Ensure Compliance with Regulations
- Assure System Performance
- Protect Public Health and Water Resources

II. Preliminary (Desktop) Site Review

III. Site Evaluation Field Investigation

- Field Investigation Parameters
- Site Evaluation Reports
- Site Limitations and Special Considerations

IV. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to site evaluations.

I. Site Evaluation Objectives

Ensure Compliance with Regulations

Nearly every state and most local, county, and city governments have developed written requirements governing the type of sites that can be permitted for subsurface effluent discharges from individual and clustered wastewater systems. Regulatory compliance parameters include maximum slope angles acceptable for system components, appropriate soil types and depth, minimum depth-to-groundwater (or bedrock) requirements, and mandatory setback distances between system components and property lines, structures, and water bodies, among others. Site evaluators should be familiar with the regulatory requirements for soil-discharging individual and clustered systems and the procedures for accommodating variances to those requirements, in terms of both the legal process for issuing variances and the system adaptations needed to ensure the desired treatment performance.

In most states, individual system regulations are promulgated by the public health agency. Requirements for clustered systems (e.g., those discharging more that 1,000 gallons per day) are sometimes under the purview of the state water resources agency. Large-capacity septic systems (i.e., those with the capacity to serve 20 or more people per day) are regulated by EPA and the states through the Underground Injection Control Program of the Safe Drinking Water Act. For more information, visit the EPA Decentralized Wastewater Program Web site and click on “Basic Information”.

Assure System Performance

Wastewater systems depend on the soil for 1) final treatment of effluent from the tank or unit process components, and 2) dispersal of the effluent to the soil. As noted in the resource guide on system design, the desired final quality of the effluent depends on the constructed/installed treatment train and the pollutant removal capabilities of the soil.

The soil component of the system receives, stores, and treats incoming effluent. The subsurface “ponding” and slow release of effluent to the soil through the biomat facilitates treatment via chemical, physical, and biological processes such as aerobic nitrification of ammonia, adsorption of potential pollutants (e.g., phosphorus), filtration of solids, and decomposition of organic constituents. Predicting the pollutant removal and overall treatment efficacy of the soil component of the system requires a fairly comprehensive understanding of how these processes work, how they are enhanced or impeded, and how the upstream processes in the treatment train can be adjusted or adapted to ensure that the soil can handle the flow and pollutant load delivered. Detailed discussion of these issues is presented in the EPA Onsite Wastewater Treatment Systems Manual.

Protect Public Health and Water Resources

Individual and clustered wastewater systems can malfunction due to soil or site-related causes. These malfunctions can threaten public health or water resources by

- Causing sewage backups in homes or basements
- Ponding poorly treated sewage in yards or landscaped areas
- Contaminating surface waters with nutrients or bacteria
- Polluting groundwater wells with bacteria or nitrate

The site evaluation procedures summarized below are designed to identify site characteristics that might contribute to elevated health or environmental risks to ensure that they can be addressed in the selection, configuration, sizing, or operation of the treatment system.

II. Preliminary (Desktop) Site Review

The preliminary review is performed prior to any fieldwork (see **Table 1**). It is based on information available from the owner and local agencies and on general resource information. The objectives of the preliminary review are to identify potential effluent infiltration sites, identify potential treatment system design boundaries (e.g., groundwater table, property line, etc.), assess the ability of the soil to provide final treatment, and develop a conceptual plan for supplying the level of treatment required prior to soil discharge. Preliminary screening of sites is an important aspect of the site evaluator's role.

More than one receiving environment might be feasible and available for use. In addition, the desktop review might suggest that treatment be provided via clustered, rather than individual, facilities. Focusing the effort on the most promising receiving environment and the most efficient and effective treatment works allows the evaluator to reasonably and methodically eliminate the least suitable sites early in the site evaluation process. For example, basic knowledge of the local climate might eliminate evaporation or evapotranspiration as a potential receiving environment immediately. Also, the applicable local codes often prohibit direct or indirect discharges to surface waters (i.e., requiring an NPDES permit) from small systems. Knowledge of local conditions and regulations is essential during the screening process. Resource materials and information to be reviewed may include, but are not limited to, the following:

- Property information should include owner contact information, site legal description or address, plat map or boundary survey, description of existing site improvements (e.g., existing onsite wastewater systems, underground tanks, utility lines), previous and proposed uses, surrounding land use and zoning, and other available and relevant data.

- Detailed soil surveys are available online from the Natural Resources Conservation Service (NRCS). Detailed soil surveys provide soil profile descriptions, identify soil limitations, estimate saturated soil conductivities and permeability values, describe typical landscape position and soil formation factors, and provide various other soil-related information. Soil survey data should be supplemented with detailed soil sampling at the site. The NRCS publication Field Book for Describing and Sampling Soils is an excellent manual for use in site evaluation.

- Quadrangle maps provide general topographic information about a site and surrounding landscape. These maps are developed and maintained by the U.S. Geological Survey (USGS) and provide nationwide coverage typically at a scale of 1 inch = 2000 feet, with either a 10- or 20-foot contour interval. At this scale, the maps provide information related to land use, public improvements (e.g., roadways), USGS benchmarks, landscape position and slope, vegetated areas, wetlands, surface drainage patterns, and watersheds.

- Aerial photographs are available from several popular online mapping sites (e.g., Google, Yahoo, MapQuest, etc.), many of which are free. Resolution varies across the nation. Some rural areas do not have fine resolution coverage. If available, aerial photographs can provide information regarding past and existing land use, drainage and vegetation patterns, surface water resources, and approximate location of property boundaries. Aerial photographs may be available from a variety of other sources, such as county or regional planning offices, property valuation, and agricultural agencies.

- Geology and basin maps are especially useful for providing general information regarding bedrock formations and depths, groundwater aquifers and depths, flow direction and velocities, ambient water quality, surface water quality, stream flow, and seasonal fluctuations. If available, these maps can be obtained from USGS.

- Water resource and health agency information, such as permit and other files for nearby treatment systems, can provide valuable information regarding local system designs, applications, and performance. Interviews with agency permitting, planning, and field staff can often provide valuable information on regional, local, and even site-specific conditions, such as water quality data, septic system complaints, and future plans for provision of clustered or centralized treatment services.

- Local installers and service providers can provide information on other sites in the vicinity, existing technology performance, and general knowledge of soils and other factors that inform both the site evaluation and the selection of appropriate treatment system components.

- Climate data, such as temperature, precipitation, and pan evaporation rates can be obtained from the National Oceanic and Atmospheric Administration. This information is necessary if evapotranspiration systems are being considered. The evaluator must realize, however, that the data from the nearest weather station might not accurately represent the climate at the site being evaluated.

Table 1. Site Characterization and Assessment Activities for Individual and Cluster Systems.

Preliminary activities	Information from research
Preliminary review	• Site survey map • Soil survey, USGS topographic map • Aerial photos, wetland maps • Source water protection areas • Natural resource inventories • Location of utilities and infrastructure • Applicable regulations/setbacks • Hydraulic loading rates • Criteria for alternative/advanced systems • Size and/or occupancy of house/facility • Loading rates, discharge types • Planned or existing location of water well
Scheduling	• Planned construction schedule • Date and time for meeting

Source: Adapted from ASTM, 1996a.

III. Site Evaluation Field Investigation

Once existing information and data have been collected, a field investigation of the site is conducted (see **Table 2**). This begins with a visual assessment of the site, which includes observing features that might increase or reduce risks to public health or environmental resources, such as the location of nearby wells, ponds, lakes and streams; the vegetation type and density, which is a good indicator of soil conditions; and features such as property lines, infrastructure, and slopes.

Table 2. Field Investigation Activities and Information Collected.

Field activities	Information from field study
Surface observations	• Available area for dispersal site • Water supply separation distances • Surface water or regulatory buffer zones • Property line setback distance • Slope position for infiltration area • Trees and other vegetation • Limiting physiographic features
Subsurface investigations	• Groundwater depth from pit/auger • Soil profile from backhoe pit • Presence of high water table • Presence of "hardpans" or bedrock • Percolation tests
Identification of infiltration area	• Integration of all collected data • Identification of preferred areas • Assessment of gravity-based flow • Final selection of dispersal site

Source: Adapted from ASTM, 1996a.

After the visual assessment of surface conditions are assessed, the site evaluation proceeds to an investigation of subsurface conditions, especially soil conditions and groundwater characteristics. Soils are one of the most important factors to consider during the field investigation, because soil-discharging systems depend on the soil matrix for a significant portion of effluent treatment. Soil properties will affect the type of treatment system selected, the design loading rate, and the size of the dispersal field. Groundwater proximity and movement is also important in considering effluent residence time in unsaturated soil and the movement of pollutants that enter the water table.

Field Investigation Parameters

Soil Profile. A soil profile evaluation typically includes an analysis of soil texture, color, structure, consistence, and layers within the area of the proposed dispersal field. Soil borings and pits are used to assess soil properties and identify any limiting or restrictive conditions such as rock layers, poor drainage, high water table, or saturated conditions. An ideal soil profile for a dispersal field is at least four feet of well-drained, aerated soil above any limiting conditions such as bedrock, hardpan, or a water table. When soil limitations exist, adjustments to the upstream treatment train may be needed to reduce biochemical oxygen demand, total suspended solids, bacteria levels, nutrients, or other pollutants. Adjustments could involve reducing pollutant inputs at the source (e.g., better plate and pot scraping prior to dishwashing in restaurant kitchens, adding grease trap tanks, etc.), applying the effluent at lower soil loading rates, or inserting a fixed film or suspended growth treatment unit between the septic tank and drainfield.

Rules differ among states regarding the depth and number of observation test holes required for each proposed drainfield site, the depth of permeable soil located beneath the bottom of the effluent infiltrative surface (i.e., trench bottom), the distance between the drainfield and nearby surface waters, and the types of tests required. For example, Oregon requires at least two test pits at least 75 feet apart (more are necessary for large systems) in the proposed drainfield area. The San Juan Basin Health District, Colorado, requires an eight-foot deep test pit to locate any subsurface conditions that would affect the design of a soil-discharging system, while the Richland County, Wisconsin, individual treatment system ordinance specifies that soil pits be constructed that allow adequate visual observations of the soil profile. The use of soil pits and borings to evaluate soils are described in USDA's Field Book for Describing and Sampling Soils. **Table 3** also provides guidance to site evaluators in the use of test pits.

Table 3. Practices to Characterize Subsurface Conditions Through Test Pits.

Activity	**Process steps**	**Information to collect**
Select backhoe pit site	Pick site near but not in proposed drainfield. Orient pit so sunlight illuminates vertical face of pit	Location of soil absorption field
Excavate pit	Excavate to depth required by agency regulations	Required groundwater or seasonally high water table separation distance, soil profile depth
Enter test pit	Take safety precautions. Beware of cave-ins. Select area of pit to examine	Safe depths for unbraced pit walls
Expose natural soil structure	Use soil knife, blade, screwdriver, or other tool to pick at area 0.5 meters wide along full height of pit wall	Soil structure type (e.g. primatic, columnar, angular blocky, subangular blocky, granular)
Describe soil horizons	Note master soil horizon layers. Describe features of each horizon	- List soil horizon - Dept of horizon, thickness - Moisture content - Color (true, value, chroma) - Volumetric percentage of rock - Size, shape, type of rock - Texture of <2mm fraction of horizon - Presence/absence of mottles - Soil structure by grade - Level of cementation - Presence/absence of carbonates - Soil penetration resistance - Abundance, size, distribution of roots
Determine soil changes	Look for lateral changes in soil profile. Use auger and/or compare to profile of second pit	Determine changes, if any, in soil profile across proposed site
Interpret results	Identify limiting depths	- Check vertical separation distances - Identify mottled layers, concretions - Determine depth to saturation - Measure depth to confining layer - Identify highly permeable layers
Issue site report	Log all data onto required survey forms in required format	Develop system type, size location, and installation recommendations

Source: ASTM (1996)

Percolation Tests. Local health departments have long used percolation or “perc” tests, to determine the loading rate and size of the soil dispersal area, despite some significant shortcomings. A percolation test consists of digging one or more holes in the soil of the proposed dispersal field to a specified depth, presoaking the holes by maintaining a high water level in the holes, then completing the test by filling the holes to a specific level and timing and measuring the water level drop as the water percolates into the surrounding soil. There are various empirical formulae for determining the required size of a drainfield based on the size of facility, the percolation test results, and other parameters.

Many states and communities have written this test into their onsite ordinances, statutes, or building codes. Maryland and a number of other states also require the use of percolation tests and site evaluations for repairs to existing septic systems that are malfunctioning.

A percolation test, however, has limitations. The test does not reveal limiting conditions in the soil profile and can provide false readings during dry conditions, leading to an inappropriately high loading rate. States and communities once relied solely on these tests to determine effluent application rates. However, the limitations of the test have caused many state and local agencies to either eliminate this test altogether or to require additional tests that must be conducted during a site evaluation to determine limiting site conditions and to estimate allowable hydraulic loading rates.

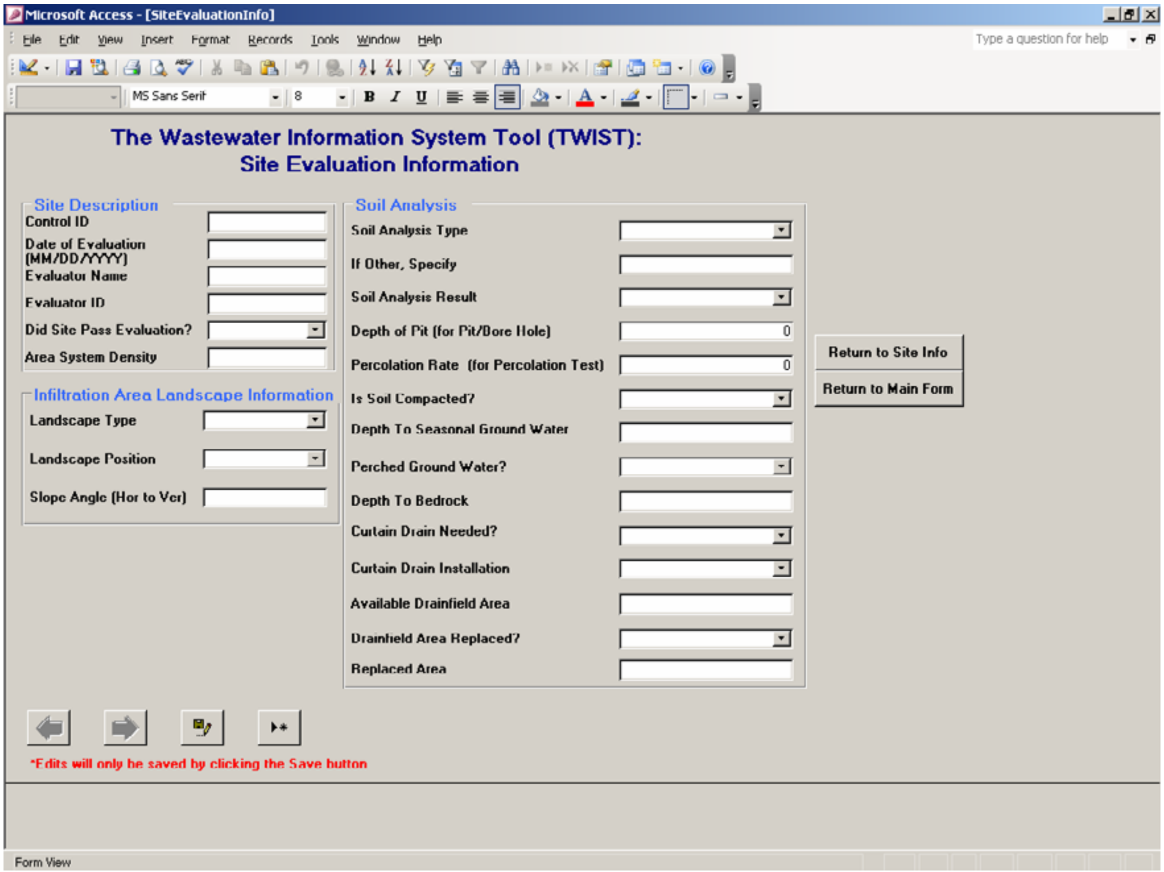
Site Evaluation Reports

Site evaluation reports provide essential information for treatment system selection, design, sizing, and siting. Many states and communities, such as Harris County, Texas, have developed forms to assist in the collection of site evaluation data. North Carolina's soil evaluation form details soil morphology and other soil profile factors. In Oregon, a site evaluation application form must include a tax lot map, a detailed drawing of the proposed development, and directions to the property. Oregon's requirement for soil test pits are provided with the site evaluation information packet and is used by the regulatory agency to generate a site evaluation report that typically specifies the approved area, the type and size of the system required, and any other requirements.

Some communities have created their own databases to assist in the site evaluation process. Fairfax County, Virginia, mapped its soils and uses its database to verify site evaluation assessments of new proposed systems. If the soil evaluation data is consistent with the county's database and the proposed design meets requirements, a construction permit is granted. If the site evaluation is inconsistent with the soil information collected by the county, further investigation will be required from the applicant. The Georgetown Divide Public Utility District in California has conducted detailed site evaluations for 965 lots using 4,000 test hole samples examined by a soil scientist. Every lot had a designated home site for a three-bedroom home, an effluent dispersal site, a replacement area, and a specified system type. In addition to using this information for designing wastewater treatment systems, the information is used to show trends and other factors that could impact system design.

The Wastewater Information System Tool (TWIST) prepared by EPA provides a typical listing of data collected during the site evaluation process (see **Figure 1**). EPA developed TWIST as a comprehensive inventory and management information system via a Microsoft Access format. TWIST accommodates a wide variety of queries, list reports, and mapping applications. The system software and training/user information are available from the EPA Decentralized Wastewater Management Web site for free download.

FIGURE 1. TWIST Site Evaluation Information.



Site Limitations and Special Considerations

In some cases, soil profile or other limitations create challenges for individual and clustered wastewater treatment. Most of these limitations are natural or induced restrictions to soil water and air movement, which limit the depth and duration of unsaturated soil conditions. Identifying these limiting conditions is a critical step in the site evaluation process. Some of the major limitations of concern are:

- High water tables, with saturated soil conditions present near the soil surface
- Restricted soil depth above dense, slowly permeable substratum materials, including unfractured bedrock and dense glacial till
- Restricted soil depth above dense, slowly permeable subsurface soil layers, including fragipans, compacted soil, and heavy clay materials
- Other layers with inadequate permeability
- Poor drainage conditions or flooding
- Excessively steep slopes
- Presence of excessive amounts of rock in the soil
- Fractured bedrock at shallow depths
- Sandy soils with excessive permeability
- Sand and gravel layers below finer textured soil materials

If a site does not demonstrate acceptable permeability or has other limiting factors that preclude the use of conventional treatment systems, some states and communities will allow the landowner to consult with an engineer to design an alternative or advanced system that can overcome a site’s restrictive soil and site limitations.

Fixed film and suspended growth advanced treatment systems provide an effluent of higher quality than conventional septic tank discharges. Higher levels of treatment allow marginal soils to more easily absorb and treat wastewater. However, these systems require more attention to design requirements, material selection, and construction detail. Regular operation and maintenance attention for these systems is critical to maintaining performance and ensuring system operation over the long term. The site evaluator needs to understand and analyze all of these critical factors when recommending an alternative or advanced treatment system.

SITE EVALUATION PROCESS – STATE AND LOCAL EXAMPLES

The Weber-Morgan Health Department in Utah has established feasibility criteria that must be satisfied before a permit for an individual wastewater system can be issued. These include site evaluation criteria for soil assessments and test pits.

- The applicant or their designee prepares the soil exploration pit(s). Pits are placed near (within 50 feet), but not within the proposed absorption system.
- The width of the pit must be sufficient to permit entry and visual inspection.
- The depth of the pit must be at least 10 feet and at least 4 feet below the bottom of proposed absorption system. Deeper pits are required if deep absorption systems, such as deep wall trenches are proposed.
- Site Assessment: Health department personnel visit the property to map the site's features and determine soil characteristics. The following information is obtained:
  - Slopes, direction of north, Global Positioning System (GPS) location, and numerical designation for each pit
  - Level of water table, if possible
  - Observable site limitations (wells, streams, irrigation ditches, ponds, wetlands)
  - Soil characteristics and horizons
- The applicant arranges for percolation tests to be performed by a Level 2 Onsite System Professional, certified by Utah Department of Environmental Quality.
- If requirements for soil characteristics, water table, lot size, slopes, system size, and replacement area are satisfactory, a letter of feasibility is issued which is valid for 18 months.

The North Carolina Division of Environmental Health uses a 10-point guide for conducting site evaluations which includes:

1. Collect needed information as specified by applicable codes for sewage treatment and dispersal systems established by the local agency.
2. Determine the wastewater flow rate and characteristics.
3. Review preliminary site information. Existing published information will help the evaluator understand the types of soils and their properties and distribution on the landscape.
4. Understand the system design options. Site evaluators must understand how treatment systems function in order to assess trade-offs in design options.
5. View the individual system as part of the soil system and the hydrologic cycle.
6. Predict wastewater flow through the soil and the underlying materials. The soil morphological evaluation and landscape evaluation are important in predicting flow paths and rates of wastewater movement through the soil and underlying materials.
7. Determine if additional information is needed from the site. Some additional evaluations that may be required are a groundwater mounding analysis, drainage analysis, hydrogeologic testing, contour (linear) loading rate evaluation, and hydraulic conductivity measurements.
8. Assess the treatment potential of the site. The treatment potential of the site depends on the degree of soil aeration and the rate of flow of the wastewater through the soil.
9. Evaluate the site’s environmental and public health sensitivity. Installing treatment systems in close proximity to community wells, near shellfish waters, in sole-source aquifer areas, or other sensitive areas may raise concerns regarding environmental and public health issues.
10. Provide the system designer with soil/site descriptions and recommendations. Based on the information gathered about the facility and the actual site and soil evaluation, the evaluator can suggest loading rates, highlight site and design considerations, and point out special concerns in designing the treatment system.

Several additional site evaluation factors may also need to be considered when planning large wastewater treatment systems or clustered facilities. EPA defines a large capacity septic system as a system that has the capacity to serve 20 or more people per day. Clustered wastewater systems, as discussed in the Cluster Wastewater Systems Planning Handbook, can serve a small to large number of connections (two to hundreds of structures). Smaller cluster systems serving a few structures can be gravity flow facilities that resemble individual systems, while larger cluster systems serving hundreds of structures are often highly mechanized with extensive collection piping, and tend to resemble centralized systems. Regular, permanent operation and maintenance of these systems is required by regulatory authorities.

As with conventional systems, sites proposed for soil-discharging cluster systems must be evaluated for water table elevations, shallow aquifers, land slope, soil texture, and permeability. There are also a number of other factors that can have a long-term impact on the operation and use of a large system. For example, road and sewer development needs to be coordinated with system siting and construction. The location of the sewage treatment site needs to fit with the overall physical plan of the development. Areas reserved for future development need to be clearly identified, and the proposed wastewater treatment needs to fit with existing plans for open space and buffers around a development.

In large cluster or soil absorption systems where increased quantities of wastewater will be dispersed, other factors must also be evaluated, such as the potential for groundwater mounding. These systems may experience artificial groundwater mounding under the drainfield due to the large wastewater contribution, restrictive soil layers, and other hydrogeologic conditions. Both the Hantush Method and MODFLOW are acceptable groundwater flow models that can be used to characterize more complicated sites. Methodologies to evaluate site conditions and system design influences on the potential for groundwater mounding and lateral spreading can also be found in Guidance for Evaluation of Potential Groundwater Mounding Associated with Cluster and High-Density Wastewater Soil Absorption Systems. More information about these models can also be found in Resource Guide 3. Performance Requirements.

Some states specify additional evaluations based on the risk posed. For example, the Idaho Department of Environmental Quality requires nutrient and pathogen evaluations for all large soil absorption systems (defined as systems with wastewater generation rates exceeding 2,500 gallons per day) located in nitrate priority areas or in areas of “sensitive resource” aquifers (e.g. the Spokane Valley-Rathdrum Prairie aquifer). The nutrient/pathogen evaluation refers to a set of activities that includes the compilation of existing information, collection of site-specific information, and the completion of predictive contaminant fate and transport modeling for groundwater.

Site Evaluator Qualifications

Conducting a site evaluation requires trained professionals. Training and certification requirements, however, differ from state to state. Most local wastewater management programs require site evaluations be performed by trained sanitarians. Many also allow a soil scientist to perform site evaluations. In Idaho, a licensed installer or local health district may perform site evaluations. Ohio rules require a site and soil evaluator be capable of properly conducting site and soil investigations and accurately recording required information. Demonstration of competency may include, but is not limited to, certification as a professional soil scientist by the Association of Ohio Pedologists. Utah has established three levels of certification:

- Level I - Soil Evaluation and Percolation Testing
- Level II - Design, Inspection, and Maintenance of Conventional Underground Systems
- Level III - Design, Inspection, and Maintenance of Alternative Wastewater Systems

In Massachusetts, the Department of Environmental Quality developed a week-long course for professional site evaluators. The state certifies evaluators and requires that all site assessments be performed by state-certified evaluators. Nebraska initiated a certification program in 2004 to certify site evaluators and other professionals who perform work on soil-discharging wastewater treatment systems. Maine issues two-year renewable licenses to site evaluators. A licensed site evaluator in Maine is required to evaluate site conditions and match soil conditions to a hydraulic loading rate set by state code. In Montana, the cooperative extension service and state universities both offer site evaluation courses periodically, however training is optional. In Florida, county environmental health personnel are required to be trained and state-certified in order to perform site evaluations.

Training for soil profile evaluation for wastewater treatment is offered through a number of state and national onsite training centers. Soil scientists with the USDA, Natural Resources Conservation Service, can also offer assistance with soil evaluations for specific sites. Click here to locate your USDA Service Center. Additional information is also available in Resource Guide 11. Training and Certification.

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for treatment system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 7. SYSTEM DESIGN

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

The high cost of centralized wastewater treatment plants and the advances made in individual and cluster (decentralized) system technologies have expanded the array of available treatment options and supported development of a more tailored approach to wastewater management services. Today, wastewater collection and treatment can be closely matched to the types and quantities of sewage generated through a "just in time" modular approach financed via a "user pays" cost structure. Options now exist that span the full spectrum of treatment facilities, from large centralized plants, to large and small soil-discharging clustered facilities, to individual treatment systems providing conventional or enhanced service.

Wastewater flow and strength, site and local infrastructure conditions, and performance requirements for the dispersed or discharged effluent are all key considerations in deciding what type of wastewater collection and treatment system is needed and how it should be designed. This overview provides readers with information about these considerations. The outline for the overview appears below. Specific design guidance for the various system types are referenced for readers who need additional details.

I. Individual and Cluster Treatment Technologies

- Basic Treatment Processes
- Conventional Systems
- Advanced Systems
- Cluster System Applications

II. System Design Standards and Practices

- Performance-Based Standards
- System Design Considerations

- Management Considerations
- Permitting and Approval Process

III. Testing and Certification

- Testing of Alternative Systems
- Certification of System Designers

IV. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to system design. In addition, the final section of this guide provides a list of references and additional resources with information on design, conventional systems, advanced systems, and costs.

I. INDIVIDUAL AND CLUSTER TREATMENT TECHNOLOGIES

There are many different types of wastewater collection and treatment technologies. Systems can treat individual homes, clusters of buildings, or whole subdivisions and/or commercial establishments. Collection systems for clustered facilities can work by gravity or operate via vacuum or pressure pump. Wastewater is typically treated through primary and secondary processes (and sometimes tertiary or advanced "polishing" procedures) and can be disinfected prior to discharge. This section discusses some of the more commonly used treatment system types. There are a number of resources available online that can provide additional information on individual and cluster system designs including:

- EPA Design Manual
- EPA Onsite Wastewater Treatment Systems Manual
- EPA Onsite Technology Fact Sheets
- Small Flows Clearinghouse Environmental Technology Initiative (ETI) Fact sheets
- EPA Alternative Wastewater Collection Systems Handbook
- Cluster System Planning Handbook
- University of Minnesota Innovative Onsite Treatment Systems
- Rutgers University Onsite Wastewater Treatment Systems: Alternative Technologies
- New England Interstate Water Pollution Control Commission

Basic Treatment Processes

Individual and clustered wastewater systems are designed to accomplish the same thing—the treatment of wastewater—but how this is accomplished is based on the type of treatment technology used. Treatment processes or methods are often described as primary, secondary, and tertiary or advanced, as summarized below:

- Primary Treatment: Physical treatment processes involving capture of solids and fats/oils/grease in an enclosed vessel, typically by settling and flotation, such as provided in a septic tank or grease interceptor tank. This process also includes trapping of solids via septic tank effluent filters or screens prior to discharge of the tank effluent.
- Secondary Treatment: Biological and chemical processes designed to remove organic matter, mostly through digestion and decomposition, often aided by introduction of or exposure to atmospheric oxygen. A typical standard for secondary effluent is biochemical oxygen demand (BOD) and total suspended solids (TSS) concentrations less than or equal to 20 mg/L each on a 30-day average basis. These standards can be achieved via flow through unsaturated soil or other media (e.g., sand, gravel, textile, peat, plastic media) or within an aerated vessel or chamber.
- Tertiary (Advanced) Treatment: Advanced treatment of wastewater includes enhanced organic matter removal, pathogen reduction, and nutrient removal.

Standards for advanced or tertiary effluent vary according to regulatory requirements. Typical effluent quality parameters can include nitrate-nitrogen (e.g., no more than 10-20 mg/l), phosphorus (e.g., 1-5 mg/l or less), and bacteria (fecal coliform less than 10 colony forming units per 100 ml). Advanced treatment can occur via process controls (e.g., alternating oxic/anoxic conditions) or through exposure to additives or media designed to cause chemical or other reactions (e.g., disinfection, phosphorus precipitation).

Conventional Systems

Conventional treatment systems are the most commonly used wastewater treatment technologies, combining primary and secondary treatment. These systems are the least expensive in terms of total cost but require specific conditions (e.g., at least 24-36 inches of unsaturated soil) and maintenance to perform adequately. A conventional wastewater treatment system consists of a septic tank and a soil absorption field that allows primary treatment (i.e., septic tank) effluent to infiltrate into unsaturated soil. Flow through the system usually occurs via gravity but can be aided by a pump, if necessary, operated by a float switch or timer.

Conventional systems can serve individual homes or businesses, or clusters of buildings. The most frequently used treatment system design for a single family home is a conventional system serving an individual home. As noted above, the conventional system has two principal parts—the tank and soil absorption field. The septic tank treats wastewater by allowing floatable materials (e.g., fats, oils, grease) to rise to the surface, forming a scum layer, and the heavier solids to sink to the bottom, creating a layer of sludge. The tank effluent is similar to that of primary sedimentation in larger treatment facilities, except that it is generally devoid of oxygen (i.e., anaerobic).

The soil absorption system facilitates aerobic treatment and filtration of the remaining contaminants. Subsurface discharge of effluent to the soil can be configured to optimize treatment via pressurized time-dosing of preset volumes of treated wastewater, which facilitates oxygenation of the soil matrix between doses, promotes film flow of wastewater over soil particles, and ensures a uniform and consistent application of effluent to the entire drainfield.

The laws of most states and counties prohibit the direct discharge of septic tank effluent onto the ground surface. Surface water discharges must be covered by an approved NPDES permit. Individual systems require periodic pumping of the tank (e.g., every 5-7 years) and inspection of the dispersal field for signs of problems, such as wastewater surfacing, soggy soil, and odor. Studies of conventional system costs indicate that installation costs can range from $3,500 to $6,000 or more, depending on local labor and materials expenses, site conditions, permit fees, and other factors. Annual operation, inspection, and maintenance costs vary, but average about $30 to $100 per year, depending on state or local requirements.

When functioning properly, individual or clustered conventional systems are effective in treating or removing pollutants. There are also many advanced technologies that have been developed for situations where conventional systems are not appropriate. The next section discusses alternatives for sites that do not meet minimum requirements for conventional systems or require advanced treatment due to more stringent treatment standards.

Advanced Systems

Treatment system components designed to pretreat septic tank effluent before discharge to the soil dispersal field are often called alternative, enhanced, or advanced systems. Advanced systems can be designed and built on-site or can consist of prefabricated units designed to overcome some site and soil limitations including:

- When the aerated (unsaturated) soil depth below the infiltrative surface in the drainfield is less than the minimum required, advanced treatment processes or components (e.g., fixed film treatment units) can be added to increase pollutant removal prior to soil discharge.
- In environmentally sensitive areas, advanced systems can be used to meet effluent standards for oxygen-demanding wastes, bacteria, nitrogen, and phosphorus.
- If a soil dispersal area malfunctions hydraulically due to a buildup of the biomat (inorganic, organic, and/or bacterial slime) at the infiltrative surface, it may be restored, and treatment may be enhanced, by improving soil oxidation through timed dosing of septic tank effluent to the dispersal field. The dose/rest cycle allows the soil to drain between doses, improving soil oxygen transfer.
- Wastewater with high organic strength (e.g., from a restaurant) can employ advanced treatment units/processes to improve aeration, biological decomposition, and treatment of organic wastes. (Note: High concentrations of fats, oils, and greases should be removed through housekeeping practices and use of a grease trap tank.)
- Advanced systems that provide timed dosing of septic tank or treatment unit effluent to the soil can sometimes be used where soil infiltration areas are limited, except in cases of high-clay content soils.
- Advanced systems that employ pressure drip dispersal of the effluent can reduce bacteria and nutrient loading to groundwater by applying wastewater high in the soil profile, improving bacteria predation and uptake of nutrients by plants and providing a carbon source for denitrification.

All treatment systems require management, but advanced systems, due to their use of pumps, switches, and other electromechanical components, especially need regular operation and maintenance attention. Permanent maintenance contracts with qualified service providers should be required by state or county code for systems with these components. Links to the treatment system types below contain information on system design, management, and other requirements.

Elevated (Mound or At-Grade) Systems. This system type includes a septic tank or prefabricated treatment unit to provide primary (and sometimes secondary) treatment prior to discharging the effluent to a modified drainfield. Effluent flows from the tank or treatment unit to a pump tank and periodically dosed to the modified dispersal area, which is typically constructed of a layer of clean, uniformly graded sand on a plowed or roughened natural soil surface. The tank effluent is uniformly dosed onto the infiltrative surface within the mound, which may be 1-4 ft above the natural grade. Sand within the mound compensates for shallow unsaturated soil conditions below the natural grade. Mound systems are appropriate for areas with a high water table or shallow, fractured bedrock. After treatment through the sand, the effluent percolates directly into the soil under the mound. At-grade systems feature effluent dispersal piping placed at natural grade, with the mound consisting mostly of cover soil for the piping. The mound should have inspection ports, so wastewater distribution across the infiltration area can be monitored. Distribution lines should have cleanouts so they can be flushed at least twice a year. Costs for mound systems range from $5,000 to $15,000. The cost is mostly related to the delivered cost of the mound materials and local labor costs. Operation and maintenance costs average $100 per year.

Aerobic Treatment Units. Aerobic treatment units (ATUs) consist of prefabricated units featuring consecutive or compartmentalized tanks, pumps, blowers, and internal piping, and are designed to treat wastewater via suspended or attached growth decomposition in an oxygen rich environment. When oxygen is supplied, the rate of microbial activity and related treatment processes accelerates. Three processes are involved in most aerobic systems: physical separation (mostly settling), aerobic treatment (aeration and mixing), and clarification (final settling). These processes may be in separate tanks, compartments of a single tank, or other configurations. ATUs vary in design and can consist of simple activated sludge variations, sequencing batch reactors, trickling filters, and combinations of two or more of these unit processes. ATU systems require permanent, regularly scheduled inspections and maintenance attention. The National Sanitation Foundation has a certification program for aerobic treatment units based on testing over a range of operating conditions. An activated sludge ATU, where oxygen is added by injecting adding air into the wastewater, can range between $6,000 and $10,000 installed with maintenance costs averaging $500 and $700 per year. Fixed-Activated Sludge Treatment. ATUs cost slightly more than an activated sludge unit; however, maintenance costs are reduced by half. The cost of Sequencing Batch Reactors, which perform all functions in a single tank, can range $8,500 to $12,000 installed, with yearly maintenance costs at $600 to $700.

Media Filters. Septic tank effluent can be applied to a layer of sand or gravel, a tank containing peat or plastic media, or compartments of hanging textile or other material to improve oxygen access and enhance biochemical treatment processes. A number of these so-called “media filters” are available to treat wastewater. Sand is the most commonly used media, but clean gravel, crushed glass, textile strips, peat, and tire crumbs are also used, depending on site restrictions and state/local regulations. In single-pass or intermittent filter (ISF) design, septic tank effluent is pump-dosed uniformly onto the media at regular intervals 12 to 48 times per day. As the effluent trickles through the media, suspended and some colloidal particles are filtered, and bacteria growing on the media aerobically treat organic wastewater. Effluent that percolates through the media bed is discharged to the soil dispersal field. Intermittent filters include higher installed costs ($6,000 to $10,000) and have some potential for odors if septic tank effluent is the influent stream. Operation and maintenance costs run from $175 to $250 per year. Recirculating sand filters (RSF) return two-thirds or more of the filter percolate to the pump dosing chamber, greatly improving nitrogen removal (e.g., up to 50 percent or more, depending on influent nitrogen levels and other factors). Effluent quality from the RSF and ISF are typically less than 10 mg/L of BOD and TSS, however, the facility size for an RSF is less, and it lacks the odor potential of the ISF. A recirculating filter system costs $8,000 to $11,000 installed. Operation and maintenance costs range from $250 to $350 per year. In addition to maintenance of the pump and controls, dosing lines must be flushed and the pressure on each line checked at 6-month intervals.

Submerged-Flow Wetland or Vegetative Submerged-Bed (VSB). Vegetative submerged beds are also called submerged-flow wetlands. This system type treats septic tank effluent by horizontal flow through a lined bed of unmulched gravel planted with wetland species. The plants fill in spaces between the rocks and provide aesthetic appeal. Wetland systems are extremely passive and require little management in producing a good quality effluent (typically BOD and TSS of less than 30 mg/L). The treatment environment in the system is mostly anaerobic, with some aerobic microsites on plant roots and near surface areas. Effluent is further treated when discharged to unsaturated soil following flow through the wetland cell(s). Septic tanks with subsurface flow gravel bed wetlands have been used successfully in many areas including Texas, Louisiana, Arizona, Indiana, and Kentucky. Constructed wetlands can have a relatively low construction cost in areas where media and land is readily available. Properly designed and constructed systems do not require chemical additions or mechanical equipment. Maintenance is important to prevent clogging the rock bed and influent and effluent structures. The average cost of a VSB system can range from $5,000 to $8,000 installed. Operation and maintenance costs are generally less than $100 per year.

Cluster System Applications

A cluster system is designed to collect wastewater from two to several hundred homes. The Cluster Wastewater Systems Planning Handbook lists a number of potential wastewater collection technologies for small and large cluster systems, including: grinder pump systems, which transport all sewage; effluent sewers, such as the septic tank effluent pump (STEP); the septic tank effluent gravity (STEG) collection system; and vacuum systems. Treatment facilities serving clustered buildings may range from a communal septic tank and soil dispersal system to a more advanced treatment system. Advanced systems may facilitate local reuse of the treated effluent for toilet flushing, irrigation, industrial purposes, or to replenish aquifers. Cluster systems must be managed by an entity with the technical, financial, and managerial capacity to effectively and efficiently handle operation, maintenance, customer billing, repair/replacement, and other tasks.

The cost of a cluster collection system varies significantly based on the number of users, collection system logistics, treatment facility design, land availability, materials/labor costs, and other factors. In Lake Elmo, Minnesota, eight subsurface treatment cluster systems were constructed ranging in cost from $5,500 to $13,500 per connection. Some states, such as Massachusetts, provide information for local communities and homeowners regarding key questions to ask system designers about costs and other issues.

II. System Design Standards and Practices

Nearly all states and some local governments have regulatory or guidance documents detailing acceptable design approaches for individual and clustered wastewater treatment systems. For example, Kansas, in its Minimum Standards for the Design and Construction of Wastewater Systems, lists the following five elements of septic tank–lateral field system design:

- Wastewater flow
- Soil and site evaluation
- Septic tank standards for design, construction, and installation
- Lateral field design and construction
- System maintenance

Performance-Based Standards

Most state and local system design codes traditionally have been based on prescriptive approaches that specify minimum site requirements, construction methods, and acceptable tank types and other components. However, the move toward site-appropriate, risk-based system design and the growing interest in clustered facilities has increased the need for performance-based design guidance.

Performance-based management approaches have been proposed as a substitute for prescriptive requirements for system design, siting, and operation. Performance codes set measurable outcomes that all treatment systems must achieve regardless of the technology used. British Columbia, Canada has a fairly comprehensive performance code, and Arizona has a hybridized code that allows a wide array of enhanced treatment methods for protecting groundwater. More information about performance-based systems can be found in Resource Guide 3. Performance Requirements.

System Design Considerations

One of the more common reasons why some individual or cluster systems do not perform properly is inappropriate system/technology selection. A wastewater system should be matched to the volume and pollutant profile of wastewater, and the site, soil, and groundwater/surface water conditions must be known in detail in order to develop an appropriate system design.

State and local wastewater system permitting programs are expanding the options available for providing treatment services, especially for sites with limiting soil conditions and those with threatened or impaired water resources nearby. Instituting a protocol to provide guidance and oversight during the system design process can also help to address:

- Impacts of different pretreatment levels on the long-term hydraulic and pollutant removal performance of the soil
- Cumulative impacts of high-density system installations
- Operation and maintenance requirements of different treatment and soil dispersal technologies
- Potential implications of water conservation fixtures

The protocol should include a pre-design meeting between the permitting agency, the management entity, the designer, and the owner of the property. All of these parties have a stake in the performance of the system, and such a meeting can assist in identifying potential problems and solutions. The protocol should be as complete as possible and should feature a rational, defensible evaluation procedure for proposed designs and materials specifications. The protocol should be dynamic and should be regularly reviewed and updated as new information and experience is gained.

Table 1 summarizes the key issues that need to be addressed in developing a design for an individual or clustered system. For jurisdictions with prescriptive requirements regarding acceptable site conditions and system types, the process of developing an appropriate design will be fairly simple. However, designers of soil-discharging clustered facilities on challenging sites near threatened or impaired waters will likely need to explore each of the issues below in detail to produce a design that meets performance, cost, and other objectives.

Table 1. General Individual/Cluster Wastewater System Design Considerations.

Regulatory Requirements
Soils, slopes, setbacks, seasonal high water, and allowable system types Operation/maintenance/management options; water reuse requirements (if applicable)
Type and Condition of Receiving Waters
Groundwater – depth, use, condition; nitrate, bacteria, or other standards Surface water – National Pollutant Discharge Elimination System (NPDES) permit limits, receiving water condition (OK or impaired?) Atmospheric discharge – expected evaporation rate, area needed Plant uptake/transpiration – predicted rate of uptake based on type, climate, etc.
Treatment System Site Considerations
Area available for treatment facilities Soils, slopes, geology, depth to groundwater, and climate Vegetated and/or other cover, presence of rocks and roots Service/pumper truck access, power/phone lines available (if needed)
Wastewater Flow and Volume to be Treated
Gallons per day for most residential and other applications Gallons per week, month, etc. for churches, camps, periodic use buildings Storage tank needed to meter the flow to treatment facilities?

Wastewater Strength Characterization
Typical residential waste, or other constituents present? Restaurant, food processing, other high strength (e.g., fats/oils/grease) wastes? Metals, other toxics present in high concentrations?
Wastewater Collection and Conveyance System
Individual or multiple facilities served by system? Transporting tank effluent only, raw wastewater, grinder pump waste? Gravity flow – conditions suitable for needed pipe fall/slope? Pressure flow – pump, vacuum, siphon, other options Manholes or inspection ports required, type, spacing
Primary Treatment Considerations
Hydraulic residence time desired in tank Grease trap or interceptor tank needed? Waste flow separation prior to tank/treatment? Tank location accessibility for pumpout truck Tank size, type, installation/anchoring, location, orientation Tank risers, effluent screens, and inspection port locations
Secondary Treatment Facilities (If Needed)
Treatment needed between tank and soil dispersal or discharge? Fixed film or suspended growth, or hybridized process? How much area needed for treatment facilities?
Tertiary (Advanced) Treatment Facilities (If Needed)
Nitrogen, phosphorus, bacteria, or other pollutant removal requirements Will discharged effluent require disinfection? To what standard? Chemical disinfection, UV lamps, or microfiltration?
Effluent Dispersal or Discharge Considerations
Soil discharge/dosing – perforated/gravelless pipe, chambers, pressure drip, other? Water discharge – NPDES permit coverage, mandatory effluent limits Atmosphere discharge – expected evaporation rate, area needed Wastewater reuse – effluent demand/use, storage needs, treatment/disinfection

As noted, wastewater treatment can be categorized as primary, secondary, and tertiary (advanced treatment). Wastewater systems are typically assembled in a modular “treatment train” fashion, with each component designed to accomplish specific treatment objectives (e.g., primary treatment in a septic tank, followed by secondary treatment in a fixed-film media filter or treatment in the soil matrix). System designers usually start at the end of the treatment train and work their way backwards through the treatment units and processes to the beginning [i.e., the design process must consider the final desired effluent quality (output) and the beginning wastewater flow/strength (input)]. The desired output parameters and the given input flow/strength information will inform the selection, sizing, and operation of the facilities and processes in between needed to meet treatment objectives.

Clustered collection systems and treatment facilities are highly engineered infrastructure components that require considerable analyses of the design parameters presented in

Table 1. Individual soil-discharging systems for residential use are simpler to design and install. EPA's Onsite Wastewater Treatment Systems Manual offers a set of principles for soil-discharging systems that specify:

- Shallow placement of the infiltration surface (< 2 feet below final grade)
- Organic loading comparable to septic tank effluent at its recommended hydraulic loading rate
- Trench orientation parallel to surface contours
- Narrow trenches (< 3 feet wide)
- Timed dosing with peak flow storage
- Uniform application of wastewater over the infiltration surface
- Multiple cells to provide periodic resting, standby capacity, and space for future repairs or replacement

The system designer should attempt to include as many of these principles as possible to ensure optimal long-term performance. The importance of these principles increases with the capacity of the soil dispersal system. **Table 2** applies these principles when choosing a soil dispersal system based various site characteristics.

Table 2. Site Characteristics and Considerations for Soil Dispersal Systems.

Characteristics	**Typical Applications**	**Applications to Avoid**
Type of Wastewater	Domestic and commercial (residential, mobile home parks, campgrounds, schools, restaurant, etc.)	Facilities with non-sanitary and/or industrial wastewaters. Check local codes for possible restrictions
Daily Flow	<20 population equivalents unless a management entity exists (20 or more using a single system requires UIC permit coverage)	>20 population equivalents without a management program or UIC permit; check local codes for specific or special conditions
Minimum pretreatment	Septic tank with risers to the surface and effluent filter/screen	Discharge of raw wastewater to subsurface infiltration system
Lot orientation	Loading along contour(s) must not exceed the allowable rate	Any site where hydraulic loads from the system will exceed allowable loading rates
Landscape position	Ridge lines, hilltops, shoulder/side slopes	Depressions, foot slopes, concave slopes, floodplains
Topography	Planar, mildly undulating slopes of <20% grade	Complex slopes of > 30%
Soil Texture	Sands to clay loams	Very fine sands, heavy clays, expandable clays
Drainage	Moderately drained or well drained sites	Extremely well, somewhat poor, or very poorly drained sites
Depth to groundwater or bedrock	> 5 feet	< 2 feet. Check local codes for specific requirements

Source: Adapted from WEF, 1990

Management Considerations

All wastewater treatment systems require management. Management services can be provided by an outside contractor or responsible management entity (see Resource Guide 9. Operation and Maintenance). In general, individual gravity flow systems with septic tanks and subsurface drainfields require less management attention; clustered facilities with collection system pumps, mechanized treatment units, and time or demand-dosed infiltration areas require much more. Factors that influence system management include:

- Operation in extreme conditions, such as very cold or wet climates
- Life of system components and access to repair parts
- Power reliability and backup power needs
- Maintenance needs, including frequency and complexity of service
- Availability of trained, reliable service providers
- System compatibility with the owner's needs or lifestyle
- Aesthetics (visible system components, noise, odors, etc.)
- Annual costs for operation, maintenance, and repair

Permitting and Approval Process

State and local governments vary considerably in their approach to approving system types and components and issuing installation and operation permits. Consultation with state and local regulatory agencies is required in all cases to ensure that minimum requirements are met. In general, a typical permit application procedure should include the following information:

- Consultation with the property owner regarding final design components
- Detailed drawing for the site, including property lines, structures, easements, topographical and drainage features, vegetation, etc.
- Detailed drawings of all system components
- Site preparation requirements
- Documentation of decisions made regarding system location and features
- Total dynamic head pressure requirements, if applicable
- Specifications for equipment and materials, based on calculations

It is important that the application include system drawings, narratives, forms, calculations, catalog cuts, photos, and other data, including detailed equipment and installation specifications to make siting the system components easier. If the site has been developed, all structures, utilities, and ingress and egress pathways should be identified. The source of potable water and distribution lines should be identified as well. If there is an existing wastewater treatment system, the condition of all components, including the reserve area, should be recorded and minimum setbacks met.

Regular maintenance is required for all systems. However, it is especially important for more complex alternative systems, especially those that use pumps, controls, timers, and pressure distribution. Verification of system maintenance contracts, operator expertise, and reporting requirements for system maintenance such as tank pumping and repairs should be included in the approval process. Oregon has developed an approval application for alternative systems which includes:

- Certification to the National Sanitation Foundation (NSF) International Class I Standard 40 Protocol
- Documentation that the system meets state performance requirements
- A guide for inspecting system installations
- A plan for training agents and system installers on installation and inspection
- A plan for training operation and maintenance providers
- Detailed plans showing that the system complies with the state requirements
- A completed checklist
- A system operation and maintenance manual outlining minimum maintenance frequency

III. Testing and Certification

Approving the use of various treatment technologies is under the purview of state and local governments. Some states individually test and validate treatment technologies and maintain a list of those approved in their state. For example, North Carolina requires vendors to test new technologies, according to the environmental technology verification (ETV) protocols. Costs for verification are paid by vendors.

Testing Alternative Systems

Test centers have been created in some states to test alternative or advanced systems. The Massachusetts Septic System Test Center was created to provide state and local managers with a reliable database on enhanced treatment system performance, operation, and maintenance. The facility has the capacity to test six residential treatment technologies (in triplicate) in addition to three conventional treatment systems, which serve as a benchmark for the other technologies, for a total of 21 treatment units. Additional capacity at the facility is used to test two nitrogen removal technologies and for research and development of new and unproven technologies. As the verified data is developed, the test center conducts an active outreach effort to convey this information to local boards of health, wastewater professionals, and consumers.

New technologies can require a great deal of time and resources to test. To facilitate new technologies, EPA developed the Environmental Technology Verification Program, managed by the National Sanitation Foundation, to test and verify treatment technologies. In addition, EPA has also invested more than $35 million in more than 25 states to fund projects demonstrating various treatment technologies. A database of these demonstration projects can be accessed at the EPA web site.

Certification of System Designers

Most state wastewater management programs require an engineer to design a wastewater system or to certify that it meets the manufacturer's specifications once installed. However, some states have added a certification or license requirement for system designers as part of their wastewater certification program. For example, the State of Washington recently passed a law (RCW 18.210) that requires a license to practice system design unless the system designer is an employee or subordinate of a licensed professional engineer or designer. More information on this and other certification programs for designers can be found in Resource Guide 11. Training and Certification.

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself, and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for treatment system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 8. CONSTRUCTION AND INSTALLATION

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

INTRODUCTION

Appropriate wastewater treatment system construction and/or installation practices are critical to the performance of individual and clustered systems. Construction activities can affect short-term and long-term system performance by failing to adhere to material specifications, neglecting proper pipe slope requirements, inadvertently switching tank inlet/outlet orientation, or failing to protect infiltration area soils from equipment compaction.

This overview provides readers with some general information about construction and installation of individual and clustered wastewater systems. Topic areas reviewed in this guide are:

I. Construction and Installation Practices

- Construction Phases
- Site Preparation and Excavation Practices
- Field Construction Practices

II. Management Considerations

- Construction Permits
- Inspections
- Installer Training and Certification

III. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to construction and installations.

I. Construction And Installation Practices

Infiltration area protection, a key component of good system installation practice, should be carefully considered during site preparation, construction equipment selection and use, and before and during construction. The development of a final design plan that includes drawings, narratives, forms, calculations, photos, and other data, including detailed equipment and installation specifications, will help ensure a successful outcome. This information must be assembled into a cohesive document to allow the proper installation of the design without the need for any assumptions.

Construction Phases

Construction/installation management of a wastewater system can be divided into the following four basic phases:

1. *Preparation Phase*

- Conduct a pre-construction conference at the site to identify site component locations, verify setbacks and other site conditions, check surface elevations, and identify potential problems or safety concerns (e.g., overhead electric lines)
- Assess changes in conditions (e.g., soils, topography, vegetation) that may have occurred since design work was completed
- If work will be delayed, flag off or otherwise protect the infiltration area
- Modify design components or layout, if appropriate

2. *Project Execution*

- Verify designed treatment system components and materials, such as tank type, size, and material; piping; and gravel (if used) that is free of fines
- Excavate areas for conveyance piping, the tank(s), secondary treatment units, and infiltration or soil dispersal components according to designated depths and required pipe slopes
- Use caution to avoid contact with power lines and excavation cave-ins!
- For gravity flow systems, all elevations are tied to the building sewer line elevation. Ensure that the proper fall is available from the building to the tank, then to the distribution box(es), and to the infiltration area
- Ensure that the tank is on solid tamped ground, installed level and at the proper elevation, and that inlet/outlet orientation is correct. Secure tank covers after hours to prevent accidents. Backfill tanks as soon as possible.
- Follow manufacturer’s recommendations for installing tanks. Plastic and fiberglass tanks usually require special installation techniques (e.g., anchoring, backfilling with sand, tamping backfill in lifts, filling tank with water as it’s backfilled, etc.)
- Use proper primer and glue for plastic piping. Attach electric lines and control wiring in accordance with design plans as appropriate
- Ensure that pumps are plumbed, wired, and installed to allow easy inspection, access, and removal (e.g., use quick-connect union and backflow prevention valve between pump and uphill dispersal piping)
- Ensure that trench bottoms for gravity flow pipes are tamped and stable and free of rocks and roots, and that backfilled areas around pipes are tamped to prevent dips and rises that could impede flow
- Ensure that distribution pipe effluent dispersal holes go on the bottom
- Extend inlet and outlet piping stubs below tank access ports, but do not block ports to ensure access for pumping and inspection. Use rubber boots or grout to completely seal around pipes and risers
- Install access port risers to the surface, install outlet filters/screens, and complete installation of pumps, wiring, control panels, and other components
- Install cleanouts and inspection ports in key locations (near building sewer, D-box, etc.); this aids in operation/maintenance later on

- Conduct functional test of the system after installation, checking flows, pump discharge (if used), operation of float switches (if used), and controls
- Verify designed component finished conditions (e.g., tank type/capacity, riser covers, elevations, location of key components, drainage, landscaping)

3. Final Inspection

- Observe system components prior to coverup; determine consistency between design and actual installation; report inconsistencies

4. Post Construction

- Prepare a scaled and dimensioned as-built drawing
- Record the materials and equipment used to meet the specifications that were established in the design
- Verify that any changes during construction are consistent with the design intent and are of similar or equivalent specification
- Record operating parameters for pumps, electronic controllers, hydraulic controllers, and other devices

Site Preparation and Excavation Practices

Overhead power lines, steep slopes, and excavations at the installation site can all present serious safety hazards. A brief preconstruction meeting can ensure that safety hazards and practices to eliminate, minimize, or respond to them are identified.

Site preparation requires a number of activities including clearing and surface preparation for filling. Use of lightweight tracked equipment will minimize soil compaction. Soil moisture should be determined to ensure that it is dry, and care should be taken to avoid soil disturbance as much as possible. To avoid potential soil damage during construction, the soil below the proposed infiltration surface elevation must be below its plastic limit during construction (i.e., it must lack the moisture required to make it moldable into stable shapes). This should be tested before excavation begins.

Site excavation is conducted only when the infiltration surface can be covered the same day to avoid loss of soil permeability from wind-blown silt or raindrop impact. Another solution is to use light-weight gravelless systems, which reduce the damage and speed the construction process. Site access points and areas for traffic lanes, material stockpiling, and equipment parking should be designated on the drawings for the contractor. Heavy equipment should be diverted from the absorption field to avoid compaction and damage to the area. Flagging off the infiltration area as early as possible is critical to ensure long-term function of the system.

Clearing should be limited to mowing and raking with minimal disturbance to the surface. If trees are cut, they should be removed without heavy machinery, and, if necessary, stumps ground out. Grubbing of the site (mechanically raking away roots) should be avoided. If the site is to be filled, the surface should be moldboard- or chisel-plowed parallel to the contour (usually to a depth of seven to ten inches) when the soil is sufficiently dry to ensure maximum vertical permeability. The organic layer should not be removed. Scarifying the surface with the teeth of a backhoe bucket is not sufficient. All efforts should be made to avoid any disturbance to the exposed infiltration surface.

Field Construction Practices

Changes in construction practices over the past 25 years have led to improvements in the performance of individual wastewater systems. For example, construction materials used in plumbing, wastewater lines, and lateral fields should meet American Society for Testing and Materials standards. Avoid work during wet conditions. Smeared soil surfaces in infiltration trenches should be scarified and the surface gently raked prior to installing the gravel or gravelless piping/chambers. If gravel or crushed rock is to be used for the system medium, the rock should be placed in the trench by using the backhoe bucket rather than dumping it directly from the truck. Rock must be free of fines. This is critical to long-term system performance. If soil compaction occurs during drainfield installation, it might be possible to restore the area, but only by removing the compacted layer. It might be necessary to remove as much as four inches of soil to regain the natural soil porosity and permeability (Tyler et al., 1985). Consequences of the removal of this amount of soil over the entire infiltration surface can be significant. It will reduce the separation distance to the restrictive horizon and could place the infiltration surface in an unacceptable soil horizon.

For gravel filled trenches, the trench bottom should be left rough and covered with six inches of clean (i.e., no fines) rock. Distribution pipes should be carefully placed over the rock, leveled, and bedded in on the sides. After the rock and pipes have been placed in the trench, the filter fabric should be placed over the top of the rock to prevent soil from moving into the rock. The soil backfill should be carefully crowned to fill the trench cavity at a height to allow for settling.

Before leaving the site, the area around the site should be graded to divert surface runoff from the area. All soil depressions over the system should be eliminated, and the area should be seeded and mulched. Post construction activities include accurate documentation of all of the system components and the system location. Flag off the infiltration area to keep construction and other traffic away.

CONSTRUCTION PRACTICES – STATE AND LOCAL EXAMPLES

Minnesota has developed best management practices (BMPs) for installing and maintaining wastewater treatment systems in shoreland areas. The BMPs provide guidance on siting a system and regulations that apply to system design and installation.

Charlestown, Rhode Island, subdivision regulations and zoning ordinances establish special standards for wastewater system siting and installation, including policies for the protection of sensitive resources. The required environmental analysis within the subdivision regulations incorporates the consideration of effluent dispersal into the soil and factors related to dispersal sites, such as soil type, slopes, and proximity to waterbodies and wetlands.

The Kansas Department of Health has developed a comprehensive bulletin that specifies minimum standards for the design and construction of individual soil-discharging wastewater systems

New Hampshire created an “Onsite Wastewater Disposal Installation Manual” in 2002. Its purpose is to help both new and experienced system installers and excavators by providing needed and helpful information to properly site and install a state-approved system design. Topics covered in the manual include *Installing Systems Consistent with Designer’s Plans, Understanding Designer’s Intent, Estimating Construction Costs, and Assuring Proper Site Layout.* All installers must be permitted in New Hampshire, and the manual provides useful information to prepare for the installer’s exam, a necessary step to qualify for an installer’s license.

II. Management Considerations

All onsite management programs should carefully consider construction and installation elements to ensure the proper operation of onsite systems. These programs should include permits, inspections, and installer training requirements (see **Table 1**; note that each level builds upon the previous level).

Table 1. Construction/Installation Programs

Basic Approach
• Construction permit based on code-compliant site evaluations and system design • Installation by trained or certified installers • Inspection of systems prior to backfilling to confirm that installation complies with design

Intermediate Approach
• Pre-construction meeting at site with owner and installer to review construction/installation issues • Certification/licensing requirements for installers • Construction oversight for all critical steps (e.g., field verification and staking of system components, inspections after backfilling, and installation completion)
Advanced Approach
• Supplemental training for installers for difficult sites and advanced technologies • Verification and database entry of as-built drawings and other installation information

Construction Permits

Most local health agencies use construction permit applications or approvals as the primary method to manage system installation. Permits may be issued for individual or enhanced systems. A comprehensive, ideal permitting program should include the following elements:

- Site evaluation procedures
- Technology selection guidance
- Design review
- Permit issuance
- Construction inspections
- Record keeping
- Training for installers

It is important to check local requirements before starting construction. For example, Nebraska system construction permits apply to gravelless and conventional drainfield systems. However, some communities in the state do not allow gravelless systems.

States that allow enhanced treatment technologies require greater oversight of construction and installation activities. For example, enhanced technologies approved for use in Massachusetts must be reviewed and approved for actual installation at a specific site. The local board of health has primary responsibility for this, but in certain instances approval from the Massachusetts Department of Environmental Protection is required. For pilot projects, the board of health issues a disposal system construction permit before installation can begin and a certificate of compliance before the system can be started up.

CONSTRUCTION PERMITS – STATE AND LOCAL EXAMPLES

Oregon requires construction permits for all individual systems. The permit requires an applicant to submit a map of the property, a construction/installation plan, and approvals from county or city planning agencies documenting land use compatibility.

Stinson Beach, California, requires a construction permit for a new wastewater system, which is valid for two years. The community also requires repair or replacement permits for modification and/or repair and/or replacement of a wastewater system or system component(s).

In Cass County, Minnesota, a construction permit is required to construct a new treatment system or replace/modify a treatment system. To obtain a permit, the property owner submits a site evaluation, system design, and site drawings for review and approval. Licensed practitioners must perform the site evaluation and develop the design. After a licensed contractor has certified that construction is complete in accordance with the approved plans, an operating permit is issued. This permit allows the system to be used as long as it performs properly.

The Arizona Department of Environmental Quality (ADEQ) currently has 22 general aquifer protection permits for soil-discharging systems. All 22 general permits follow the same two-phase process. During the first phase, a Notice of Intent to Discharge for a Type 4.02 general permit, or Notice of Intent to Discharge for a Type 4.03 through 4.23 general permit, and the applicable fee are submitted to the engineering review desk. ADEQ must provide authorization for construction before construction can begin. After determining that the facility design will conform to the general permit requirements, ADEQ issues a construction authorization, giving the applicant two years to build the system before the construction authorization expires.

The Johnson County, Missouri, regulations require a construction permit for new wastewater systems and major modifications to an existing system. The permit may be obtained via the Johnson County Community Health Services or Missouri Department of Natural Resources. The Johnson County Code of Health regulations also require installers to be licensed by the county.

Inspections

Installation inspections should be conducted by trained and certified personnel at several stages during the system construction and installation process, if possible. Most state and local wastewater programs require inspector training and certification to maintain a high and consistent level of program performance. The National Sanitation Foundation (NSF) developed a rigorous NSF Inspector Accreditation Program to test an applicant's knowledge on topics ranging from sewage treatment system design and operation to inspection procedures, safety, and basic tank capacity and other calculations. The National Association for Waste Transporters (NAWT) launched a similar but scaled-down NAWT National Inspector Certification. NAWT maintains a National Directory of Certified Inspectors.

During the construction process, inspections before and after backfilling can help verify compliance with approved construction procedures. If there are insufficient management program resources to conduct these inspections, an approved, independent design professional could be required to oversee installation and certify that it has been conducted and recorded properly. The construction process for soil-discharging systems must be flexible to accommodate weather events, since construction during wet weather may compact soils at the infiltrative surface or otherwise alter soil structure and should be avoided.

Commonly, the local health department will provide a field inspection prior to backfilling the system, after which an occupancy permit is issued. For example, in Texas, an authorization to construct must be granted by the permitting authority before building can begin. This authorization includes specific instructions on the number and schedule of inspections and at what stages of construction the inspections are required.

INSPECTIONS – STATE AND LOCAL EXAMPLES

Oregon requires a system "pre-coverup" inspection unless waived by the county wastewater management agent. Some enhanced systems, such as sand filter systems, require inspections at various stages of construction, and these inspection requirements are specified in the permit. To initiate the pre-coverup inspection, the installer must complete the As-Built Drawing and Materials List form and submit then to the county. This form must be signed by the installer certifying that it was installed according to specifications.

Marin County, California, requires that the designer of county-approved, enhanced systems also be responsible for the system installation inspection to assure conformance with approved plans. The construction inspection by the designer is in addition to the standard county inspection.

The responsible management entity (RME) for Shannon City, Iowa, provides oversight throughout the construction process either with their own trained and certified personnel or through the USDA Rural Development staff. Final pre-cover inspection and permitting is performed by the Union County Sanitarian.

The Georgetown Divide Public Utility District in California oversees the wastewater program as the RME. The utility’s onsite wastewater program hired staff inspectors to oversee the installation of wastewater systems by approved contractors on private property.

Installer Training and Certification

Several states require certification of individuals who install individual and clustered wastewater systems. However, certification requirements vary significantly across the country, with some requiring extensive training and others simply mandating registration.

National Onsite Wastewater Recycling Association (NOWRA) recommends that all wastewater system service providers, including installers, be certified. The NOWRA Installer Academy provides skill and technical knowledge training for system technicians. The National Environmental Health Association, through a cooperative agreement with EPA, has worked with various groups to develop a national credential to certify installers of individual wastewater treatment systems. The credential covers all forms of installation and is offered at both a basic and advanced levels. The credential is designed to test the knowledge, skills, and abilities needed for the successful installation of a wastewater treatment system. State and local codes are not covered through this national credential, and it is meant to enhance, not replace, a state or local regulatory program. The Consortium of Institutes for Decentralized Wastewater Treatment has also created a series of training modules that include installation/construction for use in training centers.

CERTIFICATION AND TRAINING – LOCAL AND STATE EXAMPLES

South Dakota requires all wastewater system installers to be certified. To become certified, a person must pass an open-book, take-home style exam that is based on the regulations.

In Kentucky, installers must pass a competency exam and show proof of liability insurance.

Nebraska has two certification categories for installers: Journeyman Installer and Master Installer. To obtain certification, individuals must demonstrate a minimum level of competency and knowledge of the state's wastewater rules and regulations and acceptable industry practices. Certification is effective for two years.

West Virginia certifies individual sewage system installers. Approximately 1,500 Class I and Class II installers have been trained and maintain their certification in West Virginia. These certifications are valid for five years. The state provides a listing of certified installers.

The Florida Beach and Shore Preservation Act requires installers to obtain construction control permits from the Department of Environmental Protection for installations seaward of the coastal construction control line.

The Ohio amended Household Sewage Treatment Rules (Jan. 1, 2006) requires installers to achieve and maintain status as an installation qualified contractor and complete six continuing education hours per year.

North Carolina adopted rules that required installers and inspectors to become certified by 2008.

III. References and Additional Resources

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3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 9. OPERATION AND MAINTENANCE

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

NOTICE: Many of the links in this guide are external links to non-EPA sites. Links to non-EPA sites do not imply any official EPA endorsement of, or responsibility for, the opinions, ideas, data, or products presented at those locations, and do not guarantee the validity of the information provided. Links to non-EPA sites are provided solely to reference information that may be useful, or of interest. **EXIT disclaimer**

INTRODUCTION

A very important, but often overlooked, component of an wastewater management program is operation and maintenance (O&M). Effective wastewater management ultimately hinges on the proper O&M of systems.

There are several different management approaches that can be used to support O&M, from mandatory inspection programs to permitting and monitoring requirements. In general, operation and maintenance tasks are tied directly to the system type, the wastewater being treated, and the receiving environment where effluent is discharged or dispersed. This overview provides readers with general information about the O&M management considerations for individual and clustered wastewater treatment systems. Included in this overview are:

I. System Operation and Maintenance Requirements

- Individual Wastewater Systems
- Clustered Treatment Systems

II. Management Considerations

- Education and Outreach
- Training and Certification
- Inspection and Maintenance Requirements
- Maintenance Contracts
- Reporting and Monitoring
- Operating Permits
- Public and Private Management Entities

III. References and Additional Resources

- Resource links are also included throughout this guide to provide users with more specific information related to treatment system operation and maintenance.

I. System Operation and Maintenance Requirements

There are distinct, ongoing O&M requirements associated with the various individual and clustered wastewater collection and treatment systems and the technologies employed. Most technologies come with suggested O&M maintenance activities from the manufacturer. These requirements are crucial to the proper operation and performance of the system.

Individual Wastewater Systems

Individual treatment systems collect, treat, and disperse wastewater from an individual property and are associated with low-density communities and developments, such as rural residential and small commercial developments. Individual systems generally consist of one or more treatment devices (e.g., septic tank, fixed film treatment unit) and a subsurface dispersal system. The operation and maintenance requirements of an individual system can vary greatly depending on the type of system. For example, mechanical systems, such as activated sludge-based units, require servicing three to four times a year, while conventional systems need service or pumping every three to seven years, depending on occupancy and use.

Conventional Systems Conventional "septic" systems are the most widely used wastewater treatment system. These systems are simple to operate and, when properly designed, constructed, and maintained, do an excellent job of removing pollutants from wastewater. In most communities, the operation and maintenance of conventional systems is the responsibility of the homeowner.

Conventional systems require periodic pumping to remove the solids, fats, oils, and grease that accumulate in the septic tank. When a system is poorly maintained and not pumped out on a regular basis, sludge (solid material) can build up inside the tank and may ultimately clog the absorption field, making the system unusable. A system owner should hire an experienced (i.e., licensed or certified) service provider to inspect the system at least once a year to determine pumping needs and to clean, repair, or replace any components as needed (i.e., baffles, tees, effluent screens). Most conventional system designs now include risers that allow access to inspect tanks and determine pumping needs.

Enhanced Treatment Systems Several wastewater alternative technologies have proven to be effective in situations where conventional systems are not appropriate. These systems fall into three broad categories:

- Material replacement: Technologies that replace one component of the conventional system with a component manufactured from a different material.
- Conventional system modification: Technologies that enhance or otherwise improve conventional operating or treatment performance.
- Enhanced wastewater treatment: Advanced or innovative technologies that provide a higher level of treatment beyond conventional systems. Generally, these systems have mechanical or moving parts that require periodic operation and maintenance, inspections, and eventual replacement.

Enhanced wastewater treatment systems are more complex than conventional systems and require greater oversight to keep all aspects of the treatment process in balance. Some of the more common enhanced system technologies in use today include:

- Activated Sludge-Based Aerobic Treatment Units
- Denitrification Systems
- Fixed Activate Sludge Treatment

- Recirculating Media Filter
- Sequencing Batch Reactors
- Septic Tank Filters or Screens
- Gravelless Leachfields
- Pressure and Drip Soil Dispersal Systems

There are a number of websites that offer information on enhanced wastewater systems including the New England Innovative Technology Inventory and the National Sanitation Foundation. Several states, including Massachusetts, New Hampshire, Oregon, and Arizona also maintain lists of approved alternative and innovative technology. EPA's Decentralized Wastewater Management Web site, technology fact sheets, and various other EPA publications – including the Onsite Wastewater Treatment Systems Manual - provide extensive information on enhanced wastewater treatment technologies.

Clustered Treatment Systems

Clustered systems can serve from two to 200 or more homes and/or commercial facilities. Also known as community systems, clustered systems are a treatment option when individual wastewater systems or centralized sewer service are not viable options.

Cluster systems have become an attractive option for many locations, especially in areas like small lakeside communities where a higher level of treatment may be needed. For example, Minnesota, the "land of 10,000 lakes," reports that up to 60 percent of the permits processed in recent years are for structures served by clustered wastewater systems.

The operation and maintenance requirements of cluster systems will vary based on the size of the system, the wastewater being treated, and the types of technology used. Various technologies that can be implemented via a cluster system. They range in scale from a communal septic tank and soil dispersal system serving a dozen homes to a large alternative sewer system connected to a treatment plant that can treat large wastewater flows with a variety of wastewater treatment and dispersal/reuse technologies. There are several good sources of information for cluster systems including the Cluster Wastewater Systems Planning Handbook and the Cluster System Fact Sheet Series produced by the University of Minnesota.

II. Management Considerations

In the past, state and local wastewater management programs rarely specified O&M requirements for conventional or enhanced wastewater systems. The regulation of system design, construction, and operation was considered to be satisfactory community oversight. However, as more and more systems malfunction and threaten waterways and as more systems include higher maintenance electrical and mechanical components, communities are recognizing the value of O&M requirements. Many are strengthening programs with a number of tools, including requirements for homeowner service contracts, routine maintenance inspections, revocable operating permits, monitoring, and enhanced reporting and data management that support proper system performance.

Education and Outreach

Public involvement and education is one of the most critical elements in a successful wastewater management program. Engaging stakeholders builds awareness of wastewater management issues and needs and can increase support to develop and implement an effective program. Technical and advisory committees are an effective approach to help review program options and identify O&M proposals. Thurston County, Washington, created a citizen advisory committee in 2003 to help develop an O&M proposal to address problems associated with malfunctioning systems. After public review, the proposal was approved in 2005. The O&M program establishes a more rigorous maintenance and inspection requirement for all treatment systems within the boundaries of the watershed protection area through the use of renewable operational certificates. For systems designated as “high risk,” a dye tracer evaluation is required as a condition of the operational certificate renewal.

Ultimately, it is the actions of the homeowner that will determine the success of any O&M program. Numerous surveys of homeowners have revealed a general lack of knowledge regarding their wastewater systems. Most state and local programs include an education program to promote homeowner awareness. Many have developed guides and fact sheets to inform homeowners about how to maintain and troubleshoot their systems. Some localities, like Jefferson County in Alabama, mail out reminders to homeowners to have their septic tank checked to see if it is in need of pumping. Others have developed a more rigorous approach of direct technical and financial assistance to homeowners. For example, many Washington counties have used the Washington Water Pollution Control State Revolving Fund’s low-interest loan program to help residents repair and upgrade malfunctioning systems (See Resource Guide 1. Public Education and Outreach for more information).

HOMEOWNER AWARENESS – STATE AND LOCAL EXAMPLES

In 2006, Boulder County, Colorado, started a public engagement initiative to develop the best solutions to address malfunctioning wastewater systems. The county plans to host community open-house events and to publish information in newspapers. As of 2007, an online survey was underway to assess the public’s understanding of wastewater management issues, and its feedback will contribute to the design of a communication/outreach strategy.

Washington developed a comprehensive homeowners manual that includes information on system components and maintenance needs, water conservation practices, and operation improvement options. Forms are included to help owners build and maintain a file of treatment system information to assist in operation and monitoring. The state supplemented this guide with a listing of online information resources about wastewater systems developed by the local health jurisdictions, schools, government agencies, and other professional organizations. It is intended to help the local health jurisdictions’ efforts to share educational information and resources about treatment systems.

Texas has developed the Homeowner’s Guide to Evaluating Service Contracts. The guide describes the frequency of service activities, types of service contracts available and how they compare, and information on finding a local service provider.

The Town of McClellanville, South Carolina, adopted a voluntary maintenance program in 2006 that uses postcard reminders to inform system owners of the need for maintenance, based on a five-year pumpout rotation basis. The two-part postcard includes a portion that the property owner voluntarily returns to the town to report on the tank pumpout. The information is used to update the town’s wastewater system database.

Training and Certification

Communities that require inspections of wastewater systems (construction, operations, and maintenance) typically also require using only trained or certified inspectors and service providers. Several states have established certification and licensing programs for inspectors, pumpers, haulers, and other service providers. In addition, some states and jurisdictions have created registries for certified providers to encourage the use of trained professionals.

Training courses are offered through a number of state wastewater training centers. States and communities can also take advantage of national inspector training, certification, or accreditation programs available from the National Association of Wastewater Transporters, National Sanitation Foundation International, and the National Environmental Training Center for Small Communities. For more specific information on training/certification programs see Resource Guide 11. Training and Certification.

TRAINING AND CERTIFICATION – STATE AND LOCAL EXAMPLES

Oregon initiated an installer and maintenance provider certification program in 2006. A maintenance provider who inspects, maintains, certifies, or supervises maintenance on systems using enhanced treatment technologies, recirculating gravel filters, or commercial sand filters must be certified as a maintenance provider unless the maintenance provider owns the system being serviced and has received training from the manufacturer on proper maintenance of the system.

Seattle and King County, Washington, requires service providers to obtain a Certificate of Competency in order to perform inspections and/or preventive maintenance of individual systems. Continuing education is required for renewal. The public health department maintains a list of certified maintenance providers.

Minnesota developed a homeowner's guide to hiring treatment system professionals. The guide reviews service provider specialty areas such as pumpers, designers, and inspectors, and details state licensing requirements. Helpful tips on hiring service providers are also included to help protect the consumer.

Inspections and Maintenance Requirements

In many communities, local health officials often have no legal authority to monitor systems or enter private property unless they receive a complaint or have other evidence that there may be a problem with a system. To prevent widespread problems with systems, some local jurisdictions have amended their codes to include routine maintenance inspections of individual wastewater treatment systems. These programs can be administered and regulated by special entities such as sanitary, sewer, or water districts; by local health agencies; or by other organizations, such as town governments and homeowners' associations. Enabling legislation must be passed at the state level to give these organizations the legal authority they need to manage systems. Other communities and a few states have amended their wastewater codes to require a system inspection and documentation of a system's condition when property is sold or transferred. Arizona began a statewide property transfer inspection program of all individual systems (both conventional and enhanced systems) in 2006.

Maintenance inspections are gaining appeal as a management tool to assess the condition of systems and determine pumping or other O&M needs. In some cases, this is a strictly voluntary program, while in other cases, communities have elected to mandate pumping based on third party inspections. Following inspection, the system owner should be notified of any needed corrections and assigned a deadline to furnish acceptable proof that the corrections have been made. Acceptable proof is usually a certification by the contractor listing the types and dates of corrections made and final inspection. Some local agencies have adopted a sewage management program that requires the annual inspection of systems with newly issued or modified permits and proof of septic tank pumping for all systems (old and new). Other agencies have designated certain geographical areas (such as aquifer or shoreline protection zones) as being subject to annual system inspections and/or routine tank pumping.

Operation and maintenance inspection programs are usually coupled with a mandatory septic tank pumping program. The local agency notifies the system owner when pumping is due. Verification of pumping is provided to the regulating agency. Typical pumping requirements vary from three to five years or more based on the daily sewage flow and individual household wastewater characteristics.

Alternative and enhanced wastewater technologies require additional maintenance and/or ongoing attention. In states and communities where these systems are authorized, performance inspections are mandated in the state code or in the system's operating permit.

INSPECTIONS – STATE AND LOCAL EXAMPLES

Fairfax County, Virginia, amended its wastewater ordinance to include a requirement that individual systems be pumped at least once every five years to comply with the state's Chesapeake Bay protection commitment. The county health department sends out maintenance reminders to system owners when pumpouts are due.

The Coastal Georgia Regional Development Center prepared a model onsite maintenance disposal ordinance in 2005, requiring mandatory system pumpouts (not to exceed five years), notification letters, proof of maintenance and inspection, five-year operating permits (which expire on property transfer or system malfunction), corrective procedures, and enforcement provisions. The center also prepared a model inspection ordinance.

North Carolina state rules include management and maintenance requirements for enhanced wastewater systems. For conventional and pressure manifold systems, an evaluation by the health department is required every five years. Low-pressure pipe systems are evaluated every three years. The health department notifies homeowners regarding the timing for the inspections, and permission is sought to access the system. A contract between the homeowner and an operator for the six-month inspections of low-pressure pipe systems is also required for the lifetime of the system.

Maintenance Contracts

For enhanced wastewater systems, a long-term maintenance contract is highly recommended and typically required in state or local regulations, or as a provision of a system's operating permit. In addition, the National Sanitation Foundation (NSF) requires that manufacturers seeking NSF/American National Standards Institute (ANSI) certification of a particular wastewater technology must include the price of maintenance for the first two years in the product's price as a condition of certification. In response, many manufacturers of wastewater systems now offer maintenance contracts with their products.

While maintenance contracts are a viable option to better manage enhanced systems, they must be supplemented with adequate reporting and tracking to monitor their use. Enhanced systems may also require an increased frequency of inspections to determine if they are performing as required. In Monroe County, Florida, state law requires enhanced nutrient reduction systems (nitrogen and phosphorus) to protect the sensitive ecosystem of the Florida Keys. These systems are performance-based treatment systems and require an annual operating permit, maintenance contract, and annual inspection from the county health department. Operation and maintenance information, including tasks and some costs, were developed for the Wekiva Basin region in Florida in 2004.

MAINTENANCE CONTRACTS – STATE AND LOCAL EXAMPLES

Texas requires ongoing maintenance contracts for treatment units that use secondary systems, non-conventional treatment systems, drip irrigation, and surface application dispersal, even if the system is not in operation. However, in counties with a population of less than 40,000, the owners of single-family residences can maintain their own aerobic treatment unit, provided they receive training from the licensed installer.

Massachusetts regulations require that all "alternative and innovative" (i.e., enhanced) systems must have an operation and maintenance contract with a licensed wastewater operator. All systems must be inspected at least annually, and those installed for nitrogen reduction must generally be inspected quarterly. The inspections include effluent sampling.

The Dallas County, Iowa Board of Health adopted regulations requiring maintenance contracts for all discharging systems and for any system having an alarm system or pumping station. (Note: All systems that discharge to surface waters must have National Pollutant Discharge Elimination System (NPDES) permit coverage, under federal and state law.) The maintenance contractor must report maintenance and testing events to the county sanitarian. Failure to sustain a maintenance contract or conduct the required maintenance results in enforcement actions.

In Rhode Island, state regulations require all enhanced wastewater treatment systems to have an operation and maintenance contract. The contract is recorded in land evidence books for the life of the system.

Reporting and Monitoring

A key part of an O&M program is to track the maintenance of systems. The only way to ensure that maintenance contracts are kept in effect and that systems are monitored when required is for the management entity or regulatory authority to have a structured reporting program. Service providers should report maintenance events and any lapses in maintenance contracts to the management or regulatory authority. This information should be managed in a database to monitor O&M activities and provide a system of accountability. Advances in technology via Web-based remote monitoring or telemetry can also allow multiple system operating parameters (e.g., pump cycles) to be monitored from remote locations around the clock. More information on this subject can be found in Resource Guide 4. Inventories, Reporting, and Recordkeeping.

REPORTING AND MONITORING – STATE AND LOCAL EXAMPLES
The Barnstable County Department of Health in Rhode Island began to use its system database in 2005 to track required services (monitoring, inspections) and O&M contract renewal as required under maintenance contracts. If a component is not inspected on schedule, a notification appears in the service schedule summary. Homeowners in Hamilton County, Ohio, contract with manufacturers and local plumbers to maintain home aeration wastewater treatment systems. Managed by the county, all of the system locations are recorded using a geographic information system (GIS) tied to a regional GIS that serves the entire Cincinnati Metropolitan Area. Waterborne diseases are also tracked through this integrated geographic database. Health officials can review these data by watershed and evaluate and compare findings. The Montgomery Township in New Jersey updated its Onsite Wastewater Treatment Management Database in September of 2004. Invoices, late notices, and license renewal letters can be automatically generated through the newly added query and programming functionalities. In addition, the database has the capability of linking the location of wastewater treatment systems to the municipality's GIS by parcel data.

Operating Permits

In some cases, renewable operating permits are used to ensure ongoing maintenance of a wastewater system. In areas where operating permits are issued to conventional systems, the permit may specify routine septic tank pumping. Or in the case of Spokane, Washington, new systems and systems located over the Spokane/Rathdrum Aquifer are tracked and issued a renewable three-year permit by the health district. Inspection and maintenance is required prior to permit renewal.

More complex (enhanced) systems, however, often include maintenance inspections, maintenance contracts, and compliance measures. In the case of a performance-based system, the operating permit may include specific standards that must be maintained along with monitoring and reporting requirements. Ohio adopted O&M regulations in 2004 that authorize the use of operating permits as a legal means to establish O&M requirements and, in some cases, mandatory service contracts. The regulations include a provision that O&M, in accordance with the manufacturer's instructions, shall be met when required as a condition of an operating permit. The O&M rules also require:

- Increased levels of management related to risk conditions associated with higher sewage treatment system density, complexity, and reliability and location of systems in areas of high risk for surface water or groundwater contamination.
- Recording of operating permit conditions, service contract requirements, or other O&M management information on property deeds as a means to provide notification upon transfer of property.
- Utilization of private sector professionals or responsible management entities, or designation of qualified agents to conduct monitoring or other O&M management responsibilities.

- Inclusion of enhanced O&M management mechanisms such as Web-based reporting, remote telemetry, and use of publicly and privately available database programs to support O&M tracking requirements.
- Establishment of a household sewage treatment district.

OPERATING PERMITS – STATE AND LOCAL EXAMPLES

Marin County, California, requires renewable operating permits for enhanced systems. The permits are the basis for verifying the adequacy of a system's performance and their renewal is based on the performance of the system. Failure to undertake any required corrective work may be cause for non-renewal or revocation of the operating permit.

In Monroe County, Florida, state law specifies enhanced nutrient reduction systems to protect the coastal ecosystem. These systems have biennial operating permits, and maintenance contracts and are inspected annually.

Malibu, California, Ordinance 242 adopted in 2001, establishes a renewable operating permit for new and replacement wastewater treatment systems. Inspections from private registered inspectors are required on a regular basis. Operating permits for enhanced systems are good for two years. Permits for conventional systems are good for three years.

Four health districts in the northeastern corner of North Carolina established the Albemarle Septic Management Entity (ASME) to monitor the subsurface drainage of wastewater treatment systems. ASME issues operating permits in accordance with state and local rules. In addition to conventional systems, two inspections of enhanced systems are conducted each year. ASME has authority to repair a malfunctioning system and bill the owner or place a lien on property for failure to reimburse ASME.

Public and Private Management Entities

Enhanced systems and cluster systems can pose greater risks of mechanical and performance failure than passive conventional systems. Special districts, water/sewer authorities, and public utilities can be an effective option for managing these systems. Private entities can also be authorized to own, operate, and/or maintain an individual or cluster system.

Michigan law provides for a number of institutional options for community wastewater management and the construction of community wastewater treatment systems. For example:

- Rural townships can contract for management services from an adjacent community with a preexisting wastewater management entity.
- If the county has a county sewage/water district, then local governments contract directly with the county for wastewater management services.
- Small communities, townships, and villages can contract with a private company to monitor and maintain individual and community wastewater systems.
- Several townships and/or villages can establish a joint authority, such as a sewage district or management district, to share building and management costs.

At least 12 possible institutional variations for wastewater management entities are authorized in North Carolina. Minnesota has several wastewater management districts operating, including two sponsored by local rural electric associations. The utilities subcontract with local installers to perform the twice-a-year O&M service. These utilities have the ability to bill their wastewater customers for O&M as part of their electric bill.

Finally, accountability is an important aspect of administering a private or public management entity. Health departments and state agencies generally retain their authority to approve system designs and issue permits. The public or private management entity conducts inspections, provides maintenance, and executes remediation and repair activities.

MANAGEMENT ENTITIES – STATE AND LOCAL EXAMPLES

The Village of Indian Point in Missouri, located on Table Rock Lake, is Branson's largest resort area, with 29 lakefront resorts. Studies revealed that wastewater treatment systems used by most of the 558 residents were not effective due to soil and site conditions and some were threatening drinking water supplies. The community investigated a number of options and ultimately created a Board of Public Works to manage the wastewater systems. Regulations were adopted in 2004 for the construction, operation, and ongoing management of all private and public treatment systems. The goal is to phase out conventional systems and effectively manage the newer enhanced systems.

Among the elements of the Indian Hill Onsite Wastewater Program are:

- Renewable operating permits conditioned on a plan for operation and maintenance and an executed contract with a licensed service provider for the life of the permit.
- Operation inspections
- Inventory of all wastewater systems
- Construction, operation, and ownership of system by the board of public works
- Comprehensive planning for wastewater improvements
- Ongoing assessments of system compliance

The community has banned the installation of new conventional systems and requires operation and maintenance agreements for existing conventional systems. Two multi-home enhanced treatment cluster systems and two commercial systems have since been installed, and ten individual systems have been updated.

Information Adapted from Small Flows Quarterly, 2005, Volume 6, Number 3.

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
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Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 10. SEPTAGE / RESIDUALS

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Residuals are normally produced as a result of wastewater treatment. The term "septage" is commonly used to describe the liquids and solids that are pumped from a septic tank, port-a-potty, cesspool, or other locality. EPA regulates the management of septage to ensure that this material is treated, used, and/or disposed of in an environmentally sound manner.

This overview provides regulators and practitioners with information about various septage treatment methods and management options and includes coverage of the topics below:

I. Septage Characteristics
II. Federal Septage Rules
III. Treatment and Disposal Options
IV. Management Considerations

- Inventories, Recordkeeping, and Tracking
- Operation and Maintenance
- Training, Certification, and Licensing
- Public Education
- Inspections and Compliance

V. References and Additional Resources

- Resource links are also included throughout this guide to provide users with more specific information related to septage and residuals management.

I. SEPTAGE CHARACTERISTICS

Septic tanks with soil absorption systems are the most commonly used individual wastewater treatment system in rural and suburban areas. Untreated household waste flows into the tank where the solids separate from the liquid. Light solids, such as soap suds and fat, float to the top and form a scum layer. The liquid waste goes into the drainfield, while the heavier solids settle to the bottom of the tank where the organic matter is partially decomposed by anaerobic bacteria. Some non-decomposed solids remain, forming a sludge layer that eventually must be pumped out. A septic tank will usually retain 60 to 70 percent of incoming solids, oil, and grease.

Because it is concentrated, the strength of septage is generally fifty to several hundred times greater than municipal wastewater. The physical characteristics of septage vary depending upon the septic tank size, design, and pumping frequency; user habits; climatic conditions; water supply characteristics, and the use of garbage disposals, household chemicals, and water softeners. Some general characteristics of septage appear in **Table 1**.

It is important that samples of septage be collected and tested to determine local characteristics, since they can affect the proper management of these materials.

Table 1. Septage Characteristics – Conventional Parameters.

Parameter	Minimum Concentration (mg/)	Maximum Concentration (mg/l)
Total solids	1,132	130,475
Total volatile solids	353	71,402
Total suspended solids	310	93,378
Volatile suspended solids	95	51,500
Biochemical oxygen demand	440	78,600
Chemical oxygen demand	1,500	703,000
Total Kjeldahl nitrogen	66	1,060
Ammonia nitrogen	3	116
Total phosphorus	20	760
Alkalinity	522	4,190
Grease	208	23,368
pH (Standard Units)	1.5	12.6
Total coliform (CFUs /100 ml)	107/100	109/100
Fecal coliform (CFUs / 100 ml)	106/100	106/100

Source: EPA Handbook: Septage Treatment and Disposal (1984)

In its Septage Treatment and Disposal Fact Sheet (EPA 832-F-99-068; September, 1999), EPA describes septage as:

> Highly variable and organic, with significant levels of grease, grit, hair, and debris. The liquids and solids pumped from a septic tank or cesspool have an offensive odor and appearance, a tendency to foam upon agitation, and a resistance to settling and dewatering. Septage is also a host for many disease-causing viruses, bacteria, and parasites.

The volume of residuals generated by a wastewater system will vary based on the treatment method. A general method to determine septage generation appears below. Some advanced treatment units, such as activated sludge-based aerobic treatment unit (ATU) systems, can significantly increase the volume of residuals generated. In contrast, filtration technologies are often used to minimize the generation of residuals.

GENERAL METHOD TO DETERMINE SEPTAGE GENERATION

volume pumped[1] x residences served / frequency of pumping[2] = annual volume

[1] *Typical default values for septage are 1,000 gallons (septic tank volume) per pumping*

[2] *Frequency default value is every five years.*

Note: Some advanced treatment units will significantly increase the volume of residuals generated. If pumping occurs on an as-needed basis, residuals management (receiving) facilities will need a significantly larger short-term capacity for processing. The method of residuals processing may also require some additional evaluation of septage characteristics.

II. Federal Septage Rules

In 1993, EPA issued regulations that address septage use and disposal practices as part of Chapter 40 of the Code of Federal Regulations. 40 CFR part 503 regulates domestic septage as a part of the requirements controlling the use and disposal of sewage sludge.

The rule defines “domestic septage” as liquid and solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receive only domestic sewage. The 503 regulation includes minimum requirements for land application of domestic septage applied to non-public contact sites such as agricultural fields, forestland, and mine reclamation areas.

40 CFR Part 257 governs the management of grease trap wastes and other types of residuals resulting from the treatment of non-domestic sewage by individual and clustered commercial and industrial treatment systems.

40 CFR Part 258 governs the disposal of septage, sewage sludge, and other residuals into municipal solid waste landfills.

THE FEDERAL 503 RULE

Requires domestic septage pumpers to meet four basic requirements:

- Meet (and certify) applicable pathogen and vector attraction reduction requirements
- Follow specific management practices
- Ensure that septage is from domestic sources only
- Keep records on land application sites, rates, etc.

Most states build upon the federal 40 CFR part 503 regulation as the minimum requirements for managing septage, although states may and often do impose more stringent requirements. In some cases, municipalities have established local regulations for septage handling, treatment, and disposal in addition to the federal and state regulations.

For example, Minnesota has developed a model local ordinance for Land Application of Septage at Non-Public Contact Sites. The ordinance builds upon the federal 503 rule for land application. It provides pumpers with detailed information on site suitability, separation distances to features such as surface waters and wells, and detailed site management requirements.

These are practices commonly used for land application of other by-products and wastes in Minnesota that have proven to be effective for preventing runoff of wastes and contaminants from application sites and preventing contamination of groundwater.

SEPTAGE LAWS – STATE AND LOCAL EXAMPLES

North Carolina requires any individual or firm who collects, transports, or handles septage in any manner to obtain at least one (and sometimes two) permits. The septage management firm must obtain a permit to transport septage over state roads. In order to obtain a permit to operate, the owner must submit information including:

- The number and capacity of pump trucks and pumping equipment
- The method for ultimate disposal or disposition of the septage
- The location of all septage disposal sites

Information on the method for managing washings and cleanings generated from the interior of the septage hauling containers and the location of the disposal site for those washings is also required. If septage is applied to agricultural lands, the permittee must submit information concerning the operation of that site. The information must include an estimate of the nutrient and metal assimilative capacity of the site, evidence that the hydraulic components contained in septage will be assimilated on that site, and documentation of the nutrient requirements of the crop growing or to be grown on that site.

In all cases, the state and federal regulatory agencies must consider the impact of the septage management program on rare and endangered species. The state also limits septage application rates based on both a hydraulic and a nutrient load.

III. Treatment and Disposal Options

Septage can be processed through land application, at wastewater treatment plants, or at processing facilities specifically designed to treat septage. The following section describes these alternatives:

Land Application. Domestic septage contains nutrients that can condition the soil and decrease reliance on chemical fertilizers for agriculture production. Typically, the best land application sites are located in isolated or remote areas. Both tilling the soil and adding lime to septage may benefit crop production. Adjusting septage pH can also reduce or eliminate odors and disease-causing organisms before land application.

Subsurface application, or surface application with subsequent incorporation, are the preferred methods for land application of septage since they minimize odors, reduce vector attraction, minimize ammonia volatilization losses, conserve nitrogen, minimize contact with rain, and reduce potential water contamination. State regulations for land application of septage often require pre-approval from the regulating agency through permits and/or licenses, soil tests, and site management plans.

A storage or transfer tank may be needed when land application sites are inaccessible due to weather conditions or if pre-application treatment of the septage is required. Some states require septage to be disinfected before application.

Pretreatment, such as screening and grit removal, may also be necessary prior to discharge into a tank or lagoon. Enclosed holding tanks or lined lagoons in isolated areas are preferred temporary storage facilities. Additional information can be found in EPA's design manuals for land application (EPA/625/R-95/001) and surface disposal (EPA/625/R-95/002), and its "Guide to Septage Treatment and Disposal" (EPA/625/R-94/002). One of the major concerns regarding land application is odor and pathogen problems. Pretreatment and stabilization can reduce minimize odors. The simplest and most economical method is to add lime or other alkali to raise the pH to 12 for a minimum of 30 minutes.

Other septage stabilization options include ***aerobic digestion, anaerobic digestion, and composting.*** Relative to alkaline stabilization, these options have higher operating costs and require more skilled operating personnel. A number of states require septage be stabilized before it is applied to the land. Michigan law includes a requirement to screen all septage prior to land application and bans septage waste application on frozen soil.

Surface disposal of septage is another alternative outlined under the federal rules, This includes disposal in holding lagoons, trenches, and sanitary landfills. Some states, however, have more restrictive rules concerning burial. For example, Georgia does not allow burial of septage in trenches or lagoons.

Publicly owned treatment works (POTWs). Septage can also be handled and processed at wastewater treatment plants. This process usually employs a septage receiving station, which pretreats the septage by screening and other unit processes. Some of these facilities separate the liquid from the solids, which are then processed by the POTW. The allowable amount of septage handled by a POTW is a function of the type and size of the treatment plant, capacity of the plant, and characteristics of the septage.

Smaller POTWs must be cognizant of how the higher-strength septage will affect overall wastewater organic loads and should control the feed rate. Pretreatment may be required to prevent problems in the treatment system. EPA has developed a guidance manual for the Control of Waste Hauled to Publicly Owned Treatment Works (EPA-832-B-98-003; September, 1999) for smaller POTWs on how to develop and implement hauled waste controls. Larger systems can more easily handle septage without process upset. POTWs should track each septage load to identify any potential for a system upset.

Independent Septage Treatment Facility (ISTF). When suitable land is unavailable and wastewater treatment facilities are too distant or do not have adequate capacity, independent septage treatment plants may be an option. ISTFs vary from stabilization lagoons to treatment plants that use aerobic digestion, anaerobic digestion, composting, and other biological and chemical treatment processes.

One of the advantages of an ISTF over a conventional POTW is that unlimited amounts of grease trap wastes can be processed. However, in recent years, a growing number of POTWs (e.g., East Bay Municipal Utilities District in California and West Lafayette, Indiana) have modified their operations to accommodate the processing of fats, oils, and grease; food wastes; and other organic residuals, while increasing the biogas production from their sewage sludge anaerobic digesters for use in generating onsite power or conversion to biofuels.

Advantages and Disadvantage of Various Treatment Methods Selecting the appropriate septage treatment approach depends on several factors including:

- Capacity of approved treatment facilities
- State and local regulatory requirements
- Land availability and site conditions
- Costs (fuel, labor, and dispersal costs)

Incentives should be given for choosing septage management alternatives that emphasize reuse and recycling. The advantages and disadvantages of various approaches are reviewed in **Table 2.** Septage/sewage handling infrastructure and capacity should be reviewed every five years as part of the wastewater planning process.

Table 2. Advantages and Disadvantages of Septage Disposal Alternatives.

Process	Description	Advantages	Potential Risks/Concerns
Land Application	**Land Application** of untreated septage to non public contract land, such as agricultural land, forestland, and reclamation sites	• Recycles organic material and nutrients to the land. • Simple and economical • Low energy use	• Public health concerns from pathogens • Potential water contamination • Odors • Negative public perception of land application of waste • Need for holding facility during periods of frozen or saturated soil
Preapplication Processing Techniques	**Alkaline Stabilization** Lime or other alkaline material is added to raise the pH to 12.0 for minimum of 30 minutes	• Very simple, minimal operator attention • Low capital and O&M costs • Provides temporary reduction in sulfide odors	• Increases mass of solids requiring disposal • Handling of lime may cause dust problems • Lime feed and mixing equipment require regular maintenance
	Composting septage mixed with bulking agents in aerated piles. Biological activity generates temperatures to destroy pathogens	• Final product market-able and attractive to users as soil amendment • Potential for generating Class A biosolids	• High odor potential • Medium to high operating costs
	Aerobic Digestion. Septage is aerated in an open tank to achieve biological reduction of organic solids and odors	• Relatively simple • Reduction in odors • Potential for Class A biosolids with autothermal thermophilic aerobic digestion	• High power costs • Large tanks or basins required • Cold temperatures require longer digestion periods
	Anaerobic Digestion. Septage is retained for 15 days to 30 days in an enclosed vessel to achieve biological reduction in organic solids	• Generates methane gas, which can be used for digester heating or other purposes • Potential for generating Class A biosolids with thermophilic digestion	• Requires skilled operator to maintain process control • High capital costs • High maintenance requirements for gas handling equipment • Generally not used except for co-treatment with municipal sewage sludge
Wastewater Treatment Plants	Septage is added to the headworks, upstream manhole, or sludge handling process for co-treatment with sewage or sludge. Septage volumes that can be accommodated depend on plant capacity and types of unit processes employed	• Centralizes waste treatment operations • Reduces potential environmental, health, and odor concerns associated with land application of septage • Use of existing capital treatment plant infra-structure	• Potential need for equalization tanks to prevent overloading • Potential for toxic liquids to be discharged into the treatment plant due to lack of controls or regulations on what is collected by septage haulers • Additional odor control • Need for additional aeration capacity for the septage • Increased residuals handling and disposal requirement
Independent Septage Treatment Plants	Public or private facility is constructed solely for the treatment of septage	• Regional septage management solution • More direct control over the septage treatment process	• High capital and operation/ maintenance costs • Additional operating staff unless located very close to the municipal Wastewater Treatment Plant (WWTP)

Source: Adapted from Alberta Environment Septage Management Advisory Committee, *Aug. 2004.*

IV. MANAGEMENT CONSIDERATIONS

The safe, practical, and acceptable practices for the use or disposal of septage should be a key goal of any wastewater management program. Septage management plans must be developed within the context of state, local, and federal rules and the nature of residuals produced. The general state of septage management can be summed up by the following statement from a survey conducted by California:

> A 2002 survey of local onsite wastewater programs in California revealed that less than half of the jurisdictions tracked the total volume of septage handled. Most did not have information on the number of pumper vehicles and companies operating within their jurisdiction. Of the 81 septage facilities identified, several were no longer receiving septage or were closed. Based on these findings, the California Wastewater Training and Research Center recommended the development of a comprehensive septage management plan to continually assess septage capacity needs and design strategies.

To manage septage there are a number of questions that must first be asked to develop an appropriated septage handling and treatment program including:

- What are the current residuals handling practices?
- How much septage is being generated now, and how much will be generated when all planned new development and treatment facilities are in place?
- Where are pumpers currently discharging their trucks?
- What is the capacity of each of those sites versus the needed capacity?
- Can we secure any needed capacity or performance improvement without a major municipal investment?
- Can we secure agreements with receiving facilities to handle the ultimate volume of residuals generated at the design condition?
- Do the existing septage receiving facilities comply with the 40 CFR part 503 requirements and part 257 guidance?
- How can the management program provide support (e.g., public education and involvement, service provider training, financing for system upgrades) to overcome any barriers?
- What should fees be to assure a sustainable receiving, treatment, and use or disposal program?

Ultimately, each state must adopt its own unique approach based on its needs and regulatory authorities.

SEPTAGE MANAGEMENT – STATE AND LOCAL EXAMPLES

Ohio provides low-interest loans to communities for the installation of septage receiving facilities. The intent of the Ohio program is to establish a grid of POTWs with septage receiving capabilities.

Yarmouth/Dennis, Massachusetts, financed an independent septage treatment facility with advanced processing and liquid-stream soil dispersal to avoid an excessively high-cost sewer.

Both Wisconsin and New Hampshire incorporate septage planning into municipal wastewater planning requirements.

The Town of Pittsfield, Maine, conducted a septage pilot study in 2003-2004. The process used pretreatment, including manual screening of the raw septage; conditioning raw septage with lime; blending in ferric chloride and polymer; trapping the gross solids in a dewatering container; and treating only the liquid filtrate in the existing aerated lagoon facility. The Pittsfield Water Pollution Control Federation (WPCF) processed more than 1.3 million gallons of raw septage during the pilot study, with the best plant performance observed when filtrate total phosphorous was less than 2 mg/l. Results of the pilot study were favorable for developing a long-term expansion of Pittsfield's septage receiving facility.

Inventories, Recordkeeping, and Tracking

A management program should have an inventory of individual and clustered wastewater systems within their area. These inventories are typically kept current through periodic reporting of septage removal by system owners, service providers, or both. The management facility that accepts residuals is responsibility for compliance with the part 503 recordkeeping requirements. Facilities must keep records and produce them on demand for authorized regulators.

Most states require the haulers to keep records for a minimum of five years and use manifests to track septage. A local government may also require haulers to obtain permits to operate within its jurisdiction. Permits may cover septic tank pumping, treatment at a sewage treatment plant, land application, or treatment at an independent septage treatment facility.

Michigan's septage volume pump record and land application of domestic septage forms are an example of information collected by state reporting requirements.

CAPACITY DEVELOPMENT – STATE AND LOCAL EXAMPLES

Virginia requires the board of health to develop and revise, as necessary, a five-year plan for the handling and disposal of sewage from individual treatment systems. The code also requires the board to report to the governor and the general assembly every five years on the status of individual treatment systems in Virginia and the progress in implementing its long-range plan.

Legislation to support septage disposal and management in Wisconsin was enacted in 2006. The law requires a municipality planning for a treatment facility upgrade that will result in a capacity increase of 20 percent or more to evaluate the need to include septage receiving facilities and additional treatment capacity specifically for septage. Municipalities are also encouraged to include an assessment of septage needs even if the project provides less than a 20 percent increase. Zero-percent loans from the Clean Water Loan fund are available for qualifying proposals even if the capacity upgrade is not greater than 20 percent. The general concept of the new legislation is to increase awareness of septage disposal needs and to promote the provision of adequate facilities for receiving septage and to encourage capacity for its treatment unless adequate alternative treatment or disposition options are available. An incentive to address septage needs is created by providing the zero-percent Clean Water Fund loan for septage receiving facilities and the portion of the treatment capacity necessary to treat the septage component.

In 2006, the New Hampshire Legislature authorized additional funds under the State Aid Grant (SAG) Program. The SAG Plus funds allow municipalities to be reimbursed by the state an additional ten percent of the eligible costs resulting from the acquisition and construction of septage treatment facilities, which result in increased septage handling and/or treatment capacity to meet the septage disposal needs for that municipality. The grant increases by two percent for each additional town for which the host community formally agrees (through written agreement) to meet their septage disposal needs. The grant amount is not to exceed 50 percent of eligible costs contribution.

Operation and Maintenance

The need to pump septage from small wastewater systems cannot be overstated. Without proper operation and maintenance, soil absorption systems will malfunction and can potentially impair water quality or cause sewage surfacing and threats to public health. In most cases, the homeowner is responsible for maintenance of their treatment system.

Some communities, however, have strengthened their wastewater programs by conducting periodic inspections of individual treatment systems and maintaining pumping records to better monitor when pumping is needed. In these communities, the system owner is required to have his or her tank pumped by a locally approved hauler within a given time period and provide documentation that the tank was pumped in accordance with local requirements. Another approach is for a responsible management entity to assume complete responsibility for inspecting, pumping, and disposing of septage. In all cases, the management program goal should be to pump, transport, treat, and use or dispose of the residuals in a manner that has the least impact on the system owners, the community, and the environment. More information can be found in Resource Guide 9. Operation and Maintenance.

Training, Certification, and Licensing

The National Association of Wastewater Transporters conducts a comprehensive training and certification program for pumpers and haulers. Several states have also established training centers to promote proper handling and disposal of septage. For example, Wisconsin requires all septage operators to pass an exam in order to become a certified septage operator.

Several management programs also provide system owners with access to a list of certified service providers to promote proper septage management. North Carolina requires training and certification for land application operators and has similar requirements for pumpers. The state also provides a listing of certified land application operators.

TRAINING AND CERTIFICATION – STATE AND LOCAL EXAMPLES
Septage operators in Wisconsin are required to pass an exam to be certified. Two levels of certification are available for septage servicing and land application. State rules require continuing education credits to maintain an active certification.
Ohio rules that took effect on January 1, 2007, require that sewage treatment system installers, service providers, and septage haulers that register with a local health district to perform work required under this chapter take a state examination. The Ohio Department of Health is the state agency responsible for the implementation (http://www.ohioonsite.org/).

Public Education

Wastewater management programs require that community residents be informed about pumping and proper disposal of septage. Programs must reinforce O&M requirements and proper septage handling and disposal procedures, especially targeting the pumpers and haulers. Citizen feedback and input loops should be incorporated into the management program to maintain program support.

The York County Authority in Pennsylvania publishes newspaper notices informing residents about proper septage system pumping and use of licensed haulers. The authority also created a biosolids learning station, and presentations on the topic are available to school and civic groups at no cost.

Most states with licensing and certification requirements provide listings of approved septic pumpers and haulers. For example, Oklahoma provides a Web-based data-base of licensed pumpers and haulers.

Inspections and Compliance

Numerous states inspect septage pumping businesses. Inspections typically consist of reviewing 40 CFR part 503 requirements with pumpers, including record keeping, liming practices, and site management.

Oklahoma has developed a Septage Hauling and Pumping Inspection form to conduct inspections of septage operations and investigate complaints. Minnesota conducts a compliance inspection for all new disposal sites. Washington requires annual biosolids reports be filed each year for septage management activities to verify vector and pathogen controls and provide soil, septage, and water quality monitoring data.

INSPECTIONS AND COMPLIANCE – STATE AND LOCAL EXAMPLES

Montgomery, Maryland, conducts annual inspections of sludge hauling trucks. The trucks must be properly lettered and at least one-half full of clean water at the time of inspection.

Since 1996, Minnesota has required businesses that pump septic systems to be licensed by the state. The state has regulated licensed (and unlicensed) pumper businesses by investigating complaints and taking appropriate enforcement actions. In 2005, the state increased staff to provide greater oversight of licensed septage practitioners. Funding was provided by a $25 tank installation surcharge fee. Since licensed pumpers have never been subject to routine inspections, the state is now conducting proactive voluntarily inspections.

Septage haulers in Minnesota are required to pay a one-time, nonrefundable fee of $100 to the Minnesota Department of Environmental Quality, which is deposited into a contingency fund used to clean up sites where domestic septage was discharged in violation of state law.

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for treatment system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 11. TRAINING AND CERTIFICATION

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Individual and clustered wastewater treatment system service providers, regulators, and management staff need to have a solid working knowledge of treatment processes, system components, construction/installation methods, operation and maintenance requirements, and laws and regulations. Programs that train and certify these professionals should be based on sound science and appropriate technical principles and should advance a consistent understanding of wastewater collection, treatment, and management. This overview provides readers with general information about training and certification programs. Included in this overview are:

I. Training Programs

- Training Program Components
- State Training Centers
- National Training Programs

II. Licensing and Certification Initiatives

- Pumpers and Haulers
- Inspectors and Maintenance Providers
- Installers and Designers
- National Certification Programs

III. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to training and certification.

I. TRAINING PROGRAMS

There have been significant changes in many local and state wastewater design and permitting programs. At the same time, major advances in the scientific, engineering, public health, and management aspects of wastewater collection and treatment have occurred. An increasing range of professions are involved in wastewater systems, including planners, surveyors, engineers, geoscientists, environmental consultants, installation and service contractors, and environmental health officers.

To accommodate the training needs of these professionals, states have developed a variety of training requirements and incorporated them into their regulations. A matrix of state wastewater service provider training requirements can be found in the publication *Training and Certification Programs – A Necessary Part of Onsite/Decentralized Wastewater Treatment.* The list reveals that about 40 states have some type of wastewater systems training requirement.

The type of training requirements differs among states. For example, some states require practitioners to complete specific training courses and pass exams in order to be certified to operate in a locality or state. Some require continuing education credits to maintain certification. Others do not specify training courses, but instead require wastewater professionals to take exams to verify competence.

Training Program Components

More and more states are now requiring mandatory training as part of a wastewater management program. Training not only offers an important measure of quality assurance for industry, state, and local officials and homeowners, but is critical for keeping pace with rapidly changing technology and regulatory issues.

The principal components of a generalized wastewater training program are:

- Wastewater flow and strength from various facilities
- Biological, physical, and chemical treatment processes
- Soils, slopes, climate, and other site conditions affecting treatment
- Structure and function of treatment system components
- Treatment system selection, sizing, design, and siting
- Advanced treatment system options and applications
- System inspection, operation, maintenance, and management
- Statutory and regulatory issues; compliance assistance and assurance

Effective training programs include a mix of approaches, including:

- Classroom sessions with presentations, visual aids, and discussion time
- Field observation of system components and operations
- Individual and group exercises that demonstrate knowledge and applicability
- Clearly defined learning outcomes, assessment criteria, and participant feedback

A survey of small wastewater system training courses by National Environmental Training Center for Small Communities showed there is fairly equal representation in four major topic areas: design, installation, site/soils, and maintenance. The survey also found that there are relatively few programs that provide a comprehensive selection of wastewater systems courses. However, a number of initiatives are currently working to address this need with the development of national training programs, strengthening of university curricula, expansion of state wastewater training centers, and the standardization of certification and licensing requirements.

State Training Centers

Several states have established training centers to meet the needs of wastewater professionals. The first training facility and related training program was developed in 1990 in North Carolina followed, in 1994, by Rhode Island. Training centers are now operating in 16 states, three of which are regional centers (see **Table 1**). Although training center activities may vary somewhat, the common objective is to provide training, education, demonstrations, and outreach. Most contain a classroom and an outdoor demonstration area where technologies used within the jurisdiction are partially or fully installed, on display, or otherwise available for viewing.

Classes and training opportunities offered at training centers vary based on state or localized needs. The Alabama Onsite Wastewater Association Training Center, located at the University of West Alabama, offers a range of classes from basic to advanced installer and pumper training. The center also offers annual continuing education classes for installers, pumpers, and system manufacturers to meet state licensing requirements. Courses offered by the regional New England Onsite Training Program, located at the University of Rhode Island, include:

- Bottomless Sand Filter Design and Installation
- Conventional Wastewater Treatment Basics
- Hands-on Component Installation Techniques
- Effluent Pumps and Control Panels
- Sand Media Specifics
- Septic Tank Design and Construction
- Conventional Septic Inspection Procedures
- Maintenance and Inspection Procedures
- Innovative and Alternative Technology Overview

Table 1. State and Regional Decentralized Wastewater Training Centers.

Alabama (West) Onsite Wastewater Training Center
Arizona Onsite Wastewater Demonstration Project
California Wastewater Training and Research Center
Florida Onsite Sewage Training Center
Kentucky Onsite Wastewater Training Center
Minnesota Onsite Sewage Treatment Program
Missouri Small Wastewater Flows Education and Research Center
New England Onsite Wastewater Training Program at University of Rhode Island
New York Onsite Wastewater Treatment Training Network
North Carolina Southeast Regional Onsite Wastewater Training Center
Northwest Onsite Wastewater Training
Ohio State University Soil Environment Technology Learning Lab
Tennessee Onsite Wastewater Training Center
Texas Cooperative Extension Onsite Training Centers
Utah Onsite Wastewater Treatment Training Center
Wisconsin Small Scale Waste Management Project

Funding for training centers typically includes vendor and state financial support. The Tennessee Onsite Training Facility, located at the University of Tennessee's Middle Tennessee Experiment Station, opened in 1995 and received funding, equipment, and services donated by the Tennessee Onsite Wastewater Association, the Tennessee Department of Environment and Conservation Division of Ground Water Protection, the Tennessee Valley Authority, and a grant from the Nonpoint Source Program administered by the Tennessee Department of Agriculture in cooperation with EPA. Florida and Texas use permit fees to help fund their training centers. Local contractors and wastewater professionals also support the centers by donating time and resources.

Wastewater treatment training centers also serve as demonstration sites for both conventional and advanced system technologies. The New England Onsite Training Program, a regional center at the University of Rhode Island, has constructed 22 full-scale systems for hands-on learning and public outreach. The center also has 56 demonstration systems located throughout the state that were installed to replace failed systems and generate research data. The New England center also offers ongoing technical assistance to municipalities in developing wastewater management programs, assessing risks, and drafting zoning ordinances based on treatment standards and performance-based watershed protection zones.

Most training centers are located at universities or colleges and are staffed by university/college faculty and/or staff from the Cooperative Extension Service. Some training centers, however, employ their own staff. For example, the Northwest Onsite Wastewater Training Center, a regional center located at Washington State University, is administered through a state contract with the Washington Onsite Sewage Association. The Florida Department of Health's Bureau of Onsite Sewage Programs contracts with the Florida Onsite Wastewater Association to operate and maintain the Florida Onsite Training Center for department field staff and service contractors. Cooperative extension staff conduct about eighty percent of in-field and classroom training at the New England Onsite Training Center.

States that do not have wastewater systems training centers often develop agreements with state colleges and universities to provide classes. Michigan State University provides basic training courses for installation contractors, sanitarians, system designers, and others on functional characteristics of conventional systems and alternatives that are commonly used in Michigan. About one-third of the two-day class is conducted in a field laboratory setting where participants receive hands-on experience with hydraulically functional, full-sized system components. New York contracts with the State University of New York to provide approved training throughout the state on wastewater treatment fundamentals, soil analysis, site evaluation, and design standards.

National Training Programs

In recent years, a number of national organizations have created national training programs through collaborative processes with their memberships. The National Association of Waste Transporters offers the Onsite Systems Operations and Maintenance Service Provider and the Onsite Wastewater System Inspector Certification courses. The National Onsite Wastewater Recycling Association offers training for installers.

The Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT) has produced a series of training modules for use by wastewater treatment training facilities. These modules are available from CIDWT and the National Environmental Health Association. The modules were funded by the National Decentralized Water Resources Capacity Development Project, which also funded a set of modules for incorporation into university science and engineering curriculums. The CIDWT has also developed training materials for operation and maintenance service providers and is in the process of developing a Decentralized Wastewater Glossary to promote common use of terms among the industry.

II. Licensing and Certification Initiatives

Perhaps the best way to facilitate training is to require licensing or certification for key service providers, such as system designers, inspectors, installers, pumpers, and operation and maintenance technicians. In its Strategic Framework for Unsewered Wastewater Infrastructure, the National Onsite Wastewater Recycling Association notes that the *"Licensing and certification of all practitioners is the fundamental link to maintaining high standards of competence and conduct."*

One of the challenges in providing training is ensuring that the scientific, technical, and other material covered is consistent across the states and nationally. For example, system designers, installers, and pumpers should be exposed to curricula that is somewhat standardized, so that professionals in each state are hearing and learning a common set of principles regarding wastewater characterization, treatment processes, site considerations, and the structure and function of system components (see Section 1 for a suggested curriculum outline). Of course, there will be some variation in system types, local and state codes, and professional practice across the country, but the basic tenets of wastewater characterization and treatment do not change.

In support of this objective, a number of states require certification of wastewater professionals. A certification or license can be a legislated requirement at the state level or a local code requirement at the county level. The State of Utah requires that persons who design, inspect, or maintain underground wastewater treatment systems and/or conduct percolation tests or soil evaluations for these systems be certified. Certification can be obtained by completion of training and examination by the Utah Onsite Wastewater Treatment Training Program of Utah State University, followed by application to the division of water quality. In Alabama, an onsite wastewater board was created to establish the qualification levels for those engaged in the manufacture, installation, servicing, or cleaning of individual/cluster wastewater systems and equipment in Alabama and promote the proper manufacture, installation, and servicing of systems. The board currently licenses over 1,200 professionals who perform work in the wastewater industry in Alabama. Most states exempt homeowners from certification requirements; however, some, like Nebraska, now require homeowners to be certified to perform inspections, testing, repairs, or modifications to any treatment system. Programs that rely solely on homeowners for proper treatment system operation and maintenance have not proven successful.

Pumpers and Haulers

Contractors who pump, transport, and discharge septage at land application sites, treatment facilities, or other locations require at least some basic training on safety, legal requirements, proper operating techniques, and options for handling difficult situations. Training for septic tank pumpers and septage haulers varies across the country. South Carolina requires pumpers to be licensed, but training is not required. The license provides the state with authority to inspect vehicles and equipment used in pumping and to verify the location of septage disposal. Seattle, Washington, (King County) requires pumpers and haulers to take an exam to qualify for a certificate of competency. Pumpers and haulers are also required to earn continuing education credits annually for renewal of their certification.

Minnesota also requires septic tank pumpers be licensed. The state requires mandatory training and testing, an experience component, corporate surety bond, general business liability insurance, and attendance at continuing education training events. The effectiveness of any training program, however, is only as good as how it is applied in the field. For example, during the summer of 2005, Minnesota Pollution Control Agency staff inspected 34 licensed individual sewage treatment system tank pumping businesses. These inspections were a result of an increasing number of complaints received about improper land application of septage, including septage dumping at unauthorized locations and related licensing issues. The pumpers were asked to volunteer for the inspections as a way for them to access technical assistance related to recordkeeping and land application practices. The survey found that pumpers were unclear about the details of the regulations and identified areas of need, including strengthening training workshops and providing more hands-on training.

Inspectors and Maintenance Providers

Inspections and the provision of operation and maintenance services comprise key components of any treatment system management program. Most state and local wastewater programs require training and certification of inspectors to maintain a high and consistent level of program performance. However, programs are expanding to include treatment system installers, designers, and maintenance providers as wastewater technology becomes more complex and more specialized. For example, Utah has established three levels of certification:

- Level I - Soil Evaluation and Percolation Testing
- Level II - Design, Inspection, and Maintenance of Conventional Underground Wastewater Disposal Systems
- Level III - Design, Inspection, and Maintenance of Alternative Underground Wastewater Disposal Systems

Oregon now requires service providers who inspect, maintain, certify, or supervise maintenance for small systems using advanced treatment technologies to be certified unless the maintenance provider owns the system being serviced and has received training from the manufacturer on proper maintenance of the system.

Installers and Designers

Conventional individual and clustered treatment systems are typically designed by individuals with specialized training and experience. Many wastewater permitting programs require system installers to be licensed plumbers and require designers to be licensed professional engineers. Some states have added certification or licensing requirements for installers of individual and clustered systems. For example, in 2005, New Mexico required system installers to be certified. South Dakota and other states have also adopted a certification program for system installers. These programs ensure that the installers understand the design requirements, installation techniques, technical issues, regulatory requirements, and how the treatment train handles incoming wastewater at each stage of the treatment process. Most permitting agencies with certification or licensing requirements maintain a list of certified installers that is available to the public. North Carolina passed a law recently requiring installers and inspectors to be certified to inspect systems involved in real estate transactions.

States and localities are increasingly recognizing the importance of certifying system designers and installers of more complex advanced treatment systems. Alabama implemented an Installers Licensing Program in 1999. The program is divided into two categories: the Basic Installers License and the Advanced Installers License. South Dakota developed a certification program for installers to ensure that they understand system design requirements. Louisiana’s installer license requires applicants to pass exams, verify coursework, and have proof of liability insurance, all of which are becoming universally required in many programs.

Only a few states have adopted certification requirements for system designers. States typically require designers of advanced or clustered systems to be licensed professional engineers, or require that system designs be certified by engineers. Washington recently adopted rules to require wastewater treatment system designers to be licensed by the state in order to verify their knowledge and experience. The intent was to create consistency regarding individual qualifications, minimum competency, performance standards, continuing education, and enforcement approaches. In addition to passing a written examination, an applicant must have a minimum of four years of experience showing increased responsibility for the design of individual wastewater treatment systems. That experience must include the following:

- Site soil assessment
- Hydraulics
- Topographic delineations
- Use of specialized treatment processes and devices
- Microbiology
- Construction practices

The law requires that applicants for licensure provide not less than two verifications of experience from qualified individuals. These individuals include professional engineers, professional designers licensed by the board, and state or local regulatory officials. The Washington rules also give the Board of Registration for Professional Engineers and Land Surveyors the authority to reprimand, fine, suspend, or revoke the license of any designer found guilty of misconduct.

System installers and designers in New Hampshire are required to have permits from the state. Permits are issued after successful completion of written examinations and must be renewed annually. The designer's test consists of three written sections and a field test for soil analysis and interpretation. The installers must pass only one written examination. The tests are broad and comprehensive, and they assess the candidate's knowledge of New Hampshire's codified system design requirements, regulatory setbacks, methods of construction, types of effluent dispersal systems, and new technologies. Completing the three tests designers must take requires about five hours. The field test measures competency in soil science through a soil profile analysis exposed by a backhoe pit, an evaluation of hydric soils, and recognition of other wetland conditions. The two-hour written examination for installers measures understanding of topography, regulatory setbacks, seasonal high water tables, and acceptable methods of system construction.

National Certification Programs

A number of national organizations have developed certification programs to promote uniform standards and consistency among programs. The National Sanitation Foundation (NSF) developed a rigorous NSF Inspector Accreditation Program to test an applicant's knowledge on topics ranging from sewage dispersal system design and operation to inspection procedures, safety, and basic mathematics regarding design and operation. The National Association for Wastewater Transporters (NAWT) launched a similar NAWT National Inspector Certification Program, which includes listing in a National Directory of Certified Inspectors. NAWT also offers a NAWT Certification Program for Pumper/Haulers, which is recognized and/or required by many state and community wastewater management programs. State trade groups often sponsor the national training sessions. For example, the Ohio Waste Haulers Association, recently sponsored the NAWT Vacuum Truck Technician Training and Certification session.

The National Environmental Health Association's (NEHA's) newest credential, the NEHA Certified Installer of Onsite Wastewater Treatment Systems, is designed to be used in a variety of ways at both state and local levels. Part of the development process included soliciting feedback from state and local agencies on how this credential would work within their administrative frameworks. The goal was to alleviate some administrative duties for environmental health regulators and help create a uniform standard across state and county lines.

Some states and localities now accept national certification to meet state or local requirements. For example, Bernalillo County in New Mexico, developed a wastewater ordinance that requires mandatory certification for all wastewater system evaluators. Applicants are required to attend the two-day course to qualify for the National Inspector Certification issued by NAWT.

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Septage/Residuals
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for individual and cluster system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 12. INSPECTION AND MONITORING

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Routine inspections and monitoring of systems are critical elements of all individual and cluster treatment system management programs. Both individual and clustered systems must be inspected at various stages of construction and operation and monitored over the long term to ensure proper performance and the achievement of public health and environmental goals.

This overview provides readers with general information about inspection and monitoring programs for wastewater systems. Included in this overview are:

I. Inspection Guidelines and Programs

- Construction/Installation Inspections
- Operational Inspections
- Inspection Checklists and Reviews
- Inspector Training and Certification

II. Monitoring Programs

- Performance Monitoring
- National Pollutant Discharge Elimination System (NPDES) Permits
- Remote and Web-based Monitoring

III. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to inspection and monitoring.

I. Inspection Guidelines and Programs

The inspection of a wastewater system is an objective evaluation of the system's characteristics in accordance with prescribed standards or protocols. Keys to ensuring consistent and quality inspections are a trained workforce, standardized inspection protocols, and appropriate reporting procedures.

Inspection guidelines and standards have been developed by a several organizations including the Pennsylvania Septage Management Association (PSMA), the National Association of Wastewater Transporters (NAWT), the Rhode Island Department of Environmental Management, the National Sanitation Foundation International, and the Consortium of Institutes for Decentralized Wastewater Treatment (CIDWT). PSMA developed model standards for operational inspections, which, when fully applied, evaluate every component of a wastewater treatment system, including treatment tanks, distribution systems, siphons and pumps, and absorption areas. PSMA also developed a 14-minute video that details the key aspects of the inspection process.

For the most part, all of these guidelines specify several critical elements, which include:

- Inspector qualifications
- Training and continuing education requirements
- Individual and cluster system operational characteristics
- Field procedures
- Inspection checklists
- Inspection reports

Construction/Installation Inspections

A comprehensive construction management program will ensure that system design and specifications are followed during the construction process. If a system is constructed and installed improperly, it is unlikely to function as intended. Effective individual and cluster system management programs ensure proper system construction and installation of systems through permitting and inspection programs. The timing and frequency of construction/installation inspections are defined by the complexity of system components, the receiving environment, and the relative risks posed to public health and water resources.

Most individual and cluster system programs include an inspection program to verify the proper construction and installation of the systems. Typical mechanisms that ensure proper installation include a review of site evaluation procedures and findings and an inspection of a system both during and after installation. Many states require inspections as a condition of a construction permit or certificate of occupancy. A 1998 law in Kentucky requires all new home construction to have an approved individual/clustered treatment system plan before it can be connected to electricity.

The most effective construction/installation inspection programs include:

- Pre-design and pre-construction meetings with the owner and contractor
- Field verification and staking of each component
- Inspections at random times during construction
- Issuance of an operating permit as designed and built

A management agency can employ staff to conduct construction inspections or require the use of independent contractors to oversee and certify construction/installation practices. An approved (i.e., licensed or certified) construction oversight inspector, preferably the designer of the system, should oversee installation and certify that it has been conducted and recorded properly. It is highly recommended that the management agency properly record all pertinent system information, including the final as-built drawings; dates of each construction/installation event; the names of the site evaluators, designers, inspectors, and installers; and inspection reports.

Operational Inspections

Individual/cluster treatment system management programs can be further strengthened through the use of operational inspections. Operational inspections are conducted at regular intervals during the life of a system, as specified either by a management or oversight program or by an operating permit.

Components of an operational inspection program include:

- Inventory of all systems, including location, age, owner, type, and size
- Schedules, parameters, and procedures for system inspections
- Training of inspectors, monitoring program staff, and service providers
- Licensing/certification program for staff and third-party inspectors
- Authority for right-of-entry (easement) to gain access to private property for inspection or monitoring of systems
- Reporting and recordkeeping system
- Database to manage information
- Homeowner education program
- Tracking of surface water quality monitoring trends

Some management entities have instituted comprehensive programs that feature renewable/ revocable operating permits. Renewable operating permits might require system owners to have a contract with a certified inspection/maintenance contractor or otherwise demonstrate that periodic inspection and maintenance procedures have been performed as a condition for permit renewal. Financial incentives usually aid compliance and can vary from small fines for poor system maintenance to preventing the sale of a house if the system is not functioning properly.

Several states and communities require that sellers of property disclose or verify system performance. Some of these programs specify that a homeowner simply disclose the status and location of an individual system, while others require complete inspections and reporting. In some areas, inspections at the time of property transfer are common despite the absence of regulatory requirements. This practice is incorporated into the loan and asset protection policies of local banks and lending firms. However, inspectors might not have the same degree of accountability that would occur in jurisdictions that have mandatory requirements for state or local licensing or certification of inspectors. Inspection fees are often used to defray the cost of conducting property transfer inspections.

OPERATIONAL INSPECTIONS - STATE AND LOCAL EXAMPLES

The Town of Nags Head, North Carolina, chose to provide incentives to promote proper operation and maintenance of individual and clustered systems. A free inspection is offered to owners of conventional systems to promote awareness and proper operation and maintenance. A property owner that has their individual system tank pumped as a result of the inspection can also receive a $30 credit voucher toward their water service account. The inspection reports are entered into a database to track malfunctions, site use, age of the system, size of the tank, and location of the system in relation to surface waters.

In the Town of Charlestown in Rhode Island, individual and clustered system inspections are conducted every one to five years based on past performance. Pumping is required every six years or when determined by an inspection. The inspector prepares a report that describes the system, identifies maintenance requirements, and recommends a schedule for the next inspection and pump out. The town reviews the inspection results and sends a confirmation of the completed inspection and the date for the next inspection. The town also sends out reminders to homeowners before the next inspection and pump out is due.

Minnesota law requires that a seller disclose to a buyer in writing the status and location of all individual or clustered systems on the property before signing an agreement to sell or transfer real property, The disclosure must include abandoned and existing systems and indicate whether the system is in compliance with applicable laws and rules.

In Pierce County, Washington, the Tacoma-Pierce County Health Department requires a seller to prepare a "Report of System Status" when selling a home to provide some assurance to the buyer and lender that the individual system on the property is in good working order. The county requires that a certified inspection company inspect the system and complete an "Operation and Maintenance Operational Evaluation." The evaluation report is submitted to the health department along with a $138 fee. If the lending agency requests it, a water sample can be included for $13.

Jefferson County, Colorado, initiated its *Use Permit Inspection Program* in 2004. This mandatory program requires that a property with individual treatment systems be inspected and approved prior to sale or transfer. The county partners with certified private-sector companies to perform the field inspections using standardized evaluation criteria. The *Use Permit Inspection Program* is designed to be a permanent, self-funded, fee-for-service approach.

Missouri requires property transfer inspections by certified professionals. The program provides for two types of assessments: an inspection and an evaluation. An inspection is the more comprehensive assessment that may include taking measurements, performing a stress test, conducting dye tracing, and testing system components. The evaluation is a visual and sensory walk through the system with measurements limited to verifying setback distances.

Virginia state law requires that property transfer inspections be performed (per a realtor's or homeowner's request) by an "accredited septic system inspector." The state law sets minimum training requirements for "accredited septic system inspectors."

In Washtenaw County in Michigan, every individual treatment system is required to be inspected and evaluated by an inspector who is certified by the Environmental Health Division prior to property transfer or sale. A description of the current operational or functional status of the system is prepared by the inspector, including identification of any necessary repairs or replacement of all or portions of the system, results of bacteria and nitrate drinking water testing, and other water quality parameters as required by the Division. The report also includes recommendations to extend the life of the system and to prevent premature failure.

The Arizona statewide property transfer inspection program for individual treatment units became effective on July 1, 2006. The inspection requirement applies to any property served by a conventional individual treatment system or alternative individual system. The rule prescribes steps involved in the inspection process and requirements for the actual inspection. The inspector must address the physical and operational condition of the individual treatment unit and describe observed deficiencies and repairs that are completed. The Report of Inspection (See Attachment C) completed by the inspector must indicate that each individual treatment system on the property was pumped or was otherwise serviced to remove accumulated waste. The transferor of the property served by the individual treatment system (i.e., the property owner) must retain a qualified inspector to perform the inspection not more than six months before the date of the property transfer. An inspector must hold a certificate of training from a course recognized by state and a license under one of several designated categories.

The Massachusetts Title 5 program requires that individual and cluster systems be inspected when property is sold. The property owner or facility operator is generally responsible for obtaining an inspection of the system. An inspection must be conducted by a state-approved system inspector. The state maintains a listing of approved system inspectors.

Inspection Checklists and Reviews

A general summary of the inspection process can be seen in Attachment A. Many states use checklists to implement various inspection procedures or guidelines. For example, Massachusetts developed a six-page installation checklist for communities to use when inspecting a system. The National Onsite Wastewater Recycling Association and National Environmental Health Association are currently developing inspection checklists.

The need to continually review and evaluate inspection programs cannot be overstated. Reviews and revisions are important to keep inspection standards consistent with the latest industry practices, regulatory changes, and evolving scientific knowledge.

INSPECTION CHECKLISTS - STATE AND LOCAL EXAMPLES

The Rhode Island Department of Environmental Management includes a detailed inspection protocol in its Onsite Wastewater Management Program. The protocol describes two types of inspections: a maintenance inspection to determine the need for pumping and minor repairs and a functional inspection for use during property transfers. The state has developed an inspection guide, the Rhode Island Septic System Checkup, which details instructions for locating individual treatment system components, diagnosing in-home plumbing problems, performing flow testing and dye tracing, and scheduling inspections. Several Rhode Island communities, including New Shoreham, North Kingstown, and Gloucester, use this guide as their inspection standard. The University of Rhode Island also offers a training course for professionals interested in becoming certified in individual treatment system inspection procedures.

Massachusetts developed a Department of Environmental Protection Inspection and Operation and Maintenance Form and Checklist for Title 5, as well as the Guidance for the Inspection of Onsite Sewage Disposal Systems, which outlines procedures for both the system owner and the system inspector in evaluating the adequacy of existing individual systems.

New Jersey has modified the Pennsylvania Septic Management Association Pennsylvania Septage Management Association guidelines and developed a report entitled "Technical Guidance for Inspections of Onsite Wastewater Treatment and Disposal Systems" for individual and cluster treatment system inspectors. The New Jersey guidelines include procedures for conducting field investigations and completing the inspection form (Attachment B) and report.

Inspector Training and Certification

It is recommended that all inspections be conducted by trained inspectors. Most state individual and cluster treatment system regulations have training and certification requirements. These programs vary with regard to the level of training, continuing education requirements, license renewal procedures, and penalty and revocation procedures.

Training and resources are available through wastewater organizations and state training centers as well as through individual courses offered by universities and colleges. For example, NAWT offers national certification of inspectors. Those who complete a comprehensive individual treatment systems course covering terminology, treatment, tanks, construction methods, and application or who demonstrate competence in the field prior to qualifying for the inspector training program are listed on a national registry of certified industry professionals for two years. The NSF offers accreditation for individual and cluster treatment system inspectors. This professional accreditation demonstrates an inspector's knowledge and skills for conducting treatment system inspections. Written examinations can be administered at various places throughout the U.S., such as universities and public libraries. The written examination consists of 100 multiple-choice questions and covers a broad range of wastewater topics, including key terminology, sewage disposal system design and operation, inspection procedures, and safety. The practitioner's ability to gather relevant information on a site and knowledge of inspection procedures and inspection reporting are all part of the exam. About a dozen states have established wastewater management training centers to provide training of individual and cluster treatment system professionals. For more information on training resources, see Resource Guide 11. Training and Certification.

II. MONITORING PROGRAMS

Wastewater can contain a number of pollutants. Pathogens such as viruses or bacteria can enter drinking water supplies, creating a potential health hazard. Nutrients and organic matter entering waterways can lead to tremendous growth in the quantity of aquatic microorganisms. Metabolic activity of these microbes can reduce oxygen levels in the water, causing aquatic life to suffocate.

To enhance the understanding of these and emerging contaminants in individual and cluster treatment systems, studies are underway at a field test site at the Colorado

School of Mines (CSM) in Golden, Colorado. The Rocky Mountain Onsite and Small Flows Research Program was initiated at CSM to advance the science and engineering of treatment technologies and enhance the long-term viability of decentralized approaches to water infrastructure in Colorado, the U.S., and abroad.

Performance Monitoring

Most states have had limited authority to require a homeowner to test a private individual treatment system, even when they suspect that it may be the source of contamination. As a result, some states have designated certain areas to require more stringent monitoring. Others have incorporated monitoring as part of a system's operating permit. Both of these types of approaches are based on monitoring the performance of a system. Performance monitoring is conducted to determine compliance with state and local standards. It also provides data useful in making corrective action decisions and evaluating area-wide environmental impacts for land use and wastewater planning.

A combination of visual, physical, bacteriological, chemical, and remote monitoring approaches can be used to assess system performance. Performance monitoring may include water quality monitoring, such as testing of drinking water and nearby surface waters for pathogens, nitrate, and phosphorus. Performance monitoring also includes the monitoring of individual or regional wastewater system effluent before and after discharge. Examples of individual and cluster system performance monitoring can be found across the country. Some programs include intensive sampling and monitoring in a watershed, while others focus on environmentally sensitive water resources such as shellfish beds. The state of Washington designated certain Marine Recovery Areas to require more stringent monitoring. Marin County, California, incorporates performance monitoring for all alternative systems as part of its operating permit. The required frequency of monitoring ranges from quarterly to annual sampling based on performance. Monitoring frequency may be increased if the system experiences problems. Additional information about performance monitoring can be found in Resource Guide 4. Performance Requirements.

National Pollutant Discharge Elimination System (NPDES) Permits

In certain instances, treatment systems can be permitted to discharge wastewater to surface waters under an NPDES individual permit or an NPDES general permit. These permits can include a number of parameters, including effluent monitoring, frequency of monitoring, and the consequences of failing to meet permit requirements. For example, Minnesota requires an NPDES or a State Disposal System permit when wastewater is discharged to the surface or groundwaters of the state. These permits detail the wastewater source, types of requirements for discharge, the amount of monitoring necessary, and the minimum level of treatment required. The Minnesota Pollution Control Agency issues and administers both of these permits. Effluent limits are developed to protect water quality and the designated uses of waters. Both permits require monitoring to ensure the system is meeting the assigned effluent limitations.

Monitoring of effluent can be greatly assisted if access risers are installed during system construction. For wastewater systems that discharge to the soil, the monitoring program might include verification of an operation and maintenance contract measurement of pretreatment system effluent concentrations of traditional pollutants, such as total suspended solids, biological oxygen demand, total nitrogen, total phosphorus, and microbiological indicators and surrogate characteristics such as turbidity and color. See Resource Guide 3. Performance Requirements for more details.

Remote and Web-based Monitoring

The use of more advanced monitoring equipment has increased due to technology innovations and system complexity. Real-time monitoring is emerging as a tool being used to check the operational and functional status of more complex treatment systems at regular as well as more frequent time intervals. For example, in Michigan, a private company that performs maintenance on 65 individual home systems, 10 commercial systems, and 5 cluster systems offers remote monitoring. With remote telemetry control panels connected to a telephone line in the home, the company can monitor system flow, pumps, switches, and alarms. Remote monitoring is typically required with larger cluster systems.

Remote monitoring is being used by as part of a national onsite demonstration project to assess its use in individual treatment units, aerobic treatment units, and media filters on a real-time basis. Some of the benefits of remote monitoring include:

- Meeting the growing need for qualitative data
- Sampling and translating real-time events to predict and prevent failures
- Providing a rapid response to system recovery
- Minimizing labor costs and providing other economic efficiencies

Critical point monitoring (CPM) is another tool that can be used to monitor "at risk" areas. CPM identifies the critical points that should be monitored to provide suitable mitigation of identified risks. CPM can include monitoring of treated wastewater for parameters of interest at several points in the treatment train (e.g., the individual treatment unit tank outlet or distribution box, the outlet from the attached growth treatment unit, the recirculation tank, and prior to soil or water discharge). While CPM is a process standard, in practice its application requires choosing performance standards for the identified critical monitoring points. The seven steps in the CPM process include: a system hazard analysis, critical monitoring point identification, establishing critical limits, monitoring procedures, corrective actions, recordkeeping, and verification procedures. (For more information about performance monitoring see Resource Guide 3. Performance Requirements.)

The NSF and private vendors such as Carmody Data Systems and ORENCO Systems have developed Web-based monitoring programs that enable public health officials, service providers, and homeowners with a convenient, reliable means to monitor the service status of individual and cluster treatment systems. For a listing of other monitoring and data management systems, see Resource Guide 4. Inventories, Reporting, and Recordkeeping. NSF has designed their system for use with advanced individual treatment systems, however, the program may be used for conventional systems as well, either with or without telemetry.

MONITORING - STATE AND LOCAL EXAMPLES

In Yavapai County, Arizona, the local extension agency developed a water testing and education program to target problem septic systems. The program has identified six locations exhibiting increasing nitrate levels. In a county experiencing rapid growth and increasing water supply demands, this program has opened up a dialog between private well owners and local governmental agencies.

Oakland County, Michigan, has set minimum standards for advanced treatment systems that include the ability to remotely monitor systems 24 hours per day, 7 days per week. Standards are based on manufacturer/distributor and certified maintenance provider recommendations and are accessible to the county onsite regulator.

The State of Washington is developing a mandated statewide monitoring process for local health agencies to develop and implement plans to conduct periodic monitoring of all individual and cluster systems. The CPM process is being used to provide a systematic preventive-based approach for monitoring individual and cluster systems. By concentrating on the wastewater flow points that are most critical to monitor and control, CPM catches problems in the early stages before they become serious and expensive to correct.

Wisconsin requires management plans with maintenance or service contracts stipulating inspection and monitoring schedules for certain systems with electro-mechanical components. Property deeds must note that management plans are in effect. Inspection and monitoring services must be provided by a licensed, certified, or registered person.

Harris County, Texas, now requires remote monitoring of all new advanced mechanical residential treatment systems and commercial systems. The existence of this feature permits a reduction in the frequency of maintenance visits from four to two per year. The county requires the use of the NSF Onsite Monitoring Program for monitoring.

III. References and Additional Resources

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National Sanitation Foundation International. July 2003. ***Onsite Wastewater Inspector Accreditation Program.*** Retrieved December 4, 2006 from the World Wide Web http://www.nsf.org/business/wastewater_inspectors/OWWI_APPLICANT_GUIDE.pdf

National Environmental Training Center for Small Communities. ***Onsite Wastewater System Operation and Maintenance Operator's Guide TRPMCD11.*** Available by contacting NETCSM at http://www.nesc.wvu.edu/netcsc/

National Association of Wastewater Transporters, Inc.***Onsite Wastewater Treatment System Inspection Reference Manual.*** Available by contacting NAWT at http://www.nawt.org/

This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping

5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Residuals Management
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for treatment system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.

Attachment A. Industry Onsite Wastewater Inspection Standards

Excerpted from Planning Can Reduce Liability from Onsite Inspections
Small Flows Magazine, Summer, 1998.

Authorization for Inspection: As in any profession, documentation is critical, and the first piece of documentation to have on file is an inspection authorization form signed by the homeowner. This form should clearly state that all preliminary information provided by the homeowner is complete and true and that the inspector has permission to enter the property, disclose history records, and contact previous pumpers and inspectors. The authorization document should clearly define what the cost for inspection includes if this Information was not specified in the contract. For example, let the homeowner know up front if the basic cost for inspecting the system does not include pumping the tank (and often it doesn't).

Gather preliminary information: At the beginning of each job, the inspector should compile background information to trace the history of the system. For example, the inspector should interview the resident about system usage and household practices that affect the system's performance. This includes laundry and cleaning schedules and types of major water- and waste-generating appliances in the dishwasher, and garbage disposal.

Visual inspection: Walk the grounds to look for obvious signs of system failure. For example, look for seepage and lush vegetation, backup of sewage, odors, effluent ponding, breakout to the surface of the ground or to surface waters, eroded soil, and any other unusual features. This is also a good time to look for risers to indicate tank location.

Locate the treatment tank: If the tank's location was not apparent during the visual inspection, the inspector can ask the homeowner for any design plans, as-built drawings of the system, or reports from previous inspection or maintenance visits that will show the tank's location. If these records are unavailable, the inspector could use a probe to locate the tank or a non-invasive technique such as an electronic transmitter. When using a probe to locate the tank, be careful not to damage the tank by over-aggressive probing, particularly if the tank is plastic or fiberglass. If the inspector chooses to use an electronic transmitter instead, always test the transmitter to ensure it is working properly. Then flush the transmitter down the toilet and use the electronic receiver to locate it, thereby locating the tank.

Access the treatment tank: If the inspector needs to unearth the tank's inspection ports and manhole, the digging should be done with care so that the inspector can neatly replace the sod.

Flush toilets: Flush every toilet in the dwelling at least once to observe level changes in the individual treatment unit tank or back-up conditions.

Check storm drainage system: Make sure the storm drainage system is not connected to the individual treatment system.

Determine condition of tank, baffles, and cover: Check the tank closely for cracks, leaks, improperly installed or loose inlet and outlet baffles, and breaks in lines outside the tank. If the tank is metal, do not walk on it since these tanks rust quickly from the sulfuric acid formed by the anaerobic decomposition of waste. Remember never to enter the tank to inspect its parts. Individual treatment system tanks contain toxic gases that can kill in a matter of minutes.

Determine the capacity of the treatment tank: Tank capacity can be checked by determining the tank surface area with a probe and then determining the water depth inside the tank with a wooden dowel or a sludge measuring device. While there are various methods for calculating the capacity of the treatment tank

Check scum and sludge levels: Determine the thickness of scum and the depth of the sludge blanket. The inspector can do this by using specialized tools such as a Sludge Judge®.

Check aerobic tank operation: For aerobic tanks, check the operation of the aerator (compressor or propeller and motor), timer, alarm, electrical components, and level controls.

Excerpted from Planning Can Reduce Liability from Onsite Inspections
Small Flows Magazine, Summer 1998

Check system pump: If the system has a pump, inspect the operation of the pump, float, alarm, and electrical connections.

Locate the absorption field: Determine the size of the absorption field and if it is holding water. If the absorption field is failing, PSMA recommends not pumping the tank without the homeowner's written waiver for a second opinion. NAWT concurs with this opinion and states in its inspection instructions ". . . upon pumping, water flowing back from the absorption area would indicate an unacceptable condition. A high water level in the tank would immediately indicate an unacceptable condition. If this occurs, do not pump the treatment tank. You probably will have trouble getting paid by the owner if you pump [the] tank and fail [the] system! Or, the owner will say you pumped the tank and everything should be okay now. Right? Not pumping the treatment tank gives the owner the option of getting a second opinion."

Check the pumping records: If the tank has not been pumped in two years, or if the combined sludge and scum level exceeds that allowed by state and local regulations, have the tank pumped. (NAWT cites 20 percent as a conservative number to use during property transfer inspections.) Observe the absorption field to determine if the wastewater backflows into the treatment tank. It is also a good idea to run water in every sink and observe whether it drains freely or sluggishly to determine if the home's plumbing is connected to the treatment tank.

Dye Test: This test is commonly used by health departments to locate hydraulic failures or illegal discharges. An advantage to this test is that if there is a breakthrough, the dye will become visible on the ground surface. This makes the dye test a simple test to perform to determine a failure of the system or to detect portions of the home's wastewater not going into the treatment tank. For example, a washing machine may not be connected to the individual treatment system but instead is depositing its waste into a roadside ditch. There are, however, several disadvantages to this type of testing: it does not pinpoint the cause of the system's failure and it may take more time for the dye to surface than the inspector allows, causing the inspector to infer that the system is functioning properly.

Hydraulic Loading or Flooding Test: This test is performed by discharging 400 plus gallons of water through the system. Many health departments discourage this type of testing since it can actually do harm to the system by artificially flooding the tank and field. This could enable suspended solids to escape the tank and clog the drainfield. In addition, the results of such a test can be misleading since environmental conditions such as rain or drought and home usage changes such as over or under utilization of the system will directly affect the outcome of the test.

Analyzing the Data: The challenge in pinpointing the cause for a system malfunction is in analyzing all the possible causes of the problem, according to the PSMA *Technical Manual for Sewage Enforcement Officers.* The manual points out that an incomplete analysis of a malfunctioning system can create more of a problem than was originally present. For example, it explains how choosing a seepage pit or deep excavation to repair surface malfunctions serves only to transfer the sewage.

Attachment B. New Jersey Onsite System Inspection Form

ONSITE SYSTEM INSPECTION FORM

Inspection Overview

- Preliminary system information
- Inspection of treatment tanks
- Absorption system inspection
- Disposal/conveyance system assessment
- Identification of any alternative technology approved components
  - Requires additional inspection

INTERNAL USE ONLY:

CLIENT INFO

Client Name: ______________________

Different from owner? () yes () no

Client Address:

____

____

____

Contact Method:

home tel. ______________________

work tel. ______________________

e-mail ______________________

ONSITE SYSTEM LOCATION

Inspector Name: ______________________

Date: ______________________

ISSDS Address (including municipality):

____

____

____

New Jersey Coordinate: **Block:** ________ **Lot:** ________

Was GPS used? () yes () no

Preliminary Information:

Weather: ______________________

Last precipitation: ______________________

Age of system: ______________________

Type of dwelling?

() Residential Number of Bedrooms: ________

() Non residential Describe: ______________________

How many systems are being inspected? ____________

List any commercial activities or high impact hobbies:

____

____

Describe prior problems and/or repair history including soil fracturing or use of chemical additives. Include dates and explain why the remedial measures have been applied to the system (if available):

____

____

____

Date file review requested with administrative authority:

____

	Yes	No
Is there a site plan or septic map available?	()	()
Is the dwelling currently being occupied?	()	()
If so, how many occupants? ____________		
If no, date last occupied? ____________		
If there is a washing machine, is it connected to a Separate gray water disposal system?	()	()
Is the dwelling free of additional gray water systems?	()	()
Is the dwelling free of garbage disposal systems?	()	()
Is the dwelling free of sump pump discharges to the System?	()	()
Is the dwelling free of any historical sewage back ups Into the structure?	()	()
Does all sewage enter the septic system and no type of sewage bypass exists?	()	()
Septic Tank Pumping:		
Is the septic tank pumped regularly?	()	()
Frequency: ____________		
Date of last pumping: ____________		
Was file review completed prior to inspection? If no, explain why below	()	()

Comments: ______________________

____

____

____

____

Page 2, Attachment B.
New Jersey Onsite System Inspection Form

Treatment Tank:

Type of system being inspected?

() Septic tank () Cesspool () Other_______________

() Gray water () Multi-compartment: #____________

Name the material of the system?

() Concrete () Block

() Steel () Other____________________

Approximate Treatment Tank Volume: ______________gal.

Evaluate the conditions of tank below:

	Satisfactory	Unsatisfactory	N/A
Top and Lids	()	()	()
Inlet baffle	()	()	()
Outlet baffle	()	()	()
Cracks or Leaks	()	()	()
Sewage Flow from structure	()	()	()

	Yes	No
Main tank lid opened for inspection?	()	()
Liquid level below the tank's inlet invert?	()	()
Liquid level below the tank's outlet invert?	()	()
Treatment tank pumped for this inspection?	()	()
Are all portions of the tank(s) clear of Structures like a deck or a driveway?	()	()
Is the area clear of evidence that sewage has Surfaced above the treatment tank?	()	()
Does water flow unimpeded from the Treatment tank?	()	()
Is an effluent filter a part of the system?	()	()
If yes, does it appear properly maintained?	()	()
Are there any other types of accessory units Present?	()	()

Depth to top of tank:_______________inches

Depth to top of tank access: _________inches

Comments: ___________________________

____

Absorption Area:

Name the type of the absorption system?

() disposal bed () disposal trench

() seepage pit () mounded

() cesspool () other ________________________________

Was the absorption system located? () yes () no If no, explain below.

Are inspection ports present? () yes () no

If yes, how many? _____________

Were the inspection ports checked? () yes* () no () N/A *All levels observed must be included in report

Was a separate probe dug in the absorption area to confirm the observations in the inspection ports? () yes () no () N/A

Is the area of the absorption system free of sewage odors? () yes () no

Does sewage flow from the treatment tank to the absorption system without flowing back? () yes () no () N/A

Is the area above or near any of the system components free from visible signs of effluent or sewage? () yes () no

Are the areas at or near the inlet invert of any absorption area component free of visible signs of sewage or effluent?

() yes () no

Are areas above or near system components free of lush vegetation? () yes () no

If exposed, is the distribution box in satisfactory condition? () yes () no () N/A

If not exposed, explain why not:____

Is the area directly over any part of the absorption system free of any evidence of, large objects (cars, pools, etc.)? () yes () no

Comments: ____

____

____

____

____

Attachment C. Arizona Onsite Wastewater Treatment Facility Report of Inspections and Notice of Transfer of Ownership

A. Property Information:
Property Address ______________________________
____
____
____

County _________ Tax Parcel No. _____________

• Residential • Non-residential

B. Date Inspection Completed: _______________

C. Name of Current Owner/Seller/Transferor:
____
____

D. Name of Buyer/Transferee:
____
____

E. Type of System (see explanation on reverse for whether an inspection and notice of transfer is needed):
- Conventional septic tank and disposal system approved under General Aquifer Protection Permit (GP) 4.02
- Alternative on-site system (non-mechanical with gravity flow) approved under GP 4.03 through 4.22
- Other alternative system approved under GP 4.03 through 4.22
- On-site wastewater treatment facility from 3000 to less than 24,000 gallons per day approved under GP 4.23

F. Inspector's Summary:

1. Were facility permit, construction and/or operational records available for the inspection? • Yes • No
2. Was septic tank pumped (recommended if more than 3 years have passed since last pumping)? • Yes • No
3. Was effluent filter cleaned? • Yes • No
4. Was there evidence of disposal field failure (sewage backup or surfacing of septic tank effluent)? • Yes • No
5. Assessment of physical and operational condition of system and identification of associated deficiencies:
   - System appears to be operating properly—no repairs are recommended.
   - Recommended actions or repairs (to extend system lifetime and prevent premature failure):
     ____
     ____
     ____
     ____
   - Critically needed actions or repairs (to remedy an imminent or existing threat to human health or the environment): ______________________________
     ____
     ____
     ____
     ____

G. Inspector's Certification: *I have inspected the physical and operational condition of the on-site wastewater treatment facility serving this property on the above-indicated date. I have completed this inspection report to the best of my knowledge, basing Part F on conditions I observed at the time of inspection. However, this report does not imply nor guarantee any future performance of this system in any way.*

Inspector's Signature ______________________________ Date: _______________
Inspector's Name (print): ______________________________ Phone: _______________
Address: ______________________________
____

H. Acknowledgment of Receipt of this Inspection Report:

Owner/Seller/Transferor Signature: ______________________________ Date: _______________

Buyer/Transferee Signature: ______________________________ Date: _______________

Arizona Department of Environmental Quality Form A316
11/01

Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems

Resource Guides

Office of Water
U.S. Environmental Protection Agency

RESOURCE GUIDE 13. CORRECTIVE ACTIONS AND ENFORCEMENT

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more. For information about downloading this guide or the other supplemental guides, see page 14. To report corrections, broken links or any technical problems click here to contact us.

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INTRODUCTION

Management programs for individual and clustered wastewater treatment systems rely on integrated planning; appropriate system design; and proper installation, operation, and maintenance. Assuring compliance with the requirements of these management program elements is essential for protecting public health and water quality, supporting cost-efficient and effective operations, and ensuring a level playing field for service providers and equipment vendors. Public entities such as health departments, water resource agencies, and sanitation districts, are usually authorized by statutes and regulations to provide compliance assurance oversight via specified corrective actions and enforcement of the rules.

There are a number of options for providing this oversight. This overview provides readers with information about the various management approaches that support corrective action and enforcement programs. Included in this overview are:

I. Roles and Legal Authorities

- State Regulatory Agencies
- Local Governments
- Responsible Management Entities

II. Management Considerations

- Enforcement Procedures and Tools
- Illicit Discharges to Storm Sewer Systems

III. State and Local Program Examples

IV. References and Additional Resources

- Resource links are included throughout this guide to provide users with more specific information related to corrective actions and enforcement.

I. Roles and Legal Authorities

Individual and clustered wastewater treatment systems are under increasing scrutiny regarding their impacts on water quality and public health. Nationwide, a significant portion of conventional treatment systems that discharge to the soil are now more than 30 years old. Many of these older systems are undersized, serve higher flows than originally intended, or suffer from poor maintenance attention. In some cases, malfunctioning treatment systems are contributing nutrient and microbial contamination to surface water and groundwater resources.

State Regulatory Agencies

The responsibility for regulating individual and cluster treatment systems has traditionally been vested in state departments of environmental health, tribal and territorial health units, and some 3,215 local public health agencies. During the 1950s, many states adopted health-based sanitary codes and regulations that focused on the suitability of the site for the codified design and installation of individual treatment systems to help eliminate public health risks associated with waterborne pathogens.

The regulation of individual wastewater treatment systems evolved as environmental laws were passed and environmental protection agencies were established. Today, the regulation of individual and clustered wastewater systems that discharge to the soil is often a cooperative approach between state environmental and health agencies, with local health agencies mostly carrying out the enforcement of these rules, especially for small systems. The nature of the interaction between state and local health departments varies. For example, 15 states operate under a unified system, in which the state directly operates local services or provides all public health services. Twenty-six states operate under an integrated state/local system in which the local government forms and operates somewhat autonomous local health departments. In nine states, the state provides services in areas that do not have local health departments.

While wastewater treatment laws and regulations vary from state to state, they typically charge local units of government with implementing rules that apply to individual and small-scale wastewater systems. The regulation of large capacity septic systems (i.e., those with the capacity to serve 20 or more people per day) and discharging systems (i.e., those that discharge to surface waters, or conveyances that lead to surface waters) are subject to federal rules typically implemented by state agencies. For example, in Indiana, the county health departments regulate individual wastewater treatment systems. The Indiana State Department of Health regulates alternative (advanced) individual treatment systems, cluster systems, and commercial systems that do not discharge to surface waters or the ground surface. The Indiana Department of Environmental Management regulates commercial and community systems that discharge to water bodies or apply wastewater to the surface of the ground.

The National Small Flows Clearinghouse maintains a repository of state regulations that includes a summary of the laws and regulations of various states. The EPA Decentralized Wastewater Management Web Site also provides state regulatory contacts.

NOTE: Wastewater treatment systems that discharge effluent to surface waters or pipes, ditches, drain tiles, or other conveyances that lead to surface waters must have permit coverage under the Clean Water Act's *National Pollutant Discharge Elimination System*. Systems that discharge below the surface of the ground that have the capacity to serve 20 or more people per day are subject to permit rules under the *Underground Injection Control Program* of the federal Safe Drinking Water Act. Cesspools are often banned by states, and large capacity commercial cesspools i.e., (those with the capacity to serve 20 or more people per day using a commercial facility) are illegal under federal and state law.

Local Governments

As noted above, local health agencies are typically responsible for implementing programs for individual and clustered wastewater treatment systems and are subject to periodic state oversight. Local governments define the powers, responsibilities, and procedures that govern their treatment system management and enforcement programs using various types of legal mechanisms, including ordinances, regulations, zoning and subdivision rules, building codes, permits, and treatment system management agreements. For example:

- A 2003 survey conducted by the California Wastewater Training & Research Center found that most local agencies in California enacted local ordinances to exercise their legal authority. Also used, but less frequently cited, are sanitary, housing, and plumbing codes.
- In Michigan, individual wastewater treatment systems serving single- and two-family dwellings fall under the jurisdiction of local health department sanitary codes. Of the 44 local health jurisdictions, 39 operate under their own separate set of regulations.
- Several counties in Florida have enacted local ordinances requiring management of individual treatment systems on a limited basis. Polk and Lake Counties have ordinances requiring all individual systems located in the Green Swamp to be pumped and inspected every five years. Escambia and Santa Rosa Counties have similar ordinances requiring that septic tanks be pumped, inspected, and upgraded to county standards at the time of real estate transactions or prior to the sale of an existing house.

A number of communities have adopted more stringent codes and/or regulations to address specific site conditions or to protect critical local resources, such as drinking water sources or environmentally sensitive areas, such as recreational lakes and shorelines.

Responsible Management Entities

As individual treatment system technology has become more advanced and complex, some local health agencies have turned to public or private entities to assume various management responsibilities for these systems. Examples of management entities include: sanitary, water, and sewer districts; public utility districts; and multiple-purpose special districts. Rural utility cooperatives and private corporations have also taken on management roles through public/private partnerships.

A responsible management entity (RME) cannot be effective without policing powers, which may be granted by state and/or local governments. Ideally, it is granted by state-enabling legislation that facilitates RME formation. For example, North Carolina statutes allow for 12 different institutional options for wastewater management. Even when RMEs manage treatment systems and exercise authority to compel compliance with their rules, it is still important for public agencies to generally oversee their operation to ensure that standards are met and public health and water resources are protected.

II. Management Considerations

To be effective, local individual wastewater treatment system management programs must have the appropriate enforcement tools to compel compliance. **Table 1** lists the various types of compliance assurance approaches used in treatment system management programs. The approach selected will vary based on the needs of a community and its enabling authority.

Table 1. Enforcement/Compliance Approaches.

Program element	Basic approach	Intermediate approach	Advanced approach
Enforcement/ Compliance	Identify problem systems through complaints and follow-up. Issue Notice of Violation and fines. Negotiate compliance schedules for documented problems	Develop revocable operating permit program based on system performance. Create computer-based system to track corrective actions and maintenance of systems. Conduct maintenance inspections of existing systems. Coordinate pumper and hauler reporting and tracking.	Enable corrective actions to be implemented by RME or third-party service providers. Establish power to impose deed restrictions and property liens or to terminate service. Conduct targeted risk-based and/or property transfer inspections. Suspend or revoke certification or license of individual treatment system installers, designers, or maintenance providers, if violations persist.

Compliance with existing state and local regulations should be a priority of any wastewater management program. A study conducted by Cornell's Local Government Program, however, found that many local programs rely on citizen complaints to identify problem systems and provide assistance to resolve or at least minimize problems. This basic approach may suffice in low-risk areas; however, in areas where there is a high density of systems and/or greater risks of surface water or groundwater contamination, a more proactive program may be necessary to protect public and environmental health.

Several states and communities have supplemented this approach with maintenance reminders and periodic inspections based on system type, environmental setting, and other risk factors to promote the proper performance of treatment systems. The use of renewable, revocable operating permits for advanced treatment systems is also a common tool to ensure proper system performance. Another approach requires the inspection of systems at the time a property is sold or transferred. Arizona recently adopted a statewide property transfer inspection program for all individual wastewater treatment systems. Several counties in Michigan have also initiated inspection programs at the time of real estate transactions to identify and address problem systems.

Enforcement Procedures and Tools

A local management program should have procedures in place to conduct compliance assurance and, if necessary, enforcement actions. Local regulatory agencies need clear authority to inspect individual systems and order remedial actions for systems that fail to meet standards set by laws and rules. Elements of enforcement procedures typically include:

- A process for reporting and responding to problems
- A defined set of conditions that constitute violations of program requirements
- Establishment of inspection procedures to investigate problems
- Use of informal and formal corrective action measures
- Additional or alternate compliance measures
- Appeals process (hearings, etc.)

Public involvement in the development of an enforcement and compliance program, with input and consent from the oversight agencies, can ensure that the enforcement procedures are appropriate for the management area. It is important that citizens served by the program have clear, consistent, and specific expectations for program and system management. It is also important to involve the public in corrective action and enforcement activities, possibly through an appeals board or another type of program performance review committee, to minimize any misinformation or other negative feedback.

There are a number of enforcement mechanisms that are used to support compliance with individual treatment system management programs. For example, a survey of local management programs in California revealed that:

- Nearly 90 percent of the jurisdictions reported a formal compliance procedure for remedying failed or malfunctioning systems
- The most frequently used enforcement tool is a violation notice followed by abatement letters
- More than half of the programs include administrative hearings
- Thirty percent of the programs have authority to order property liens, and 25 percent have the ability to issue administrative fines
- Formal legal actions and inspection warrants to abate a failing system were used infrequently

Examples of various enforcement tools can be found in **Table 2**. The use of these tools will vary based on program goals, the needs of the community, and available funding. The most effective management programs combine a variety of enforcement tools with proactive, community-based solutions for wastewater management and resource protection. The need to continually evaluate enforcement programs is important not only to assess their effectiveness but also to communicate the value of these efforts to a community's health and environmental well being.

Table 2. Enforcement Tools.

Method	Description	Advantages	Disadvantages
Liens on property	Local governing entity (with taxing powers) may add the costs of performing a service or past unpaid bills as a lien on the property.	An effective deterrent that can be enforced.	Local government may be reluctant to apply this approach unless the amount owed is substantial.
Recording violations on property deed	Copies of violations can, through administrative or legislative requirement, be attached to the property title (via registrar of deed).	Relatively simple procedure. Effectively limits the transfer of property ownership.	Can be applied to enforce sanitary code violations; may be ineffective in collecting unpaid bills.
Presale inspections	Inspections of individual wastewater treatment systems are conducted prior to transfer of property, or when property use changes significantly.	Notice of Violation may be given to potential buyer at the time of system inspection. Seller may be liable for repairs.	Can be difficult to implement due to staff resource limitations (3^{rd} party certified inspectors can be used to address this concern).
Termination of public services	A customer's water service may be terminated (as applicable).	Effective procedure, especially if management entity is responsible for water supply.	Termination of public services is potential health risk and requires political will; does not apply if property owner has private well.
Fines	Monetary penalties for each day of violation, or as a surcharge on unpaid bills.	Fines can be levied through judicial system as a result of enforcement of violations.	Effectiveness will depend on willingness of the vested authority to issue the fine.

Adapted from Ciotoli and Wiswall, 1982.

Illicit Discharges to Storm Sewer Systems

Storm sewer systems consist of roadways, ditches, and piping that transports precipitation to surface waters. Wastewater discharges to storm sewer systems constitute an illegal discharge to surface waters unless they are covered by a permit under the

National Pollutant Discharge Elimination System (NPDES). A fairly recent but important enforcement tool to find and eliminate these discharges is the Stormwater Phase II regulations under the NPDES permit program created by the Clean Water Act. One of the six "minimum control measures" required to be implemented by municipalities subject to the stormwater regulations (i.e., generally those with a population of 10,000 or more) deals with the detection and elimination of illicit, non-stormwater discharges to the storm sewer system, which includes publicly owned culverts, ditches, and other drainage features. Research conducted during the past 10 years has found that discharges to storm sewer systems from failing or improperly designed wastewater treatment systems are common in some areas and contribute to public health risks and water quality degradation.

Specifically, urbanized areas subject to the Stormwater Phase II rules are required to develop, implement, and enforce an illicit discharge detection and elimination program. This program must include

- A map of the storm sewer system and outfalls
- An ordinance or other regulatory mechanism to prohibit non-stormwater discharges into the storm sewer system, and appropriate enforcement procedures and actions
- A plan to detect and address non-stormwater discharges into the storm sewer system
- A program to educate public employees, businesses, and the general public about the hazards associated with illegal discharges and improper disposal of waste
- Implementation of best management practices and measurable goals

The *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments* manual provides valuable guidance for communities and others seeking to establish an iIllicit discharge detection and elimination program and investigate non-stormwater discharges into storm drainage systems.

III. State and Local Program Examples

How a community chooses to enforce individual treatment system rules will depend on a number of factors, including environmental risks, legal authority, public acceptance, the political setting, and available resources. Whichever enforcement measures or tools are chosen, they need to be applied to the system users as well as the system designers, installers, and maintenance providers. In 2005, Texas passed rules that provide for the revocation of a maintenance company’s registration for failure to either properly maintain an aerobic system or submit required reports.

The following programs offer a small sampling of the many community and state compliance initiatives developed to address individual wastewater treatment system issues. They represent the range of enforcement tools and incentives that states and communities are using to support the management of individual wastewater treatment systems.

Florida – Public/Private Partnership to Eliminate Problem Systems

The City of Jacksonville, Florida, the St. Johns River Water Management District, the Jacksonville Electric Authority, the Water Sewer Expansion Authority, and the Florida Department of Environmental Protection formed a partnership to reduce the amount of nitrogen discharged into St. John’s River. The group is developing financial and technical solutions to phase out individual treatment systems in 22 urbanized areas and upgrade the remainder. The partnership is also developing an inspection and maintenance program to identify and upgrade malfunctioning systems.

North Carolina Health District - Ongoing Maintenance with Property Liens

The Albemarle Septic Management Entity (ASME) is a management entity established by four health districts to oversee the individual and cluster wastewater systems in an 11-county area with a customer base of 3,500. ASME issues permits and conducts annual inspections. Property owners have the option to hire either a technician or ASME to perform the repairs. If repairs are not made, ASME is authorized, under the permit, to fix the system and bill the owner. ASME can place a lien on the property if the property owner fails to pay for the repairs.

Iowa – Maintenance and Repair with Water Shut-off Provisions

The Lake Panorama Onsite Wastewater Management District was established in 1980 through a county ordinance and administrative rules. Encompassing the 5,100 acres around the 1,400-acre lake, the district manages 900 individual conventional systems and six cluster systems. Inspections are conducted once every year for full-time residents and once every two years for part-time residents. Property owners are responsible for system repairs. If the property owner does not repair or replace a malfunctioning system, a request to turn off the water supply to the property is made. Shut-off requests occur approximately five or six times a year, but most cases are resolved before the shut-off.

Texas – Suspension or Revocation of Installers License

The Lower Colorado River Authority (LCRA) in Texas is a conservation and reclamation district created by the Texas Legislature to provide low-cost utility and public services. LCRA has regulated the installation and operation of individual wastewater treatment facilities around the upper Highland Lakes and Lake Travis since 1971. The district permits and inspects all individual treatment systems and requires systems built before 1971 to have low-flow toilets, showerheads, and faucet aerators to reduce water use. The district can impose criminal penalties and obtain injunctions in district court against wastewater discharges from a home or business. Complaints against installers can result in their license being suspended or revoked along with possible fines.

Massachusetts – Perpetual Easements and Inspections for Cluster Systems

Under Massachusetts' small systems wastewater treatment law (known as Title 5) users of shared (clustered) systems sign a Grant of Title 5 Covenant and Easement. Each user agrees to incur specific obligations regarding the construction, inspection, maintenance, upgrade, and expansion of the shared system and further agrees to a perpetual deeded easement in favor of the local health department and the state Department of Environmental Protection. The developer/homeowner agrees to have the shared system inspected annually and pumped no less than every three years. The inspection reports must be filed with the local health department and the state. The developer/homeowner must provide financial security that they will maintain the system. This financial security guarantees that the system will be repaired in the event that it does not meet Title 5 standards. The developer/homeowner agrees that the shared system will be constructed so that the user may be denied access to the system in the event the user fails to pay their proportionate share of the construction, inspection, maintenance, upgrade, and expansion of the shared system. Finally, enhanced lien authority is granted to the system manager in the event that the users fail to pay their share of the assessed costs.

Delaware – Compliance Inspection Program in Priority Watersheds

The Delaware Coastal Program partnered with the Ground Water Discharge Section and the state's Nonpoint Source Program to develop an individual treatment system compliance inspection program in priority coastal watersheds. The program goals are to inspect individual and cluster treatment systems every three years through public/private partnerships and create a compliance database. The Ground Water Discharges Section has developed a database of the location of holding tanks and will be using this as a template for the development of an inspection compliance database. A global positioning system device will be used to locate and map all of the inspected systems. The coordinator of the inspection program will work with the Delaware Technical Community College to ensure availability of classes to train and license inspectors. Educational material will be developed to inform the public about the importance of inspections and when and how inspections will be conducted. The program also includes cost-share funds to assist residents with individual treatment system tank pumpouts.

Nags Head, North Carolina – Voluntary Inspections with Incentives

Since 2000, the Town of Nags Head, North Carolina, has offered free inspections of individual and cluster treatment systems. In addition to the inspection refund, a property owner that has their tank pumped as a result of the individual treatment system inspection can also receive a water credit voucher worth $30 towards their water service account. The inspection reports are entered into a database to track failures, site use, age of system, size of tank, location of system in relation to surface waters, and other data. To assist property owners with malfunctioning systems, the town also offers a low-interest loan program to owners of malfunctioning systems in need of repair or replacement. The maximum amount financed to owners is $5,000 (payable over three years at prime interest rate minus 2.5%).

Schuyler County, New York – Property Transfer Inspections

Schuyler County, New York, has included a number of provisions in its individual treatment system program to support system maintenance and repairs. One provision requires property owners to show proof of pumpouts within the preceding two years when property is to be sold or transferred. If the system is malfunctioning, it must be upgraded to meet county standards as outlined in the sanitary code.

Kitsap County, Washington State – Prescribed Enforcement Procedures

The Kitsap County Health District (KCHD) in Washington is responsible for administering an operation and maintenance program for individual treatment systems within its jurisdictional boundaries. In the event the homeowner or operation and maintenance specialist fails to comply with any of the requirements in the regulations, the KCHD has a prescribed set of enforcement procedures that are implemented. A notice and order to correct violation is sent out to the violator that allows 30 days to correct the violation. If substantial progress has not been made to correct the problem in the allotted time, KCHD has the ability to issue a notice of civil infraction to the individual. The notice of civil infraction is similar to a traffic ticket and allows the violator 15 days to either submit the appropriate payment indicated in the notice or contest it. If the notice is contested, a court date is scheduled. The maximum penalty for a civil infraction is $513 per day per violation.

Washington – Strategy for Marine Recovery in Puget Sound Region

In Puget Sound Washington, since 1980, about 30,000 acres of state commercial shellfish beds have been closed to harvest, and Hood Canal has an expanding dead zone; both are caused by raw sewage from malfunction treatment systems and other pollution. There are approximately 472,000 individual wastewater treatment systems in the Puget Sound region that are not connected to sewage treatment plants. Many are aging and in a state of disrepair, allowing human waste to reach the sound. In 2006, lawmakers passed legislation that a directed the department of health and the local health officers of the twelve Puget Sound counties to develop Local Onsite Management Plans for marine recovery areas that involves inspecting all systems and identifying and repairing failing systems. A $7.5 million loan and grant program was also approved to help Puget Sound homeowners fix their malfunctioning systems.

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This Resource Guide is a supplement to EPA's Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems. The interactive version includes the Handbook itself and 13 resource guides based on key program elements that make up a comprehensive individual/cluster wastewater management program. Each of these resource guides includes background information, references and resources, and case studies and examples.

The 13 resource guides are:

1. Public Education and Outreach
2. Community Planning for Wastewater Treatment
3. Performance Requirements
4. Inventories, Reporting, and Recordkeeping
5. Financial Assistance
6. Site Evaluation
7. System Design
8. Construction and Installation
9. Operation and Maintenance
10. Residuals Management
11. Training and Certification
12. Inspection and Monitoring
13. Corrective Actions and Enforcement

Electronic copies of this guide and the other resource guides along with the interactive version of the handbook are available and can be downloaded from EPA's Septic (Onsite) Systems Web Page.

Visit EPA's Wastewater Systems Web site for more information on individual and cluster systems. The Web site also provides information for treatment system technologies, management programs, links to partner organizations useful in community education and outreach, publications for homeowners, and guidance manuals, including additional documents that supplement this Handbook.